Feasibility and Impact of Rice Self-Sufficiency Strategies in East Africa

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Jacksonville,

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Outline

- Background => CARD Initiative; Rice Production and Consumption Balances in the four countries

- Study Objectives

- Methodology => AGRM and RiceFlow Models

- Findings => Econometric estimates (elasticities) ; NRDS vs AGRM; Area-Yield requirements for SSF; Subsidies; Implications of SSF

- Summary and Conclusions

Background

- CARD – Coalition for Africa Rice Development
  - Initiative of JICA, AGRA and NEPAD
  - Established in the 4th Tokyo International Conference for African Development in May 2008
  - Post 2008 crisis adaptation strategy
  - Aim: to **double rice production** in Africa between 2008 and 2018
  - 23 member countries
  - National Rice Development Strategies (NRDS) => rice value chain upgrade action plan
  - Focus of current study:- Four East African countries: Kenya, Rwanda, Tanzania and Uganda

Consumption
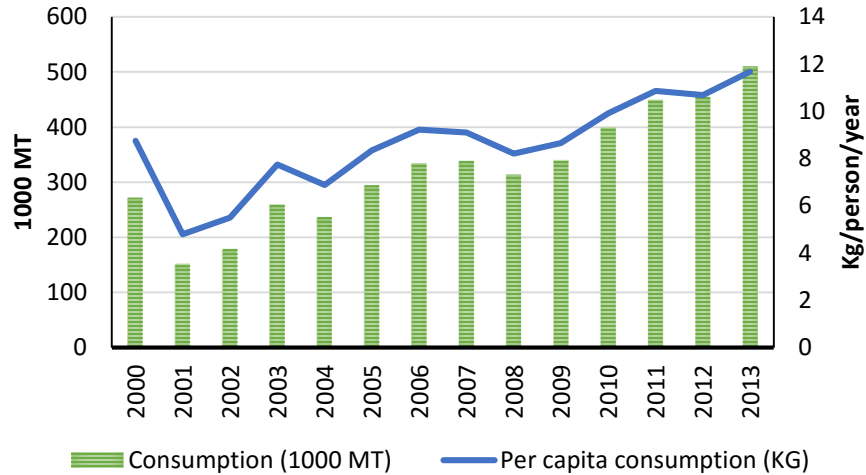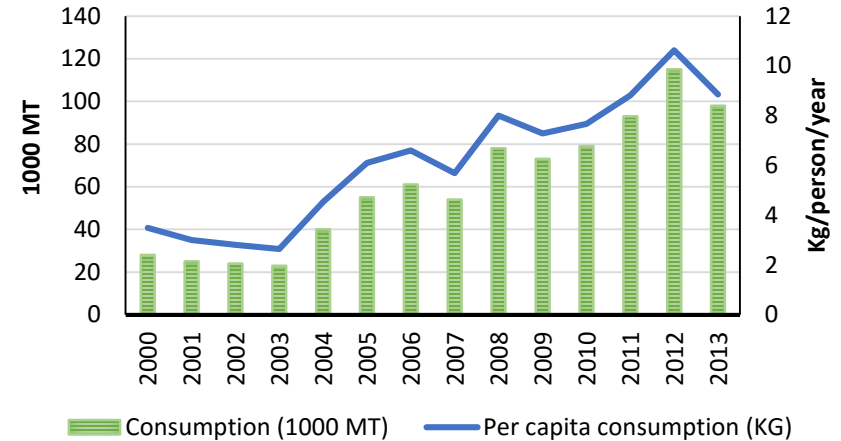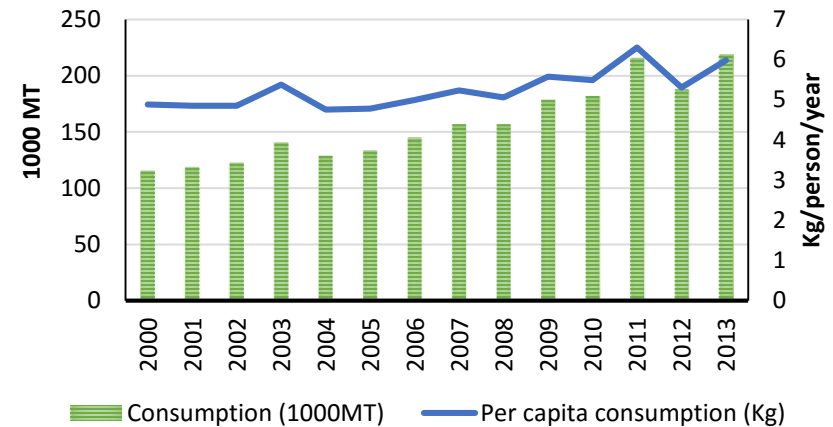
Source: P S & D Online

Evolution of Major Cereals' share in Diet
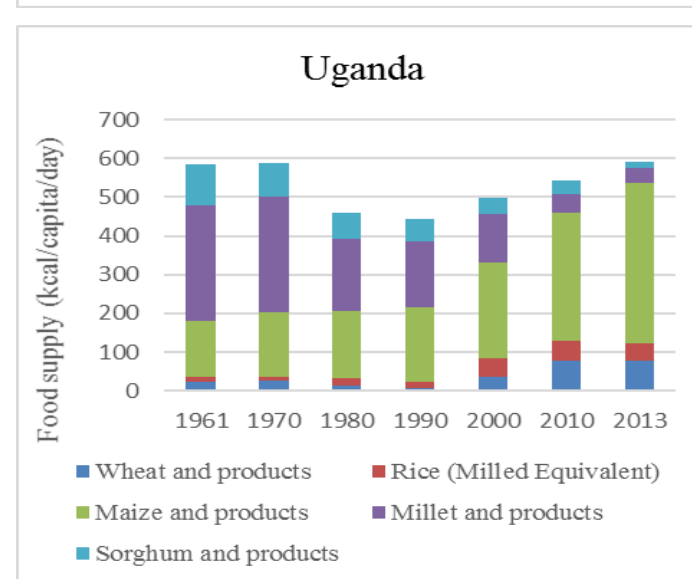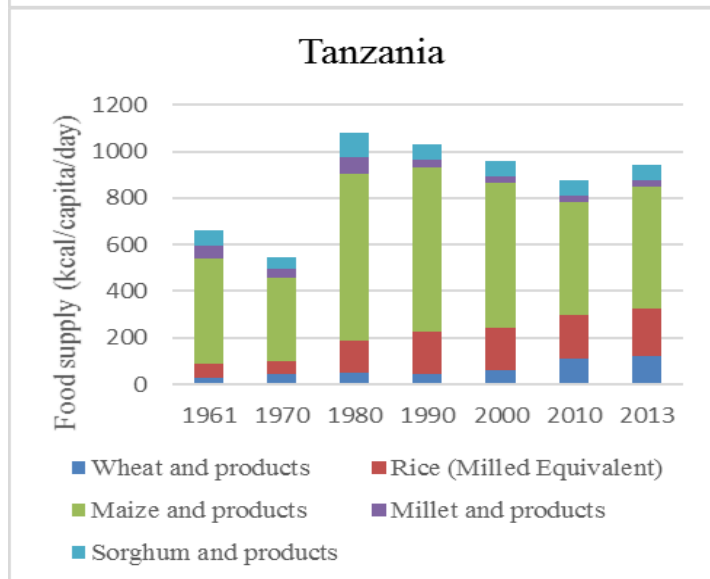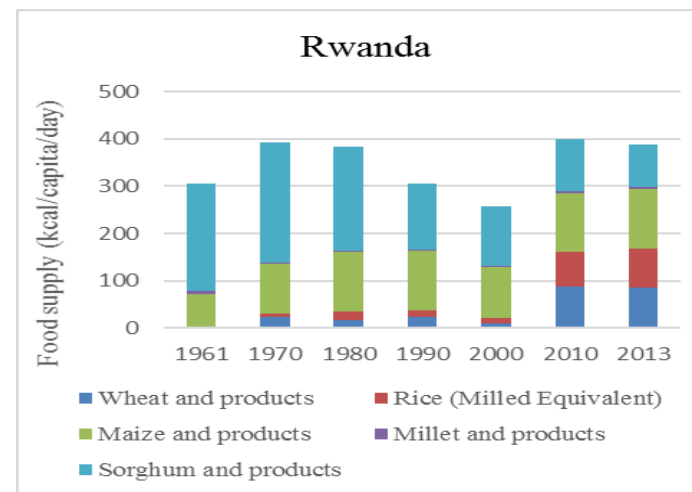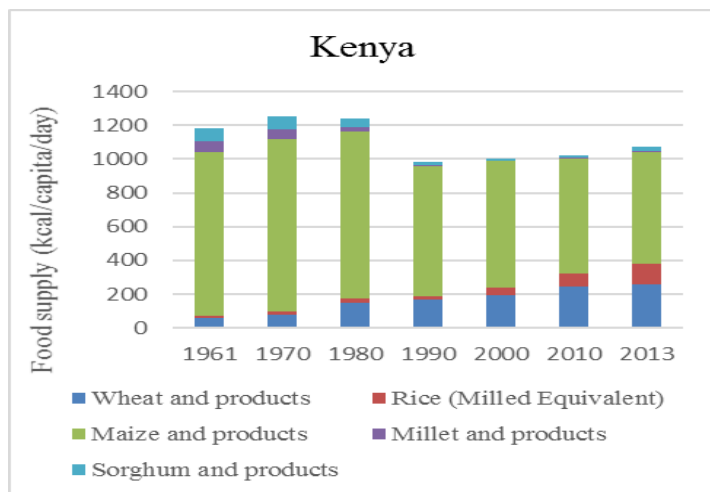
Source: FAO Food Balance Sheets
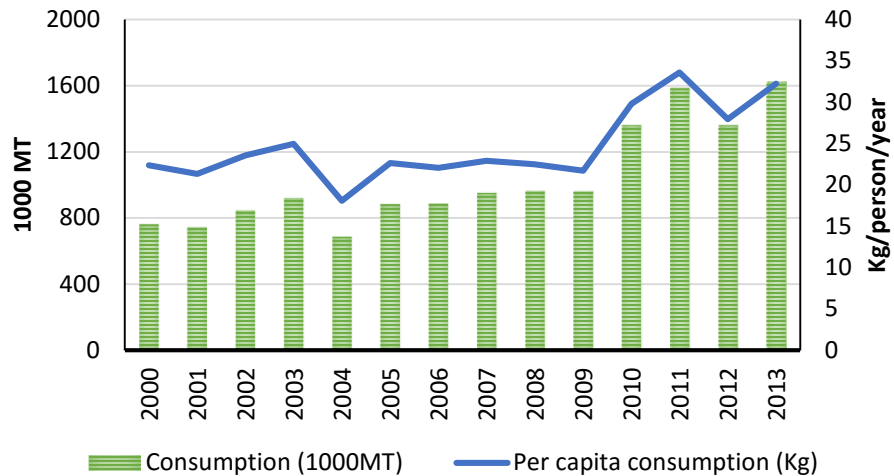
Production-Consumption Balances
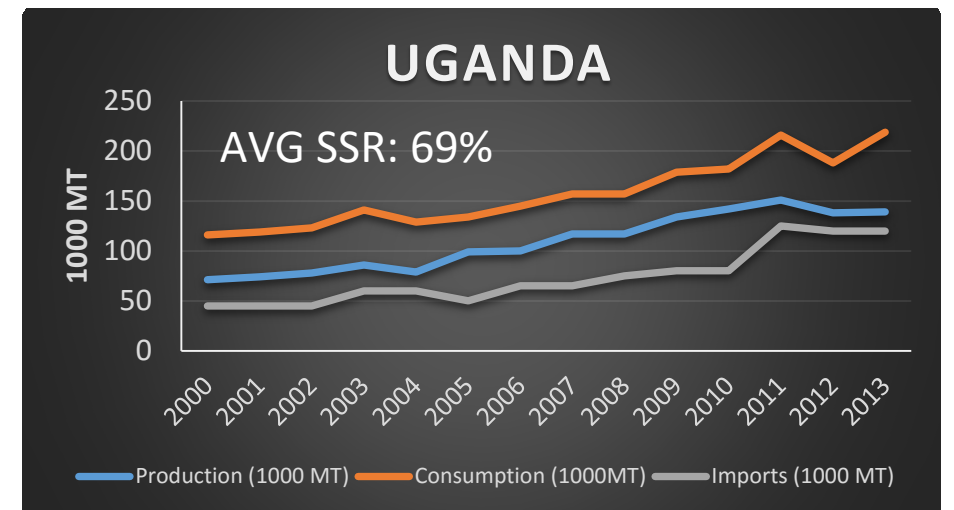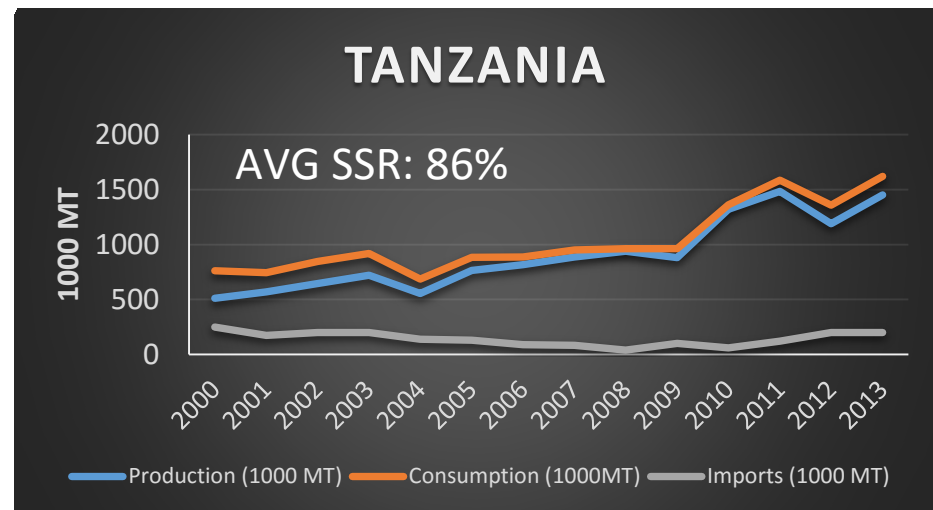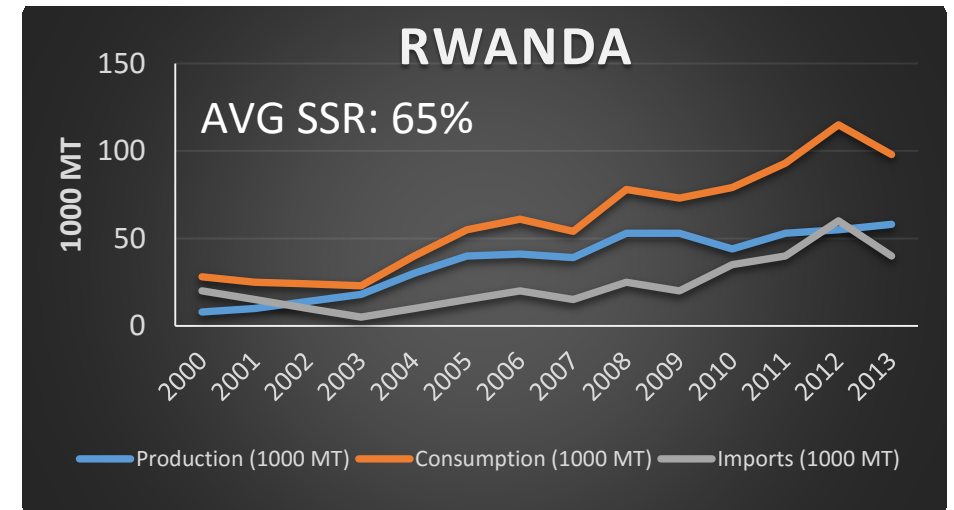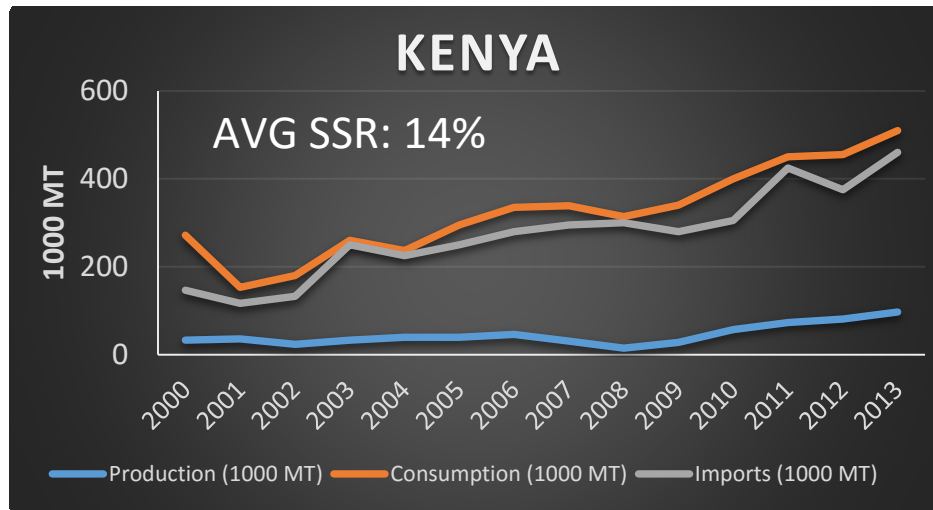
Source: P S & D Online

Objectives of the Study

Overall Objective

- To evaluate the challenges in rice sector investments and development to achieve food security in the selected African countries: Kenya, Rwanda, Tanzania and Uganda.

Specific objectives

- Assess and characterize National Rice Development Strategies (NRDS) investment plans in Kenya, Rwanda, Tanzania and Uganda.

- Estimate a dynamic baseline for Kenya, Rwanda, Tanzania and Uganda national rice sectors within the global rice economy.

- Evaluate alternative rice self-sufficiency strategies in Kenya, Rwanda, Tanzania and Uganda with regard to feasibility and impact

Arkansas Global Rice Model (AGRM)

- Non-spatial partial equilibrium modelling framework

- Country models based on econometric estimations :
  - Supply
    - $AH_t = f_1(AH_{t-1}, P_t^e, W_t^e, e_{1t})$
      - AH_t is the area harvested in hectares, P_t^e is the expected price received by farmers, W_t^e is the expected input price
    - $Y_t = f_2(P_t^e, W_t^e, T_t, e_{2t})$
      - Y_t is the yield in tons per hectare and T_t represents technological change
  - Demand
    - $D_t = f_3(M_t, RP_t, WP_t, e_{3t})$,
      - D_t is the per capita rice demand, M_t, is the real per capita income, RP_t is the retail rice price and WP_t is the price of wheat or maize.
      - Total demand = Per capita demand * Population
  - Domestic prices linked to international rice reference price:
    - Thai FOB (5% brokens, Bangkok) for Long Grain and California (No.1 medium grain ex-mill) for medium/short grain => used to clear international rice markets

RiceFlow Model

- Spatial, partial equilibrium model of the world rice economy that simulates the behavior of the entire rice supply chain, from inputs markets to aggregate final demand

- Non-linear functions are linearized =>variables in the model are in percentages rather than nominal values

- Two-stage production 'nest'

- 9 rice commodities (Set C)
  - LGP, LGB, LGW, MGP, MGB, MGW, FRP, FRB, FRW

- 76 regions (Set R)

- Baseline data => 2013-2015 average
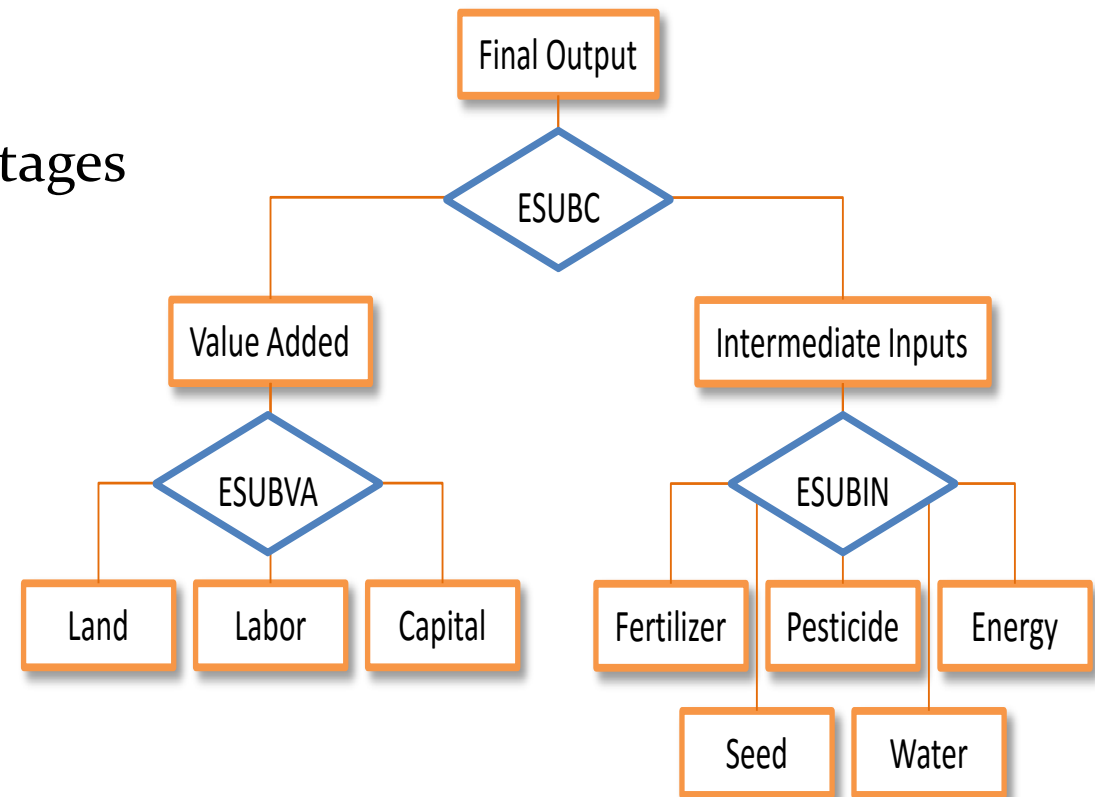
Results...

Supply and Demand Elasticities

	Area Harvested		Yield		Per Capita Consumption	
Kenya	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
	$Ln\,(Area_{t-1})$	0.6824***	$LnTrend$	0.2555***	$Ln\;Real\;GDP\;per\;capita$	**2.1904***
	$Ln\left(\frac{RicePr_{t-1}}{MaizePr_{t-1}}\right)$	**0.2898***	$Dummy_{2007-2009}$	-0.7480	$LnRiceRetailPr$	**-0.9307***
	$Dummy_{1994}$	1.1447***				
Rwanda						
	$LnArea_{t-1}$	0.7749	$LnRealProducerPr_{t-1}$	0.2056	$Ln\;GDP\;Per\;Capita$	**1.3348***
	$RealProducerPr_{t-1}$	**0.2834**	$LnTrend$	1.1052***	$Ln\left(\frac{RiceRetailPr}{MaizeRetailPr}\right)$	**-0.7568**
			$Dummy_{2009}$	0.3739*		
Tanzania						
	$LnArea_{t-1}$	0.3319*	$LnTrend$	0.3725***	$Ln\;GDP\;Per\;Capita$	**1.5886***
	$Ln(IntlRicePr + Tariff)_{t-1}$	**0.2519***			$Ln\,(IntlRicePr + Tariff)_{t-1}$	**-0.2600***
Uganda						
	$Ln\;Area_{t-1}$	0.5666***	$Ln\;ShiftTrend_{2009}$	0.5046***	$Ln\;GDP\;Per\;Capita$	**0.6383***
	$Ln\;RiceRetailPr_{t-1}$	**0.9709**			$Ln\left(\frac{RiceRetailPr}{MaizeRetailPr}\right)$	**-0.5467***
	$Ln\;ShiftTrend_{2009}$	-0.3212***				

NRDS vs AGRM

Kenya	Base (2014-2016 average)	NRDS Target (2018)	AGRM Projection (2018)
Area Harvested (1000Ha)	34	35	47
Yield Milled	3	3	3
Milled Production (1000MT)	89	116	124
Consumption (Milled 1000MT)	**543**	**244**	**622**
Self-Sufficiency (%)	**16%**	**48%**	**20%**
Rwanda			
Area Harvested (1000Ha)	16	55	17
Yield Milled (T/Ha)	4	4	4
Milled Production (1000MT)	58	243	65
Consumption (Milled 1000MT)	**99**	**204**	**114**
Self-Sufficiency (%)	**59%**	**119%**	**58%**
Tanzania			
Area Harvested (1000Ha)	**1008**	**695**	**1123**
Yield Milled (T/Ha)	2	2	2
Milled Production (1000MT)	1760	1265	1894
Consumption (Milled 1000MT)	1899	_	2100
Self-Sufficiency (%)	**93%**		**90%**
Uganda			
Area Harvested (1000Ha)	95	240	102
Yield Milled (T/Ha)	2	2	2
Milled Production (1000MT)	151	515	164
Consumption (Milled 1000MT)	**233**	**499**	**259**
Self-Sufficiency (%)	**65%**	**103%**	**63%**

Area Expansion and Yield Improvement Requirements to SS

Kenya Area Expansion and Yield Increase to achieve Self-Sufficiency
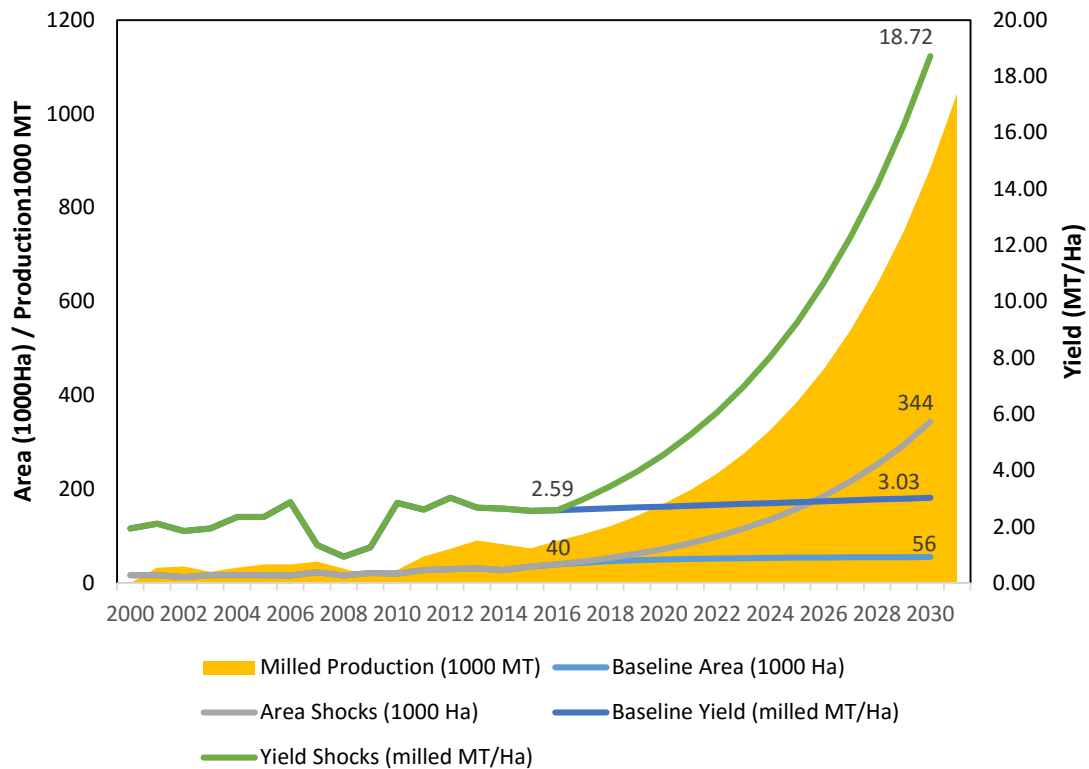
Rwanda Area Expansion and Yield Increase to achieve Self-Sufficiency
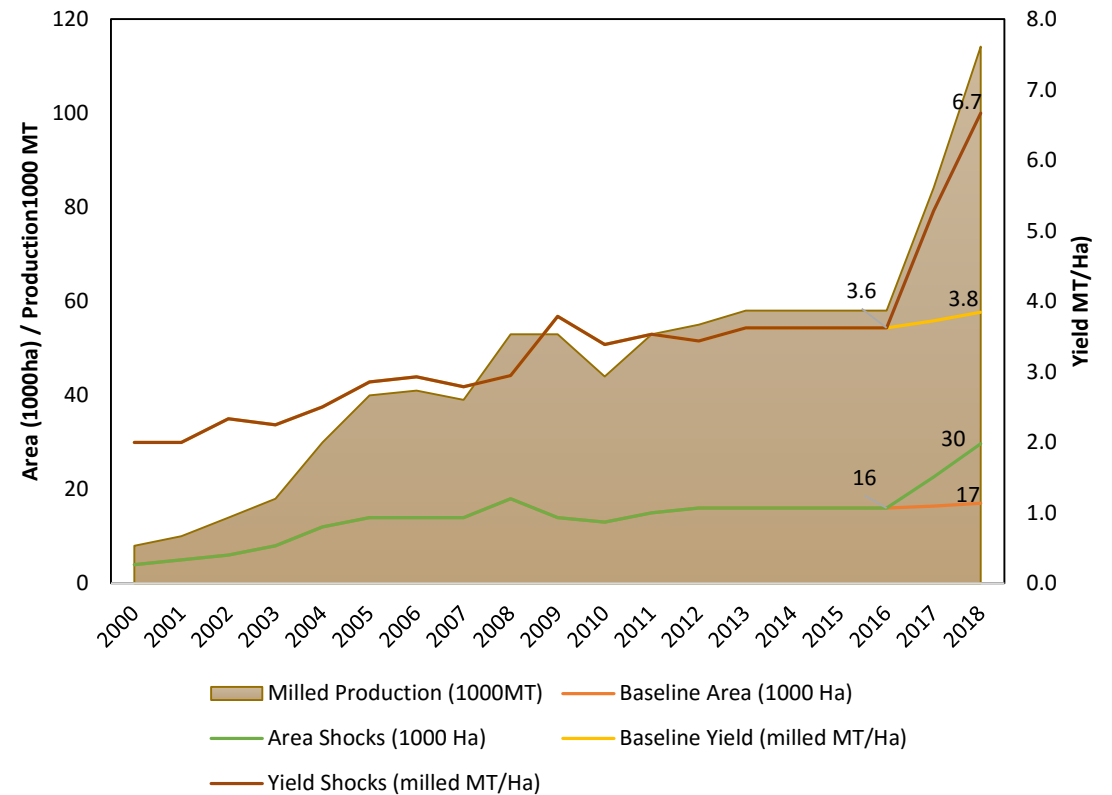
Area Expansion and Yield Improvement Requirements to SS (ctd')

Uganda Area Expansion and Yield Increase to achieve Self-Sufficiency
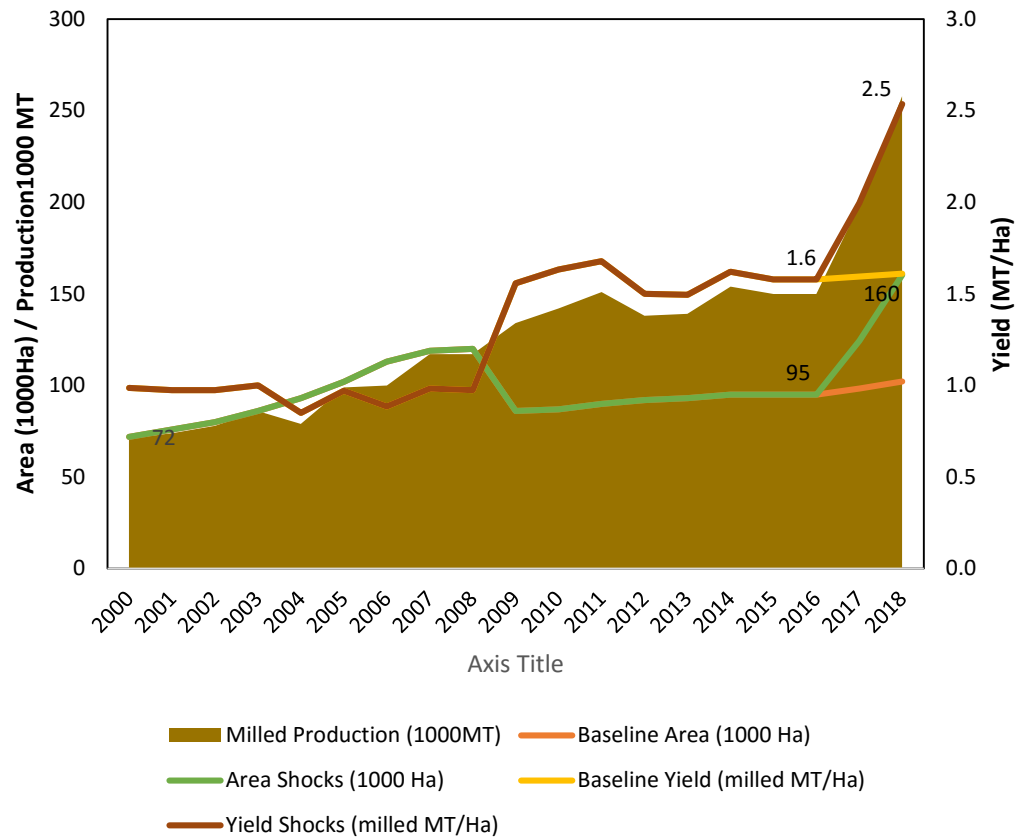
Tanzania Area Expansion and Yield Increase to achieve Self-Sufficiency
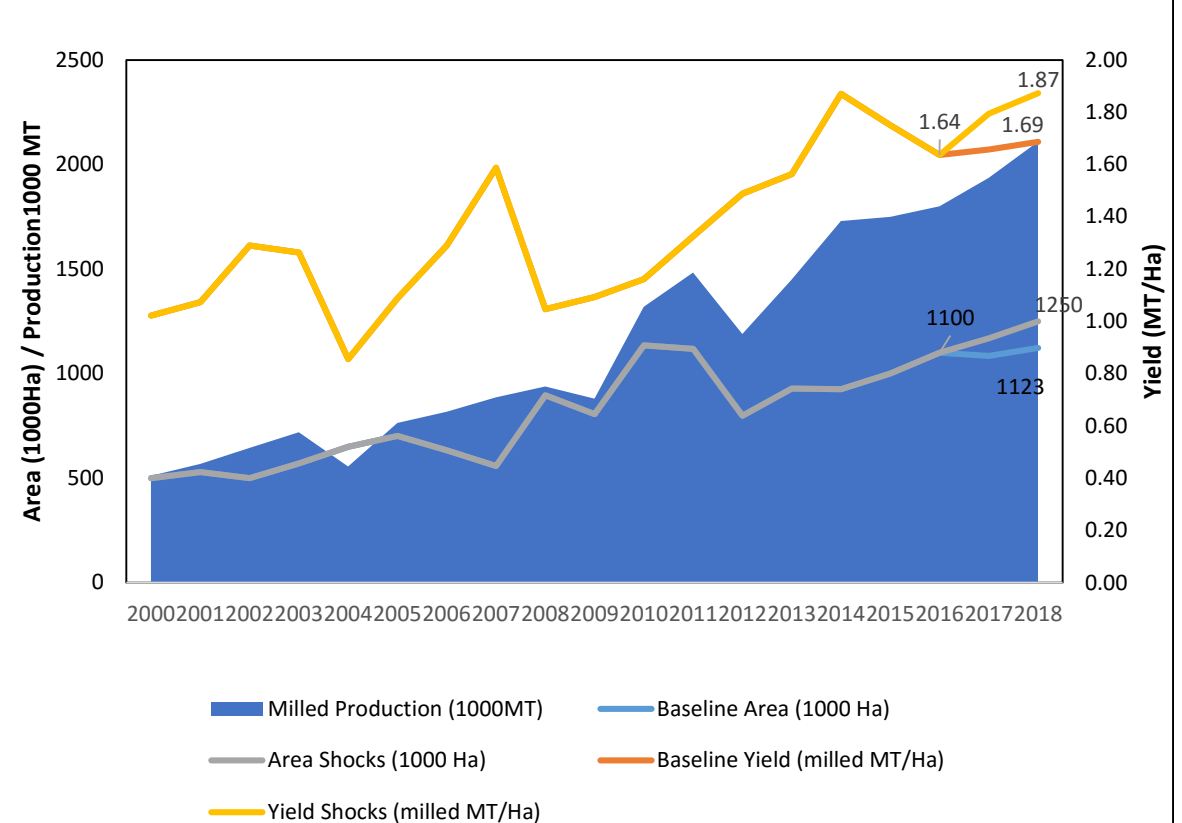
Area Expansion -Yield Improvement Equivalence

Country/Equivalent	1 MT/Ha	1000 Ha
Kenya	18,846 Ha	0.053 MT/Ha
Rwanda	4,516 Ha	0.22 MT/Ha
Tanzania	652,173 Ha	0.0015 MT/Ha
Uganda	72,222 Ha	0.014 MT/Ha

Price Subsidies to achieve self sufficiency

	Kenya 2030			Rwanda 2018		Uganda 2018	Tanzania 2018
	100%	200%	400%	100%	200%	40%	40%
Area Harvested	69	78	92	21	23	142	1256
Yield	3.03	3.03	3.03	4.44	4.82	1.61	1.69
Production	209	237	278	92	112	228	2117
Per capita use	16	16	16	9	9	5	36
Total Consumption	1026	1026	1026	114	114	215	2103
Imports	823	795	754	22	2	28	16
Exports	0	0	0	0	0	40	30
Self Sufficiency	20%	23%	27%	81%	99%	106%	101%

Implications of rice self-sufficiency

KENYA		2030 Baseline	Scenario 1 (SSF at current efficiency)		
					% change in
		Value ($ 1000)	Value ($ 1000)	% change in qtty	Price
Production	LGP	151618	826691648	345%	122380%
	LGB	161609	833747072	320%	122714%
	LGW	166244	834587264	314%	121113%
	FRW	84	110	30%	0%
Consumption	LGW	1933953	812735424	**-65%**	**121112%**
	MGW	323	421	30%	0%
	FRW	61058	79560	30%	0%
Efficiency gain required		**345%**			
Producer subsidy required ($1000)		353,014,691			

Implications of rice self-sufficiency (ctd')

RWANDA		2018 Baseline	Scenario 1 (SSF at current efficiency)		
				% change in qtty	% change in Price
		Value ($ 1000)	Value ($ 1000)		
Production	LGP	40305	1785380	93%	2194%
	LGB	41400	1787507	93%	2137%
	LGW	45776	1795959	93%	1933%
Consumption	LGW	149376	1932441	-36%	1933%
Efficiency gain required	93%				
Producer subsidy required ($1000)	823,275				

Implications of rice self-sufficiency (ctd')

TANZANIA		2018 Baseline	Scenario 1 (SSF at current efficeincy)		
		Value ($ 1000)	Value ($ 1000)	% change in qtty	% change in price
Production	LGP	749756	3137388	28%	226%
	LGB	751070	3143800	29%	225%
	LGW	770253	3169405	29%	219%
	MGB	8	8	4%	0%
	MGW	8	8	4%	0%
Consumption	LGW	1873901	5029417	**-16%**	**219%**
	MGW	906	946	4%	0%
	FRW	15524	16210	4%	0%
Efficiency gain required	28%				
Producer subsidy required ($1000)	478,678				

Implications of rice self-sufficiency (ctd')

UGANDA		2018 Baseline	Scenario 1 (SSF at current efficiency)		
		Value ($ 1000)	Value ($ 1000)	% change in qtty	% change in price
Production	LGP	131166	3121493	73%	1273%
	LGB	132076	3123327	76%	1270%
	LGW	137107	3135251	67%	1272%
Consumption	LGW	313199	2902034	-32%	763%
	FRW	196	216	10%	0%
Efficiency gain required	**73%**				
Producer subsidy required ($1000)		**1,224,667**			

Summary and Conclusions

- NRDS limitations:
  - Kenya – consumption under-estimation
  - Tanzania – flawed production data; limiting exports potential
  - Rwanda & Uganda – Overly-ambitious targets
  - Over-emphasis on supply lifting; less emphasis on demand shifting and/or value-addition

- Self-sufficiency
  - Unlikely and unrealistic in the intermediate time horizon
  - Very costly
  - Will highly impact on consumers
  - De-linking domestic markets from international markets increases vulnerability to local production shocks such as drought

- Extremely challenging and probably needless for these countries to strive to attain self-sufficiency without dramatic changes in resource allocation, productivity and consumption trends.

- Vital that, efficiency of use of resources such as water, land and other inputs is improved for sustainable self-sufficiency

Thank You