Machinery ownership model for effective smallholder mechanized rice production in Ghana

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Introduction

Rice is a major staple in Ghana, which has seen various efforts to increase its production locally.

As of 2020, local rice production had increased from 721,465 tons in 2017 to 987,000 tons[2].

To ensure its continuous production, smallholder farmers are being introduced to conservation agriculture farming methods.

Though this method of farming is gradually being adopted, the level of drudgery in the farmers' production poses major problems that threatens the agenda to increase rice production sustainably.

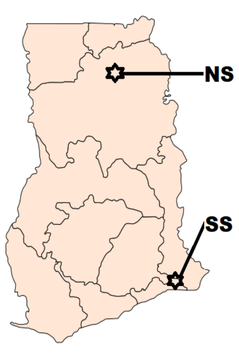
This study was formulated on the premise that if smallholder rice farmers can own or easily access machinery, it can address the problem of drudgery and increase productivity.

Objective: To develop a machinery ownership model for smallholder farmers that is economically feasible and sustainable.

Methodology

Field data collection from 150 rice farmers from both the Northern sector (NS) and Southern sector (SS)

Data analysis
- Demographics
- Machinery for full mechanised production
- Mechanization models



Results

Table 1: Analysed field data

Parameter	NS Values	SS Values
Gender of respondents (%)		
Male	66	63
Female	34	37
Average Age (years)	48 ± 6	43 ± 11
Education status (%)		
No formal education	50	16.7
JHS	24	47
SHS	27	27
Degree /Diploma	3	9
Average farm size (Ha)	4.5 ± 1.9	2.3 ± 1.4
Land tenure (%)		
Owned	84	0
Leased	16	100
Fund for farming (%)		
Loan	29	77
Personal	68	23

Table2: Proposed Machinery For Production used in the Models

Field Activity	Type of machinery
Field preparation	13hp power tiller
Planting	Drum seeder
Husbandry activities	
Weed control	Knapsack sprayer
Fertilizer	Knapsack sprayer
Bird scaring	Human labour
Harvesting	Mini Combine
Threshing	Thresher

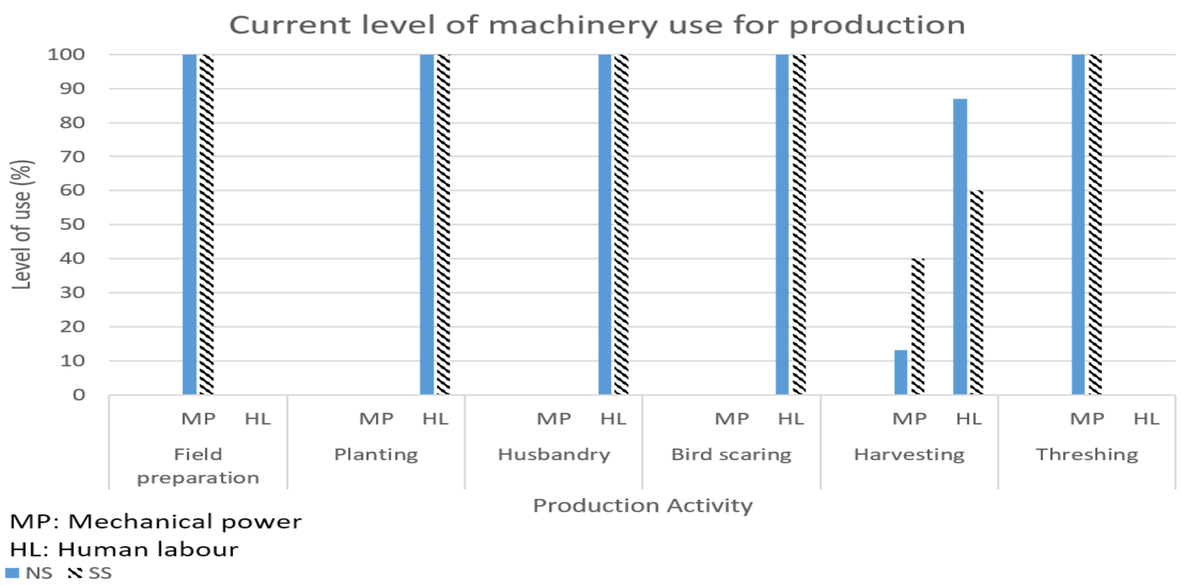


Table 3: Benefit cost ratio table

	FHM		FOM		FOHM		COM		FOHM	
	FHM-T	FHM-B	FOM-T	FOM-B	FOHM-T	FOHM-B	COM-T	COM-B	FOHM-2T	FOHM-2B
Fixed Cost										
Cost of machinery	-	-	43,000.00	43,000.00	43,000.00	43,000.00	2,150.00	2,150.00	43,000.00	43,000.00
Recurring cost										
Cost of farm input	6,627.00	5,956.00	4,525.00	3,854.00	4,525.00	3,854.00	4,525.00	3,854.00	9,050.00	7,708.00
Total Cost	**6,627.00**	**5,956.00**	**47,525.00**	**46,854.00**	**47,525.00**	**46,854.00**	**6,675.00**	**6,004.00**	**52,050.00**	**50,708.00**
Benefit Cost										
Revenue from farm produce	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	20,000.00	20,000.00
Revenue from machinery hire	-	-	-	-	2,000.00	2,000.00	-	-	2,000.00	2,000.00
TOTAL Benefits	**10,000.00**	**10,000.00**	**10,000.00**	**10,000.00**	**12,000.00**	**12,000.00**	**10,000.00**	**10,000.00**	**22,000.00**	**22,000.00**
NPV at 10% discount rate	**20,725.62**	**24,848.63**	**- 5,449.40**	**- 1,326.40**	**6,839.73**	**10,962.73**	**31,686.96**	**35,809.96**	**40,481.23**	**48,727.24**
BCR at 10% discount rate	**1.51**	**1.68**	**0.92**	**0.98**	**1.10**	**1.17**	**2.06**	**2.40**	**1.43**	**1.56**
NPV at 22% discount rate	**13,232.90**	**15,865.36**	**- 13,766.47**	**- 11,134.01**	**- 5,920.10**	**- 3,287.64**	**19,717.14**	**22,349.60**	**15,559.34**	**20,824.25**
BCR at 22% discount rate	**1.51**	**1.68**	**0.74**	**0.78**	**0.89**	**0.93**	**2.01**	**2.32**	**1.22**	**1.32**

Model*	Description
FHM-B	The farmer hires all the machinery used for production
FHM-T	The farmer hires all the machinery used for production
FOM-B	The farmer owns all the machinery used for production
FOM-T	The farmer owns all the machinery used for production
FOHM-B	The farmer owns all the machinery used for production and operates hiring services
FOHM-T	The farmer owns all the machinery used for production and operates hiring services
COM-B	A farmer cooperative owns all the machinery used for production
COM-T	A farmer cooperative owns all the machinery used for production
FOHM-2B	The farmer owns all the machinery used for production, operates hiring services and crops twice in a calendar year
FOHM-2T	The farmer owns all the machinery used for production, operates hiring services and crops twice in a calendar year

*Cropping under broadcasting (B) and Transplanting (T) methods.

Conclusions

- The best ownership model is where a cooperative owns machinery for use by its members (COM-B and COM-T).
- However the models FHM-B, FHM-T, FOHM-2B and FOHM-2T are also good ownership models.
- To ensure that these models work seamlessly, the farmers will have to be trained in machinery operation for the personal ownership model to be effective.
- In addition, there needs to exist a vibrant professional technical service sector which will ensure the machinery is properly maintained, as well as adequate spare parts availability.
- The study also envisage that when these models are promoted it will lead to demand for local machinery manufacture, which can drive up local production of machinery.
- Further studies on the factors that affect the choices of the local farmer, the constraints on local production and supply of equipment will be critical for the full operationalization of the models proposed in this study.

Reference

[2]FAO. (2022, Feb 17). *FAOSTATS*. Rice Production Data for Ghana. Retrieved September 13, 2022 from http://www.fao.org/faostat/en/#data/QC

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