Sustainable Animal Productivity for Livelihoods, Nutrition and Gender Inclusion

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Can the efforts to intensify smallholder pig production in Uganda be sustained?

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Explore opportunities... for managing natural resources and a better life for all

The importance of piggery

For PEOPLE & Nation

- Employment, income for

  >2 million Households

  75% smallholder women farmers

- Economy
- Food and nutrition
- Resilience and risk management

And the Environment

- Contributes to carbon cycle, energy…
- With a cost of
  - Land & water usage
  - Pollution & degradation (on land & water)
  - GHG emissions

Sustainability is a big issue and needs to be managed

Optimize the environmental footprint

"Good" & "Bad"

Without compromising the good!

The Ugandan case: Rising demand ~ market niche

- The fastest-growing livestock sector in Uganda, growing annually by 1.5% since 1966.
- Approximately 139,185 metric tonnes produced annually, valued at USD 421 million
- Per capita pork consumption at 3.4kg/person/year, highest in East Africa.
- Current Pig Pop. 7.1 million, up by 122.5% from 3.2 million in 2008
- 32% of this is in the central region of Uganda – with an average herd size of 3 pigs per household.
- Implementation of National Development Plan (NDP) III 2020 - 2025 underway, aiming to increase agricultural sector growth from 3.8% to 6% by the year 2025
- This will involve a shift from conventional to commercial agriculture

However, the sector is highly informal and faces triple productivity challenges:

Low-producing breeds

Seasonal low-quality feeds + competition for resources

Diseases

This jeopardize its performance potential and environmental sustainability.

https://www.reportlinker.com/clp/country/1592/726256
https://www.ubos.org/explore-statistics/2/

Integrated package of pig husbandry and VC interventions pitched as the solution!

Addressing productivity challenges through a continuum of innovations for:

- Improved feeding
- Biosecurity
- AI synchronization

With the aim of

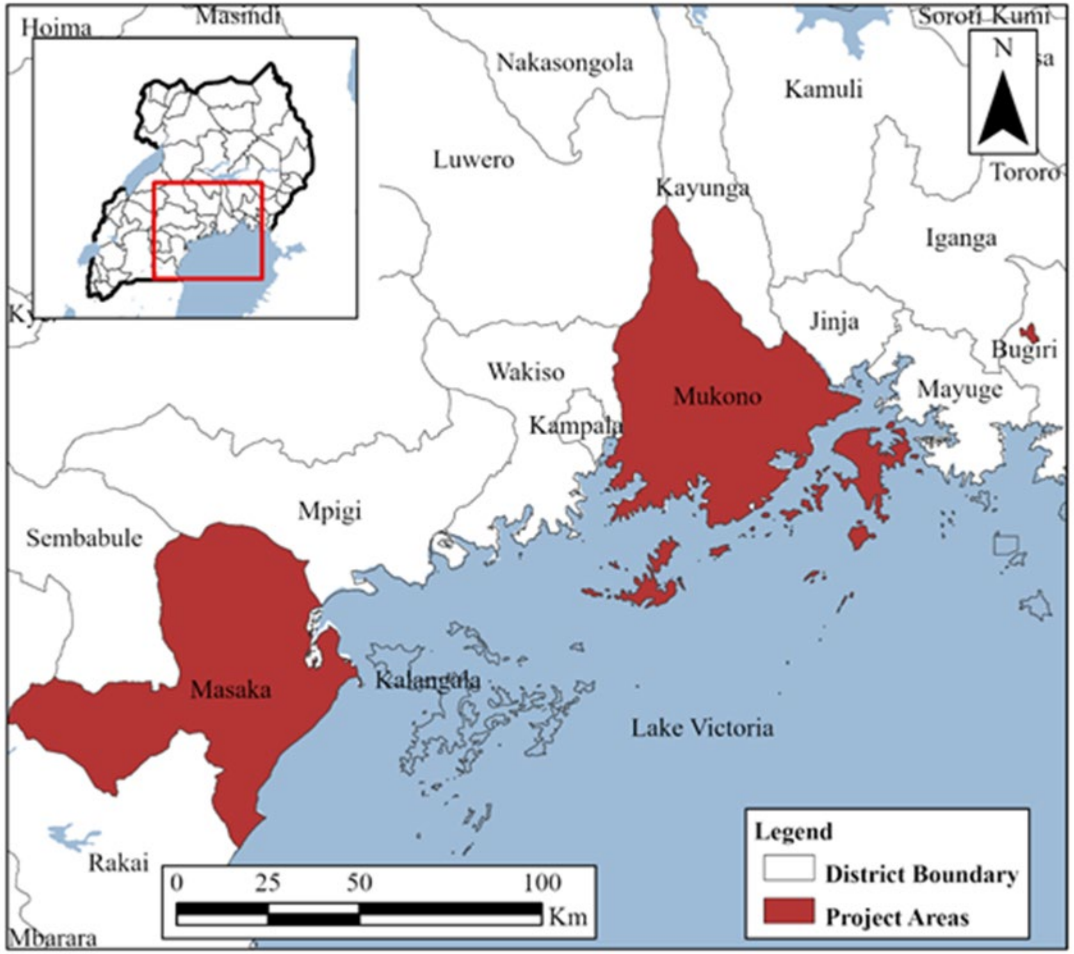
- Reducing pig mortality
- Closing seasonal feed quantity and quality deficits (building climate resilience)
- Increasing livestock productivity and efficiency
- Increasing incomes (reducing feed costs)
- Reducing GHGe intensity
- Improving land productivity

¡!

… a need to generate environmental evidence to affirm these assumptions!

Objective: Assessing the potential productivity-environmental trade-offs of the integrated package of technologies

- **Central region:** Masaka and Mukono districts.
- **Diverse value chains;** *rural-rural, rural-urban, and urban-urban domains.*
- **Agroclimatic;** bimodal rainfall (1200-1500mm/year), mean annual temp. 24-28^{0}C, lixisols soil, altitude 1000-1800m
- **Data collection:**
  - Step 1: Literature (6 publications) –characterizing extensive & intensive systems in terms of herd size, structure & composition, diets, and productivity.
  - Step 2: Validation with experts + scenario mapping
  - Step 3: feed optimisation – iteratively in Excel.
- Environmental assessment (4 baseline runs + 6 sensitivity scenarios)



Systems overview

Site	Livestock systems	Production type	Management system	Breed type	Type and No. of animals	Season	Type of feed
Masaka	Intensive	Farrow to finish	confined	Cross breed	Pigs – lactating exotic: 1 pregnant - sows: 2 Pigs - dry sows: 1 Pigs - growers: 5 Pigs - boars: 1	Wet – Long rains (MAM),Short rains (SON)	Forages- 16% Purchased -34% Crop residues-30% Kitchen leftovers -10 Home mixed dry ration (mash) -10%
						Dry –Dec, Jan, Feb, June, July, Aug	Forages- 10% Purchased -37% Crop residues-26% Kitchen leftovers -16 Home mixed dry ration (mash) -11%
	Extensive	Farrow to finish	scavenging	Local	Pigs – lactating : 1 pregnant - sows: 1 Pigs - dry sows: 1 Pigs - growers : 2 Pigs - boars: 1	Wet – Long rains (MAM), Short rains (SON)	Forages- 42% Purchased -7% Crop residues-42% Kitchen leftovers -9%
						Dry –Dec, Jan, Feb, June, July, Aug	Forages- 32% Purchased -12% Crop residues-42% Kitchen leftovers -14%
Mukono	Intensive	Farrow to finish	confined	Cross breed	Pigs – lactating : 1 pregnant - sows: 2 Pigs - dry sows: 1 Pigs - growers : 5 Pigs - boars: 1	Wet – Long rains (MAM), Short rains (SON)	Forages- 18% Purchased -35% Crop residues-37% Kitchen leftovers -10%
						Dry –Dec, Jan, Feb, June, July, Aug	Forages- 13% Purchased -38% Crop residues-37% Kitchen leftovers -12%
	Extensive	Farrow to finish	scavenging	Local	Pigs – lactating : 1 pregnant - sows: 1 Pigs - dry sows: 0 Pigs - growers : 2 Pigs - boars: 0	Wet – Long rains (MAM), Short rains (SON)	Forages- 20% Purchased -5% Crop residues-65% Kitchen leftovers -10%
						Dry –Dec, Jan, Feb, June, July, Aug	Forages- 16% Purchased -7% Crop residues-63% Kitchen leftovers -14%

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Environmental analysis

Environmental rapid assessment tool - "CLEANED" (https://alliancebioversityciat.org/tools-innovations/cleaned)

Inputs: livestock data, agro-ecology, feed basket, feed management

Input/ Parameter	Baseline Value	Value if technology is successful
Number of lactating sows	1	1
Number of pregnant sows	1	1
Number of Dry sows	1	1
Number of Growers	2	7
Number of Boars	1	1
Liveweight gain (kg/year) - Growers	40	58.8
Average Body weight (kg) - Lactating sows	70	70
Average Body weight (kg) - pregnant sows	70	70
Average Body weight (kg) - Dry sows	50	50
Average Body weight (kg)- Growers	28	46
Average Body weight (kg) - Boars	70	70
Number of piglets born alive per litter	7	7
Parturition interval (days)	115	115

Feed basket	Baseline diet		Optimised diet for Lactating Sows, Pregnant Sows, Boars		Optimised diet for Dry Sows		Optimised diet for Growers	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Natural Pasture (2 seasons), %	36	28	5	6	0	0	0	0
Cassava residue (2 seasons), %	12	12	8	12	8	8	10	10
Cocoyam (2 seasons), %	14	14	27	26	18	18	30	30
Banana peelings (2 seasons), %	9	14	20	18	30	30	22	22
Amaranthus (2 seasons), %	6	4	0	0	0	0	0	0
Sweet potato vines and peelings (2 seasons), %	16	16	20	22	12	12	10	10
Maize bran (2 seasons), %	7	12	10	8	32	32	28	28
Brachiaria grass (2 seasons), %	0	0	5	4	0	0	0	0
Desmodium (2 seasons), %	0	0	5	4	0	0	0	0

Parameter	Baseline Value	Value if technology is successful
Manure application tonne/ha	1	5

● + ● + ● = baseline situation

● + ● + ● = focused intervention package

● + ● + ● = integrated intervention package

Environmental trade-offs of pig intensification

Absolute outputs: changes in land requirement, water use, soil N balance & erosion, and greenhouse gas emissions

IP1 = focused intervention package
IP2 = integrated intervention package

Pig System Types	Total pork produced (kg/year)	Absolute footprints									
		Total area required (ha/yr)	% change from baseline	Total water requirements (m^3/year)	% change from baseline	Area Nitrogen mining (%)	% change from baseline	Total soil lost (t soil/year)	% change from baseline	Total GHG emissions (t CO2eq./year)	% change from baseline
Masaka extensive - Baseline	47.57	0.29	--	256.80	--	97.52%	--	12.67	--	0.28	--
Masaka extensive - IP1	246.96	0.70	139.47%	614.94	139.47%	98.00%	0.00%	30.35	139.47%	0.76	169.05%
Masaka extensive - IP2	246.96	0.49	69.01%	426.89	66.24%	96.00%	-1.85%	26.14	106.25%	0.50	76.46%
Masaka intensive - Baseline	135.00	0.20	--	178.45	--	88.98%	--	9.30	--	1.28	--
Masaka intensive - IP2	246.96	0.26	28.16%	261.91	46.77%	95.00%	7.24%	7.75	-16.70%	3.73	190.87%
Mukono extensive - Baseline	54.00	0.21	--	206.28	--	100.00%	--	13.92	--	0.21	--
Mukono extensive - IP1	246.96	0.60	187.84%	593.75	187.84%	100.00%	0.00%	40.06	187.84%	0.60	179.36%
Mukono extensive - IP2	246.96	0.40	92.33%	395.13	91.55%	98.00%	-1.93%	31.54	126.63%	0.49	129.61%
Mukono intensive - Baseline	150.00	0.27	--	217.13	--	82.90%	--	17.54	--	1.04	--
Mukono intensive - IP2	246.96	0.27	1.29%	296.60	36.60%	70.00%	-15.64%	8.62	-50.86%	3.22	211.08%

- Total absolute increases in environmental impacts, except in a few scenarios with improved nitrogen supply & reduced soil loss.
- IP1 in Mukono extensive is the most affected, while IP2 in Mukono intensive is the best performing despite high GHG emissions.
- Varied environmental impacts in different systems and across scenarios; with lower impacts on integration.
- Focused package performed better in Masaka than Mukono.
- Extensive systems more suited for integrated (IP2) than focused (IP1) interventions.

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Environmental trade-offs of pig intensification cont'.

Relative outputs: changes in ha/MT pork, m^3/kg pork, kg soil/ kg pork, and kg CO_2 eq. /kg pork

IP1 = focused intervention package
IP2 = integrated intervention package

Pig System Types	Total pork produced (kg/year)	Relative footprints							
		area required (ha/MT pork)	% change from baseline	Water use (m^3/kg pork)	% change from baseline	soil lost (kg soil/ kg pork)	% change from baseline	GHG emission intensity (kg CO_2 eq. /kg pork)	% change from baseline
Masaka extensive - Baseline	47.57	6.12	--	5.40	--	266.46	--	5.97	--
Masaka extensive - IP1	246.96	2.82	-53.88%	2.49	-53.88%	122.90	-53.88%	3.09	-48%
Masaka extensive - IP2	246.96	1.99	-67.45%	1.73	-67.98%	105.85	-60.28%	2.03	-66.01%
Masaka intensive - Baseline	135.00	1.49	--	1.32	--	68.90	--	9.51	--
Masaka intensive - IP2	246.96	0.52	-64.97%	0.53	-59.88%	15.69	-77.23%	7.56	-20.50%
Mukono extensive- Baseline	54.00	3.86	--	3.82	--	257.74	--	3.96	--
Mukono extensive - IP1	246.96	2.43	-37.06%	2.40	-37.06%	162.22	-37.06%	2.42	-38.92%
Mukono extensive - IP2	246.96	1.62	-57.94%	1.60	-58.11%	127.72	-50.45%	1.99	-49.79%
Mukono intensive - Baseline	150.00	1.77	--	1.45	--	116.92	--	6.90	--
Mukono intensive - IP2	246.96	0.55	-69.24%	0.60	-58.52%	17.45	-85.08%	6.52	-5.53%

- Overall environmental efficiency gains (EEG) despite the absolute increases in environmental impacts.
- Varied EEG in different systems and across scenarios; with more positive impacts on integration.
- Extensive systems in Masaka performed better than those in Mukono.
- Extensive systems more suited for integrated than focused interventions.
- GHGe intensities are comparatively lower than the global average of 10 kg CO_2eq.

Conclusion

To modernize Uganda's pig sector:

- A balance of production targets and environmental welfare is required.
- Integrating best-bet pig technologies is key – employing more personalized solutions in diverse settings.
- Nutrient requirements vary between pig categories, optimizing diet would therefore play a key role in lowering environmental & productivity inefficiencies.
- Well-managed pig manure has great potential for improving soil fertility while also acting as a climate mitigation strategy.

More efficient use of scarce resources e.g., water and land, and transition to low-emission piggery will require multistakeholder efforts:

- Breeders developing the best-performing forage varieties for diverse agroecological conditions.
- Feed specialists improving nutritional quality for crop residues and advising farmers accordingly.
- Farmer cooperation in biosecurity, breeding, and diet rationing to realize benefits.
- Value chain actors (private & public) prioritizing and investing in promising pathways.
- Policymakers leverage evidence data to improve fodder and piggery value chain policing.

This information is intended for immediate use by farmers and development partners seeking sustainable solutions to enhance productivity amidst the production challenges they face.

Thanks!

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Ministry of Water and Environment
Republic of Uganda

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