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**African Commitments for Agricultural Development
Goals and Milestones for Rwanda**

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Abstract

The study developed a results framework to analyze Rwanda's progress towards selected CAADP/Malabo, SDGs and Agenda 2063 goals. A Computable General Equilibrium model linked to an income distribution Micro-Simulation model were used to identify priority investment areas for accelerated agricultural growth, poverty and inequality reduction. The current investment trend simulated in the baseline scenario would leave Rwanda off-track to meet these objectives. The analysis of alternative agricultural investment scenarios shows that enhancing the role of the private sector in agriculture will be critical in curbing supply side constraints. The government plays a central role by creating an environment and making the sector more attractive to private investors. Developments outside of the agricultural sector and social protection will be critical to further reduce poverty. Productivity remains one of the major challenges but also one of the most effective solutions for accelerated agricultural growth in Rwanda. Agricultural investments should be designed considering the agricultural value-chain.

Resume

L'étude a élaboré un cadre de résultats pour analyser les progrès du Rwanda vers certains objectifs du PDDAA / Malabo, des ODD et de l'Agenda 2063. Un modèle d'équilibre général calculable lié à un modèle de micro-simulation de répartition des revenus a été utilisé pour identifier les domaines d'investissement prioritaires pour l'accélération de la croissance agricole, la pauvreté et la réduction des inégalités. La tendance actuelle des investissements simulée dans le scénario de référence laisserait le Rwanda sur la bonne voie pour atteindre ces objectifs. L'analyse des différents scénarios d'investissement agricole montre que le renforcement du rôle du secteur privé dans l'agriculture sera essentiel pour réduire les contraintes du côté de l'offre. Le gouvernement joue un rôle central en créant un environnement et en rendant le secteur plus attrayant pour les investisseurs privés. Les développements en dehors du secteur agricole et de la protection sociale seront essentiels pour réduire davantage la pauvreté. La productivité reste l'un des défis majeurs mais aussi l'une des solutions les plus efficaces pour accélérer la croissance agricole au Rwanda. Les investissements agricoles devraient être conçus en tenant compte de la chaîne de valeur agricole.

1. Introduction

Building on the Comprehensive Africa Agriculture Development Programme (CAADP) signed by African Heads of State (AU/NEPAD, 2003), the 2014 Malabo Declaration on Accelerated Growth and Transformation for Shared Prosperity and Improved Livelihoods upheld the original Maputo commitment of achieving a 6% annual agricultural growth rate and a 10% agricultural expenditure as share of total public expenditure (AU/NEPAD, 2014). The seven priority areas of the 2014 Malabo Declaration marked a strong commitment to the goals of improving investments in agricultural production, ending hunger and halving poverty, boosting intra-African trade in agricultural commodities and services, enhancing resilience to climate variability and other related risks, as well as the goal of creating mutual accountability to actions and results through a review process of the progress made in implementing the provisions of the Declaration. At the same time, countries have signed on to the African Union (AU) Agenda 2063 as well as the United Nations (UN) Sustainable Development Goals (SDGs) – which are committed to accelerating economic growth and eradicating poverty and inequality, among several other goals. A key challenge to implementing these commitments is that they involve a large number of obligations and goals.

To address the CAADP/Malabo, SDGs and Agenda 2063 goals, a results framework for 2015-2025, 2016-2030 and 2014-2035, respectively, has been developed as a key tool for translating Africa's agricultural agenda into tangible outcomes. This paper applies this results framework for Rwanda. The application of the result frameworks also considers Rwanda's national policies that have been developed and aligned with these continental and global policy frameworks. The policies considered include those outlined in the Economic Development and Poverty Reduction Strategy (EDPRS), the 7-year government program (7YGP), National Strategy for Transformation (NST1) and the Strategic Plan for the Transformation of Agriculture in Rwanda (PSTA4). The Results Framework assists the tracking, monitoring and reporting on progress and facilitates mutual learning and accountability for Rwanda. The goals are organized into two broader areas with two sets of metrics that have been identified to measure targets, define milestones, and guide progress and performance tracking and review. The first area deals with overarching goals and targets as derived from the 2003 CAADP and recommitted under the 2014 Malabo Declaration, which include achieving 6 % annual agricultural growth, reaching a 10% agricultural expenditure share, eliminating hunger and halving poverty by 2025. These overarching goals are aligned with SDG1 (end poverty) and SDG2 (end hunger and promote sustainable agriculture) as well as Agenda 2063 Goal 5 (modernize agriculture for increased production) and Goal 1 (quality of life and wellbeing for all citizens). Moreover, these overarching goals are aligned to the objectives of the NST1 and the PSTA4.

The second section of this study covers metrics detailing sub-goals and targets that are made under each of the specific thematic areas covered under Rwanda's national policies, CAADP/Malabo Declaration,

Africa's Agenda 2063 and SDGs. It must be noted that Agenda 2063 and SDGs also contain goals for non-agricultural sectors, some of which are considered for this analysis. The goals analyzed in the second area under CAADP/Malabo include: agricultural investments, ending hunger, ending poverty and intra-Africa trade. The SDG goals analyzed include halving poverty, ending hunger, sustainable economic growth, inclusive and sustainable industrialization and reducing poverty. Finally, under Agenda 2063, the goals analyzed include poverty reduction, hunger eradication, inequality reduction, increase in employment and incomes, inclusive economic growth, productivity growth and intra-Africa trade. Under each of these, relevant indicators in the results framework are considered and additional complementary metrics are proposed and used to ensure that status assessment and program and investment plan designs are comprehensive enough to meet the vision outlined by the three Agendas including the country policies.

The analytical approach proposed here addresses the overarching goals and targets. We use economic modeling to assess Rwanda's current economic and agricultural growth path against predefined agricultural development goals and targets. The modeling tool is also used to identify priority areas for investment in agriculture and to define the milestones to achieving the predefined agricultural development goals. The economic modeling tools consist of a Computable General Equilibrium (CGE) model linked to an income distribution Micro-Simulation (MS) model to assess the poverty outcomes of public agricultural investments. Finally, a multi-market approach is used to enhance greater commodity coverage and to identify priority commodities for agricultural development in Rwanda. The models are used to construct a business as usual scenario which demonstrates the expected impacts of a continuation of recent economic trends on development goals, as well as an agricultural investment scenario of accelerated agricultural growth.

2. Policy Coherence and Agricultural Development Goals

The Economic Development and Poverty Reduction Strategy (EDPRS) is Rwanda's medium-term economic development plan. The first EDPRS was elaborated in 2007. The EDPRS 2 covered the period 2013 to 2018. It was aimed at changing the structure of the economy towards achieving the country's long-term targets of the Visions 2020 and the MDGs. Rwanda has attained most of the MDGs. Poverty reduced from 60% in 2000 to 38% in 2017 while extreme poverty declined by more than half over the same period. Economic growth averaged 6.1% while agricultural growth reached 4.1% over the period 2013-2016 (NST1). Rwanda has made new global commitments including: Sustainable Development Goals (SDGs) – 2030 and African Union Agenda 2063. The elaboration of Vision 2050 was informed by these international commitments and strives towards high standards of living for all Rwandans. For the realization of this vision, high and sustained economic growth is required. The target of becoming a middle-income country by 2035 and a high-income country by 2050, will require an average annual growth above 10%.

The 2017 elections marked the elaboration of the 7-year government program (7YGP). The 7YGP builds upon lessons learned from previous strategies and embraces the above-mentioned visions, commitments and strategies. All these objectives are consolidated in the National Strategy for Transformation (NST1). Within its economic transformation pillar, the NST1 aims at modernizing and increasing the productivity of agriculture and livestock, and to transition towards a Green Economy by promoting sustainable management of the environment and natural resources (The Republic of Rwanda NST1, 2017).

The agricultural sector accounts for one third of GDP, nearly half of exports and employs two third of the population (National Agricultural Policy, NAP 2018). Agriculture grew at an average of 5.3% between 2000 and 2016. Recent year were marked by slower agricultural growth owing to stagnating crop yield and the small holding size, climate conditions, soil degradation and erosion. Agricultural policies are guided by the NAP and implemented through projects formulated under the Strategic Plan for the Transformation of Agriculture in Rwanda (PSTA), which is in its fourth phase. PSTA 4 is elaborated for the period 2018-2024. The PSTA 4 envisions a transformation of Rwandan agriculture away from subsistence agriculture towards a knowledge-based sector with higher value addition. It emphasizes a stronger role of the private sector as the main investor while the government would become a market enabler rather than a market actor. In line with the CAADP, the PSTA 4 is designed to achieve four strategic impact areas: Increased wealth contribution; Increased Economic Opportunity and prosperity - jobs and poverty alleviation; Improved Food Security and nutrition; and Increased Resilience and sustainability. A set of four priority areas has been identified along with their projected contributions to the four impact areas innovation and extension, productivity and resilience, inclusive markets and value addition and enabling environment and responsive institutions.

Table 1 below presents the indicators aimed at measuring progress towards these four impact areas. While Rwanda has met, but would need to maintain, the objective of a 10% annual agricultural production growth, the other seven targets set in the PSTA4 have yet to be achieved in 2018/19.

Table 1: Indicators of strategic agricultural impact areas

PSTA4 Indicator	NST1, CAADP and/or SDG indicator	Unit of measurement	2018/19	2023/24
A1. Agricultural production	NST: 39	Percentage growth	10%	10%
A2. Exports	NST: 39	Value in million USD	403	537
B1. Rural households living below poverty line	CAADP: 4.1.ii	percentage	34.7%	17.0%
B2. Jobs related to agriculture	CAADP: 4.1.ii	Number	60,000	360,000
B3. Average income per smallholder farming household	SDG 2.3.2 CAADP: 3.2.i SDG: 2.3.1	Annual income growth	3.7%	3.7%
C1. Food insecure households	SDG 2.2.2	Percent	19%	10%
C2. Food production per capita		Kilo calories per capita	2,180	3,094
D1. Agriculture land under sustainable land management practice	NST: cc1 CAADP 6.1 SDG 2.4.1	Percent	60%	83%

Source: adapted from PSTA 4

CAADP is Africa's policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all (AU/NEPAD (2003)). It was adopted in Maputo in 2003 by the African heads of states and government. CAADP had four pillars: sustainable land and water management, improved rural infrastructure and trade related capacities for market access, increasing food supply and reducing hunger and agricultural research, technology dissemination and adoption. In 2014, the AU heads of states and government evaluated the achievements of CAADP in the first 10 years of implementation (2003-2013) and also identified areas that need to be strengthened to realize the aspirations of CAADP. They then adopted the Malabo Declaration on CAADP which is a statement that entails further commitments on pursuing the goals of CAADP.

The Malabo Declaration was adopted in 2014 with seven priority areas or commitment areas, (AU/NEPAD (2014)): Commitment I: Retain the principles and values of the CAADP process, Commitment II: Enhancing Investment Finance in Agriculture, Commitment III: Ending Hunger in Africa by 2025 through accelerating agricultural growth by at least doubling current agricultural productivity levels and by integrating measures for increased agricultural productivity with social protection initiatives focusing on vulnerable social groups. Commitment IV: halving poverty by the year 2025, through inclusive agricultural growth and transformation to ensure that the agricultural growth and transformation process is inclusive and contributes at least 50% to the overall poverty reduction target, to sustain annual agricultural GDP growth of at least 6% and to establish and/or strengthen inclusive public-private partnerships for at least five (5) priority agricultural commodity value chains with strong linkages to smallholder agriculture and to create job opportunities for at least 30% of the youth in agricultural value chains. Commitment V: Boosting

Intra-African Trade in agricultural commodities and services through tripling intra-Africa trade in agricultural commodities and fast tracking continental free trade area and transition to a continental common external tariff scheme. Commitment VI: Enhancing resilience in livelihoods and production systems to climate variability and other shock. Commitment VII: Mutual accountability to actions and results. Among these seven commitments, this study will address progress made by Rwanda towards four commitments that the methodology can measure. Table 2 presents these four commitments and the indicator used as a metric of performance and the target. While most targets can be assessed as compared to a predetermined target, some are expected to increase (>) or decrease (<).

Table 2: Selected CAADP Malabo Commitments and Goals

Goal	Indicator	Target
Commitment to Enhancing Investment Finance in Agriculture (II)		
Enhance investment finance, both public and private, to agriculture	Share of Government agriculture expenditures in total Government expenditures (%)	10
	Private investment in agriculture, variation (%)	>
Commitment to Ending Hunger in Africa by 2025 (III)		
End extreme poverty and hunger	Extreme poverty level, at the national food poverty line, variation (%)	-95
Increase agricultural productivity and production levels	Growth rate of agricultural value added per agricultural worker (%)	100
	Growth rate of agricultural value added per hectare of arable land (%)	100
Halve the current levels of Post-Harvest Losses, by the year 2025	Growth rate of agricultural post-production value added per worker (%)	50
Integrate measures for increased agricultural productivity with social protection initiatives	Gini coefficient, variation (%)	<
	Share of the poorest 40% quintile in food expenditures, variation (%)	>
Commitment to halving poverty by the year 2025, through inclusive agricultural growth and transformation (IV)		
Increased economic opportunities and reduced poverty levels	Poverty level, at the national poverty line, variation (%)	-50
	Household final consumption expenditure per capita at constant 2010 local currency, variation (%)	>
Ensure agricultural-led growth and poverty reduction target	Agricultural GDP, annual variation (%)	6
	Agricultural contribution to GDP growth (%)	50
Commitment to Boosting Intra-African Trade in Agricultural Commodities (V)		
Increased intra-African regional trade and better functioning of national & regional markets	Growth rate of the value of agricultural commodities traded with Africa, in constant values (%)	200

The vision of the United Nation's Sustainable Development Goals is a world free of poverty, hunger, and where food is sufficient, safe, affordable and nutritious, where every country enjoys sustained, inclusive and sustainable economic growth and decent work for all (United Nations 2015). The SDGs are grounded in the Universal Declaration of Human Rights, international human rights treaties, the Millennium Declaration and the 2005 World Summit Outcome Declaration on the Right to Development. Specific goals of interest are the following: End poverty in all its forms everywhere (Goal 1), End hunger, achieve food

security and improved nutrition and promote sustainable agriculture (Goal 2), Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all (Goal 8) and reduce inequality within and among countries (Goal 10). Regarding poverty reduction, Rwanda has achieved important results on the Millennium Development Goals (MDGs): the share of population living in extreme poverty fell from 40% to 16% between 2000 and 2017. The country is also a signatory to the Sustainable Development Goals (SDGs) that replaced the Millennium Development Goals, which ended in 2015, with the objective of achieving a set of common goals that meet urgent global environmental, economic and political challenges by 2030. Among the seventeen SDGs considered by the United Nations Agenda, the agricultural sector is concerned by or is expected to have a direct contribution to following five goals (Table 3).

Table 3: Selected SDGs

Result	Indicators	Target
Halving poverty (Goal 1)		
Eradicate extreme poverty	Proportion of population below the international poverty line of \$1.25 a day PPP	-95
Reduce at least by half the proportion of population living in poverty	Proportion of population living below the national poverty line	-50
Implement nationally appropriate social protection systems and measures	Proportion of population covered by social protection floors/systems	>
End hunger (Goal 2)		
End hunger and ensure access to safe, nutritious and sufficient food	Poverty level at national food poverty line (Prevalence of undernourishment if data available)	-95
Double the agricultural productivity and incomes of small-scale food producers	Volume of agricultural production per labor	100
	Average income of food producers	100
Promote sustained, inclusive and sustainable economic growth (Goal 8)		
Sustain per capita economic growth	Annual growth rate of real GDP per capita	>
	Annual growth rate of real GDP	7
	Annual growth rate of real GDP per employed person	>
Achieve full and productive employment and decent work	Average hourly earnings	>
	Unemployment rate	< 5
Promote inclusive and sustainable industrialization (Goal 9)		
Promote inclusive and sustainable industrialization	Manufacturing value added as a proportion of GDP and per capita	100
	Manufacturing employment as a proportion of total employment	100
Reduce inequality within and among countries (Goal 10)		
Achieve and sustain income growth of the bottom 40 per cent of the population	Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population	>
Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	Labor earning share of GDP	>

The Vision for the Africa Agenda 2063 was adopted in March 2013 by the African Union Commission (AUC). The first implementation of the plan runs between 2013 and 2023. The Agenda 2063 is a strategic

framework for the socio-economic transformation of the continent over the next 50 years. It builds on and seeks to accelerate the implementation of past and existing continental initiatives for growth and sustainable development. Some of the main characteristics and intensions of the Agenda 2063 include, the creation and maintenance of an effective-equitable and people-centered growth and development, the eradication of poverty, and enabling internal coherence and coordination to continental, regional and national frameworks and plans adopted by the AUC, Regional Economic Communities (RECs) and member states. Some of the Africa Agenda 2063 goals which are important for this study includes a high standard of living, quality of life and well-being for all citizens (Goal 1), healthy and well-nourished citizens (Goal 3) and modern agriculture for increased productivity and production (Goal 5).

An important issue is whether Rwanda's vision and goals are coherent with its continental agricultural sector wide commitments and goals as set out in the CAADP Malabo, SDGS and Agenda 2063 commitments and goals. As discussed above, each of the commitments have goals, some similar, others different. In some cases, the agendas specify a numeric target, while in others the target is simply an increase or decrease in the value of an indicator. These targets are used in assessing whether the country would be able to attain the goals set out in the different commitments.

3. Models and data

An economic modeling framework is built to assess the strategic options available to Rwanda to accelerate growth and reduce poverty as envisaged by the NST1 and committed under the Malabo Agenda and UN SDGs. The framework consists of an economywide general equilibrium model and a microsimulation model. The two models are linked in a sequential manner, that is, the output from one model is used as an input by the other model. Indeed, as suggested by Fofana et al. (2019), a mix of economic models is necessary to properly address multiple goals carried by the agricultural development agendas. Thus, the macroeconomic model addresses the growth and investment goals and targets. However, the latter does not include issues related to inequality and poverty which are better handled in the microeconomic model.

The macroeconomic model is an agricultural investment focused computable general equilibrium (CGE) model grounded in the Walrasian small open economy framework. The microeconomic model is a statistical economic model built to capture income distribution among the population. The changes in the probabilities associated with individual income levels induced by changes in mean (per capita) income is assessed through a "generalized entropy" measure (Lee and Judge, 1996). Further details about key characteristics

of the micro and macro models are available in Fofana et al. (2019).¹ The following sections focus on salient features of Rwanda’s macro and micro databases used to calibrate the models.

We use the Fifth Integrated Household Living Conditions Survey (2016/17 EICV5) conducted by the National Institute of Statistics of Rwanda (NISR) is used to implement the microeconomic model. EICV5 is part of household surveys series conducted every three years and is used as data source for tracking poverty and welfare, informing the policy making bodies and helping the Government of Rwanda for evidence-based decision making and planning. The CGE model is implemented using a Social Accounting Matrix (SAM). A SAM is a square matrix that describes the transaction flows taking place within an economy during a given period of time (Fofana, Diallo, Sarr, and Diouf, 2015). The CGE model is implemented using the 2011 SAM for Rwanda (Pradesha, Angga; and Diao, Xinshen, 2014). The SAM describes 54 industries (or commodities), including 26 agricultural industries (or commodities); 9 food processing, tobacco and beverages industries and 19 other industries (or commodities); 9 accounts for factors; and 7 institutional accounts, including 1 account for the rest of the world.

4. Results

The business as usual (BaU) scenario projects the Rwandan economy over the period 2011-2024 based on its performance between 2011 and 2014 (Table 4 and 5). While Table 4 presents the benchmark data used to calibrate GDP and other major macroeconomic indicators up to 2024, Table 5 is used to calibrate major socio economic variables based on past performance.

Table 4: Rwanda’s Selected Economic Variables, Trend and Outlook 2011-2024

Subject Descriptor	Units	2011-2014	2015-2024
Gross domestic product, constant prices	Percent change	7.24	7.67
Total investment	Percent of GDP	25.27	27.30
Gross national savings	Percent of GDP	8.94	14.21
Volume of imports of goods and services	Percent change	12.84	7.54
Volume of exports of goods and services	Percent change	14.81	11.63
General government revenue	Percent of GDP	24.56	23.66
General government total expenditure	Percent of GDP	26.75	26.77
Current account balance	Percent of GDP	-9.49	-9.27

Source: World Economic Outlook (IMF, 2019)

¹ ISMAËL FOFANA, MIRIAM W. O. OMOLO, ANATOLE GOUNDAN, LÉA VICKY MAGNE DOMGHO, JULIA COLLINS, ESTEFANIA MARTI. 2019. NAIP toolkit for Malabo domestication: Economic modeling of agricultural growth and investment strategy, case study of Kenya. IFPRI Discussion Paper 01813. Washington DC.

Table 5: Rwanda's Selected Socioeconomic Variables, Trend 2011-2018

Subject Descriptor	2011-2014	2015-2018
Households and NPISHs Final consumption expenditure (annual % growth)	6.97	6.49
GDP growth (annual %)	7.24	7.39
Agriculture, forestry, and fishing, value added (annual % growth)	5.28	5.33
Industry (including construction), value added (annual % growth)	11.62	7.63
Manufacturing, value added (annual % growth)	6.68	8.07
Services, value added (annual % growth)	7.95	8.59
Population growth (annual %)	2.47	2.61
labor force, (annual % growth)	2.64	3.09
Employment, (annual % growth)	2.61	3.15
Rural population growth (annual %)	2.46	2.53
Urban population growth (annual %)	2.52	2.96

Source: World Development Indicators (World Bank, 2019); * African Statistical Yearbook (AfDB; UNECA and AUC, 2019); ** ReSAKSS Database (ReSAKSS, 2019)

Under the BaU scenario, Rwanda would make insufficient progress towards meeting most of the CAADP commitments and objectives although the country meets the goal of increasing public agricultural investment targets (Table 6). Though improvement is likely to be made in increasing agricultural productivity, there is still much room for progress in this area. Agricultural productivity remains far behind CAADP targets. The private sector could play an important role in boosting agricultural productivity and growth. Improving the competitiveness of the sector and its attractiveness to private investors is one of the intervention areas the government would need to work on. As mentioned in the PSTA4, public private partnerships are one form of collaboration and a stronger role of the private sector is important.

Improving agricultural performance would contribute to progress towards the overall objectives of increasing income, reducing income inequality and reducing poverty. However, it would be insufficient to achieve the CAADP goal of halving poverty between 2015 and 2025. The contribution of the agricultural sector to the creation of economic wealth would still be low because of the poor performance of the sector, due to the small share of agriculture in overall GDP. As a result, the contribution of non-agricultural sectors remains critical to achieving the CAADP goals.

Production and consumption of locally produced food would contribute significantly to reducing hunger. In the BaU scenario, little progress is made in this area. Under the BaU, Rwanda would increase its agricultural and agri-food trade with both its non-African and African partners. However, Rwanda would not achieve the CAADP goal of tripling intra-African agricultural trade under the BaU.

Table 6: Progress towards Selected CAADP Goals, BaU Scenario (Percent Cumulative 2015-2025)

Goal	Result	Metric	BaU Progress	CAADP Target
Increase Agriculture Investment	Increase Agricultural Public Investment	Public Agricultural Investment, Share of Total Public Investment	9.2	10.0
	Increase Agricultural Private Investment	Private Agricultural Investment	46.3	>
End Hunger	Increase Agricultural Productivity	Total Factor Productivity Agriculture	28.6	100.0
		Agricultural Land Productivity	62.9	100.0
		Agricultural Labor Productivity	34.9	100.0
	Increase Agricultural Post-Production Productivity	Total Factor Productivity, Domestic Trade	26.5	50.0
		Total Factor Productivity, Food Industries	19.2	50.0
	Increase Consumption of Locally Produced Food	Consumption Locally Produced Food, Ratio Total Food Consumption	0.4	>
Reduction Extreme Income Poverty	Poverty Headcount Index, Food poverty line, Change (%)	-18.8	-95.0	
Halve Poverty	Accelerate Agricultural Growth	Agricultural GDP, Annual Growth	5.1	6.0
	Achieve Agriculture-led Poverty Reduction	Agricultural contribution to GDP Growth	19.8	50.0
	Reduction Income Poverty	Poverty Headcount Index, National poverty line	-16.7	-50.0
Boost Intra-African Agricultural Trade	Increase Intra-Africa Agricultural Trade	Intra-Africa Imports and Exports of Agricultural and Food Commodities	84.5	200.0

Source: Simulation Results.

Note: Unless otherwise noted, values shown are cumulative growth rates from 2015 to 2025. Values for “Agricultural Share Public Investment” and “Agriculture Contribution to GDP Growth” denote average annual shares. Values for “Agricultural GDP, Annual” refer to average annual growth rates.

Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value.

Under the BaU scenario, we find mixed results towards the selected SDGs as presented in Table 7. While the goals of ending hunger and attaining sustainable economic growth are met or register considerable progress, the goal of halving poverty shows significant progress according to measurement based on the national poverty line. In addition, the country would not achieve the industrialization goals by 2030, as the contribution of the manufacturing industry to GDP and total employment would be remain largely below target throughout the period despite an annual economic growth rate of around 7%.

Table 7: Progress towards Selected SDGs, BaU Scenario (Percent Cumulative 2015-2030)

Goals	Result	Metric	BaU Progress	SDGs Target
Halving poverty (Goal 1)	Eradicate extreme poverty	Proportion of population below the international poverty line of \$1.90 a day PPP	-21.1	-95.0
	Reduce at least by half the proportion of population living in poverty	Proportion of population living below the national poverty line	-22.0	-50.0
End hunger (Goal 2)	Double the agricultural productivity and incomes of small-scale food producers	Volume of agricultural production per labor	81.2	100.0
		Average income of food producers	136.1	100.0
Sustainable economic growth (SDG 8)	Sustain per capita economic growth	Annual growth rate of real GDP per capita	90.2	>
		Annual growth rate of real GDP	7.1	7.0
		Annual growth rate of real GDP per employed person	81.9	>
	Achieve full and productive employment and decent work	Average hourly earnings	221.8	>
		Unemployment rate, change	0.0	<6
Inclusive and sustainable industrialization (SDG 9)	Promote inclusive and sustainable industrialization	Manufacturing value added as a proportion of GDP and per capita	39.7	100.0
		Manufacturing employment as a proportion of total employment	21.0	100.0
Reduce inequality (SDG 10)	Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	Labor earning share of GDP	14.5	>

Source: Simulation Results

Note: Unless otherwise noted, values shown are cumulative growth rates from 2015 to 2030. Values for “GDP, Annual Growth” refer to average annual growth rates. Values for “Unemployment rate” are reported for the specific year, i.e. they are not cumulative.

Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value.

In the BaU scenario, Rwanda would be on track to meet two out of the four goals of the Agenda 2063 presented in Table 8. That is incomes, jobs and decent work and sustainable and inclusive economic growth. The Agenda 2063 goal on poverty, inequality and hunger will not be met under the BaU scenario despite an increase in per capita income. Inequality reduction measured by rural-to-urban income ratio shows little progress in the baseline. Other poverty reduction goals show little progress. Similarly, the BaU scenario gives little progress on agricultural productivity and production.

Table 8: Progress towards Selected Goals of Agenda 2063, BaU Scenario (Percent Cumulative 2015-2035)

Goal	Result	Metric	BaU Progress	Agenda 2063 Target
Poverty, inequality and hunger	Poverty Reduction	Proportion of population below the international poverty line of \$1.90 a day PPP	-29.3	-95.0
		Proportion of population living below the national poverty line	-30.5	-95.0
	Hunger Eradication	Food Import Dependency Ratio	-21.9	-70.0
	Inequality Reduction	Rural-to-Urban Income Ratio	-37.0	50.0
Incomes, jobs and decent work	Employment and Incomes	Unemployment Rate	0.0	6.0
		Per Capita Income Growth	156.7	>
Sustainable and inclusive economic growth	Inclusive Economic Growth	GDP, Annual Growth	7.1	7.0
	Intra-African Trade	Value of intra-Africa Trade	269.4	120.0
Agricultural productivity and production	Productivity Growth	Agricultural TFP	65.5	500.0

Source: Simulation Results

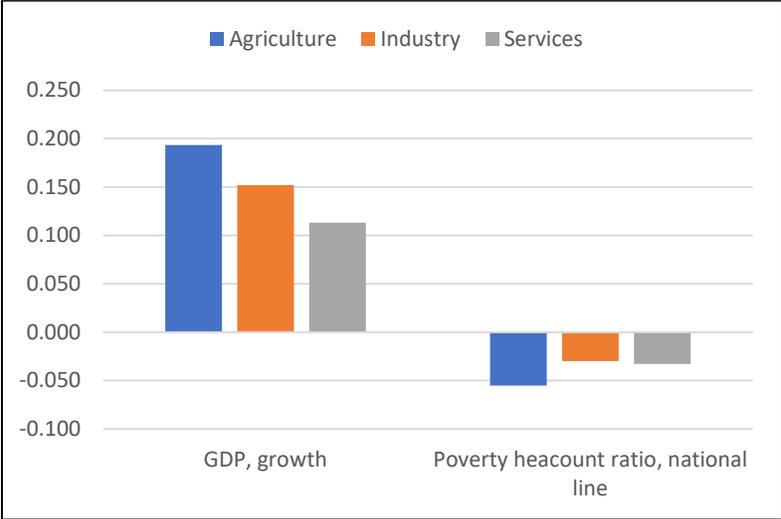
Note: Unless otherwise noted, values shown are cumulative changes from 2015 to 2035. Values for “GDP, Annual Growth” refer to average annual growth rates. Values for “Unemployment rate” are reported for the specific year, i.e. they are not cumulative. Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value.

The previous section showed that Rwanda would make progress towards achievement of some of the objectives set by the CAADP, the SDGs, and Agenda 2063. Other development objectives would not be achieved under the BaU scenario. Alternative options for accelerated agricultural growth and transformation would be needed to attain more goals set by the three agendas. The following sections present the simulation scenarios. The acceleration of agricultural growth and transformation as called for by the Malabo Declaration necessarily requires public financing to improve the competitiveness of the sector and the achievement of the sector's development objectives. In this context, it is important to ensure the judicious allocation of investments, including their distribution among the different sectors of the economy and along the agricultural value chain. In addition, in the context of resource scarcity, adequate options for financing the required public investments are needed.

Figure 1 shows the effect of a 1 percent increase in public investment allocation to the agricultural sector compared to non-agricultural sectors, i.e. industry and services. In these simulations, public investment increases are financed by external resources – foreign loans, international development assistance, and other external sources. Other options for financing public investments are explored in the next section. Increasing

agricultural public investment would accelerate overall GDP and improve income and food consumption in Rwanda. It appears that agricultural growth is more inclusive than nonagricultural growth. In other words, the resulting growth in income and food consumption is significantly larger for agricultural investments compared to non-agricultural investments. The positive effect of agricultural investment on overall GDP is higher than that of industry and higher than that of services. Thus, increasing agricultural public investment is better for Rwanda in terms of income growth and distribution and, ultimately, poverty reduction and the elimination of hunger.

Figure 1: Growth and Poverty Effects of a 1 Percent Point Increase in Public Investment by Economic Sector, Percent Point Change from Baseline

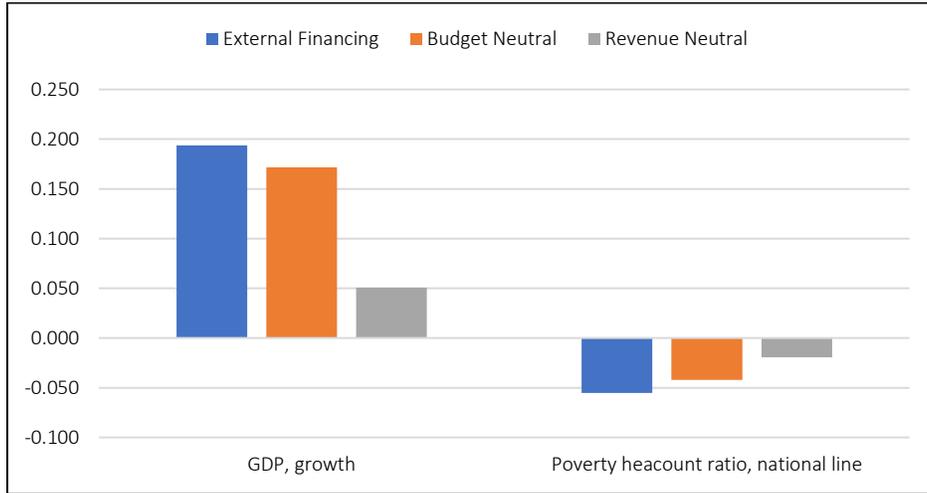


Source: Simulation results.
 Note: Under external financing option.

Irrespective of the financing options, agricultural investment has a positive impact on economic growth and poverty reduction compared to BaU; external funding exhibits the highest return. Figure 2 presents the impact of alternative agriculture and rural development investment financing options to accelerate agricultural growth and economic transformation. Specifically, three options for agricultural investment financing are compared. Revenue neutral assumes fixed total investment expenditures; thus, an increase in investment in one sector requires a decrease in other sectors. Budget neutral assumes that increases in investment expenditures are funded through increased tax revenues from households’ income and properties (direct tax). External financing assumes that increases in investment expenditures are funded externally, i.e. through international borrowing or development assistance.

Figure 2 shows that external financing of investments allows for the highest impact in terms of economic growth and poverty reduction. While external financing exhibits the best outcomes, it is worth noting the positive outcomes of investing in agriculture compared to BaU irrespective of the financing options.

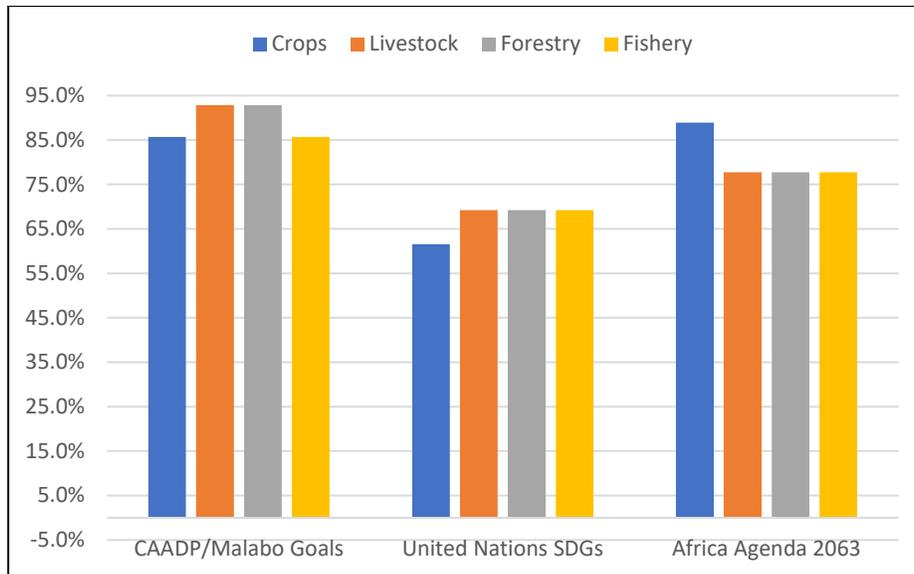
Figure 2: Growth and Poverty Effects of a 1 Percent Point Increase in Public Investment by Financing Option, Percent Point Change from Baseline



Source: Simulation Results

Across the agricultural sub-sectors, agricultural public investment is found to be more effective in the crops sub-sector for the attainment of the Agenda 2063 while livestock and forestry and fishery yield higher scores regarding the CAADP goals and the SDGs.

Figure 3: Public Investment Effectiveness Score by Agricultural Sub-Sector



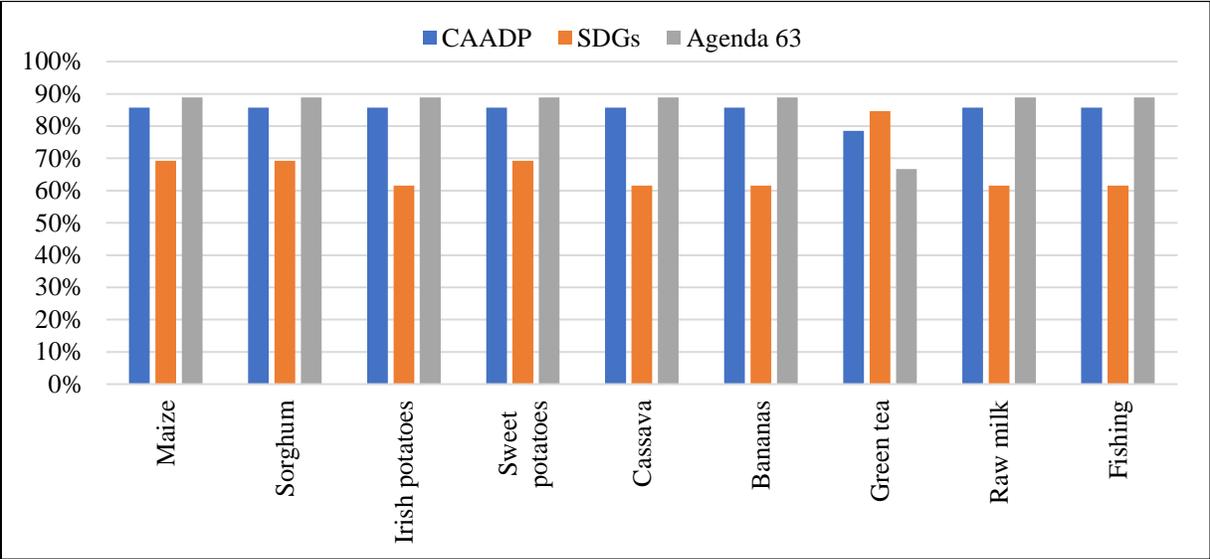
Source: Simulation results.

Note: Under External Financing Option.

The Malabo Declaration calls for the identification of priority agricultural value chains. The CGE model is used to identify priority agricultural commodities based on their contributions to advance the three agendas’

result areas, i.e. CAADP/Malabo, SDGs and Agenda 2063 (Tables 11 to 13), including the following key results: aggregate output growth, household aggregate consumption growth, food consumption growth, national and food consumption growth, rural. First, top 20 commodities are selected based on four criteria listed above. Then, at least six commodities are chosen based on their rank, i.e. contribution, across the four criteria (Figure 4). These strategic commodities with the highest contribution to improving the four results are: maize, sorghum, Irish potatoes, sweet potatoes, cassava, bananas, raw milk, fishing and green tea.

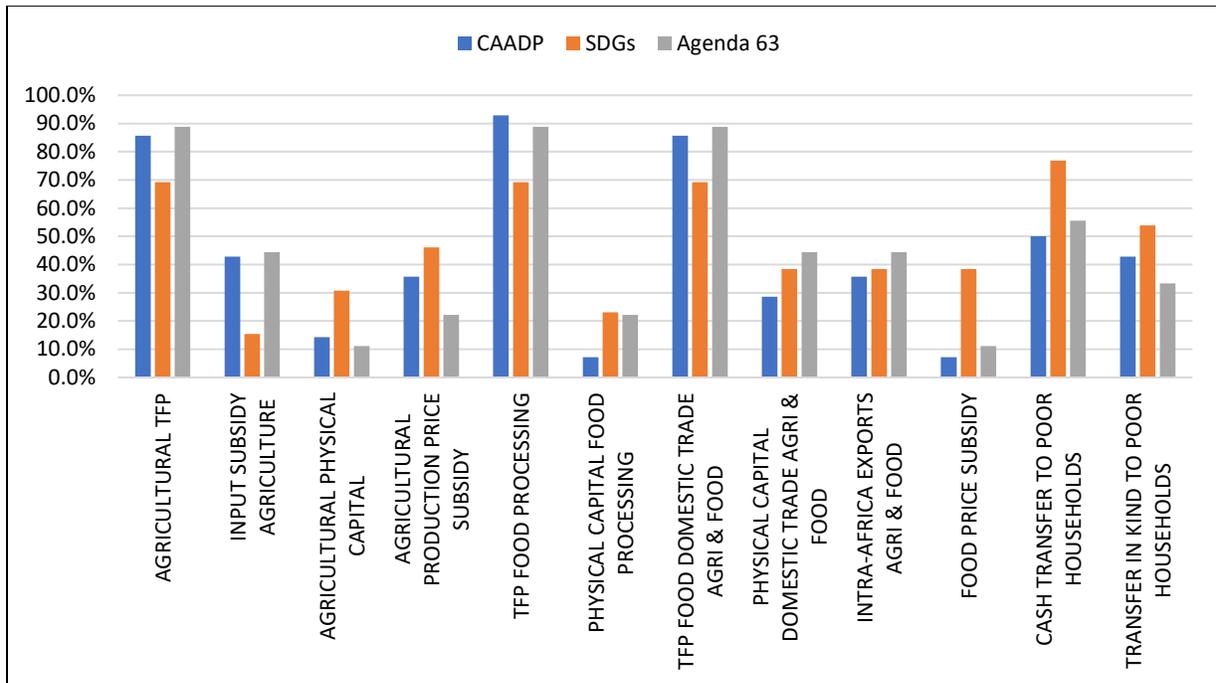
Figure 4: Public Investment Effectiveness Score for Selected Agricultural Commodities



Source: Simulation results.
 Note: Under External Financing Option.

Across the agricultural value chain, several public investment options and their outcomes were analyzed. Findings are summarized in Figure 5. Increasing productivity gives the highest effectiveness score compared to other forms of public investment followed by cash transfers and transfers in kind. Public investments allowing higher agricultural productivity (i.e. increases in technical efficiency), agroindustry productivity and productivity in food domestic trade of agricultural and processed food would enable over 85% attainment of CAADP and Agenda 2063 goals while SDGs would be attained at nearly 70%.

Figure 5: Public Investment Effectiveness Score Along Agricultural Value Chain



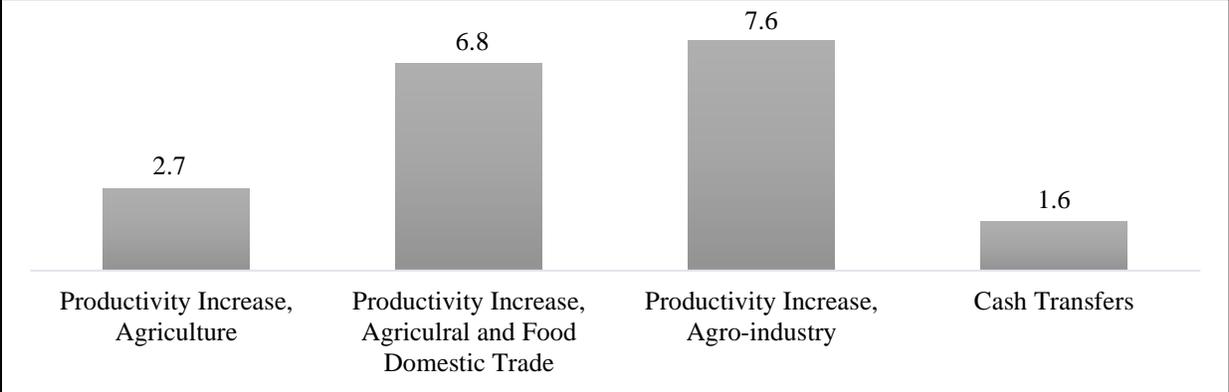
Source: Simulation results.

Note: Under External Financing Option.

Scaling up the supply side investments cannot be sustained without increasing the demand side, including the mid-stream investments, i.e. agroindustry and domestic trading of ag commodities; agroindustry productivity increase has a limit that is compensated by domestic trading of ag commodities. A priority for public agricultural investment would be to target productivity in the agroindustry (7.6% share in the public investment) and domestic trade of agricultural and food commodities (6.8% share in the public investment) as presented in Figure 6. Additional investments appear to be critical to boosting agricultural demand and strengthening the competitiveness of the agricultural sector. Government investments should increase substantially in facilitating domestic trade (Figure 6). Indeed, Rwanda has poor performance regarding consumption of locally produced food (Table 6).

The investment simulation scenario (NAIS) calls for external financing of aggregate public investment to reach an annual average of 19% over the period (Figure 7). Thus, the remaining 81% is to be domestically funded.

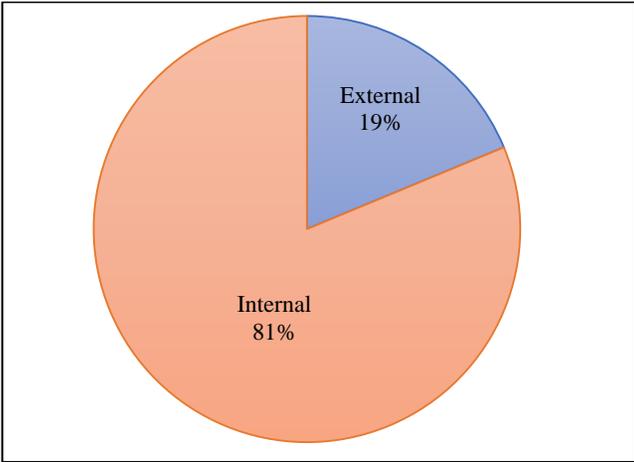
Figure 6: Public Agricultural Investment Priority Areas, Percent Point Public Investment Increase Compared to BaU



Source: Simulation Results

The NAIS scenario calls for external financing of aggregate public investment to reach an annual average of 19% (Figure 6). Thus, the remaining 81% is to be domestically funded.

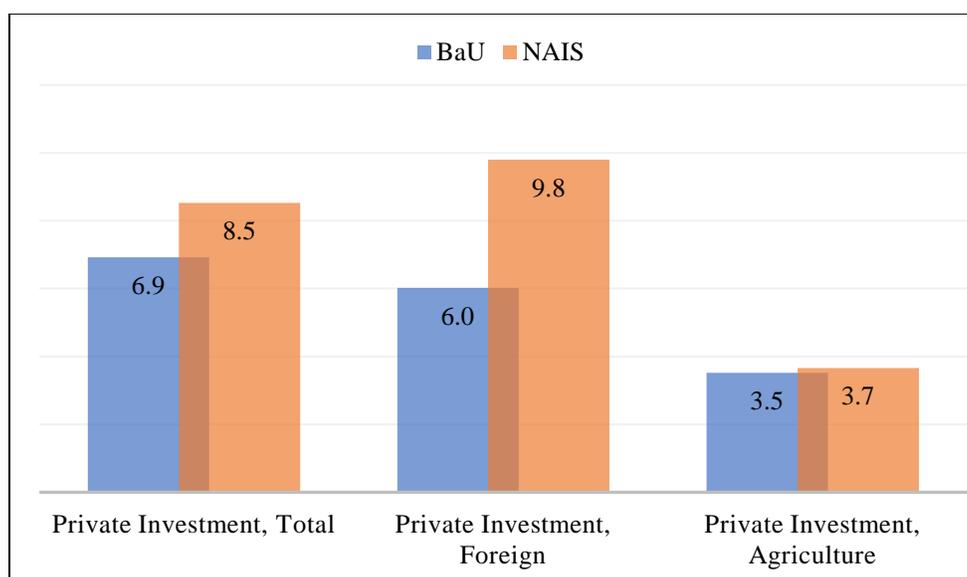
Figure 7: Public Agricultural Investment Financing, Share of Internal and External Sources



Source: Simulation Results

Public agricultural investments should increase to reach the 10% target set by the Malabo Declaration under the NAIS scenario. Public agricultural investments are expected to crowd in private investments under the NAIS scenario. This increase in private investments is much higher than that observed in the BaU scenario (Figure 8). While private investment in agriculture per se remains nearly unchanged, total private investment increases significantly in the simulation scenario partly pulled by foreign investors contribution in sectors outside agriculture.

Figure 8: Percent Increase in Private Investment, Annual Average



Source: Simulation Results

Under the NAIS scenario, the cost of input use in agricultural production should decrease relative to BaU scenario (Table 9). As a result, access to agricultural inputs improves as input expenditure per hectare is projected to increase. Increasing input use in agriculture should sustain the increase in agricultural productivity. The latter is projected to increase substantially under the BaU and double in the NAIS scenarios.

The annual growth rate of the agricultural sector would accelerate to 7.5% under the NAIS scenario compared to 5.1% under the BaU through sustained high agricultural productivity and increased market opportunities. In the implementation of CAADP, Rwanda should target a 7.5 percent annual increase in agricultural production in order to achieve several of the agricultural development goals. This should be supported by a strategy that increases domestic and foreign demand for agricultural products to sustain agricultural competitiveness and income growth.

Table 9: Agricultural Productivity and Production Growth, Average Annual Growth (%)

	BaU	NAIS
Cost of agricultural inputs	0.9	0.4
Intensity of input use	4.7	7.1
Agricultural total factor productivity	2.3	4.9
Agricultural land use	0.5	0.6
Agricultural labor-to-land ratio	1.7	1.6
Agricultural private capital-to-land ratio	9.9	9.6
Agricultural Production	5.1	7.5

Source: Simulation Results

At the sub-sector level, the NAIS scenario results in higher growth in the livestock sector followed by the fishery, forestry and crops sub-sectors (Figure 9).

Figure 9: Agricultural Production Growth by Agricultural Sub-sector (%)

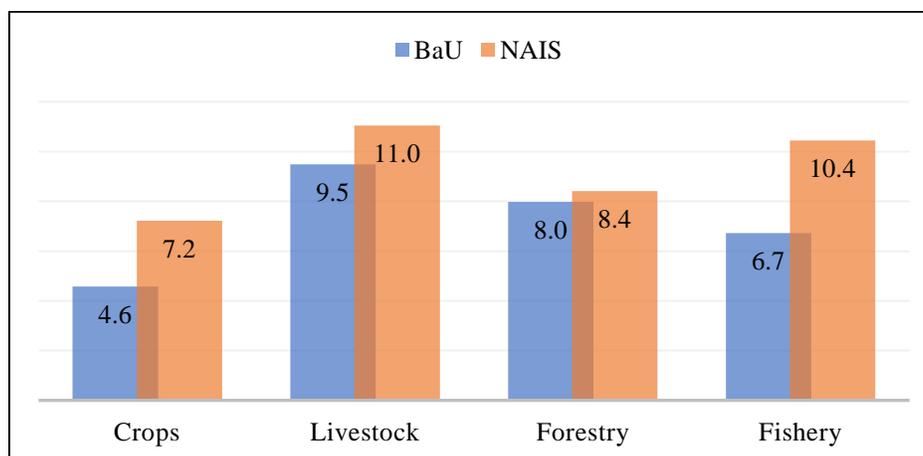


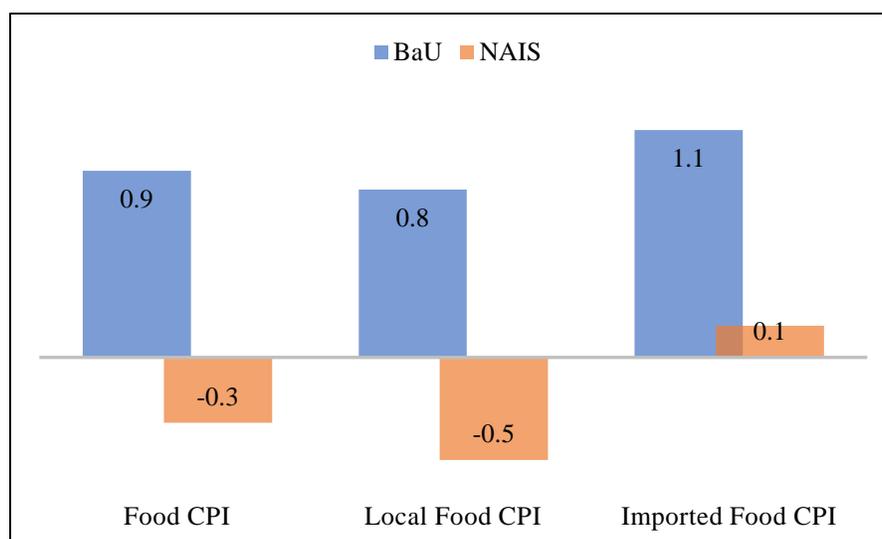
Table 10: Percent Change in Production, Exports and Imports for Selected Agricultural Commodities, NAIS Scenario, Annual Average

Commodity	Production growth	Export growth			Import growth		
		Total	Africa	Row	Total	Africa	Row
Maize	8.1	5.2	5.2	0.0	5.7	6.1	5.5
Sorghum	7.9	5.4	5.4	0.0	4.9	5.5	4.7
Irish potatoes	8.4	5.7	5.4	10.4	6.5	6.5	5.9
Sweet potatoes	7.7	5.0	4.7	9.0	-	-	-
Cassava	8.1	5.4	5.1	9.9	6.3	6.3	5.7
Bananas	8.4	11.1	6.0	11.9	5.0	5.0	3.9
Raw milk	12.6	-	-	-	-	-	-
Fishing	14.1	15.2	14.8	32.0	-3.0	-1.5	-6.0
Green tea	10.4	9.1	9.1	-	-	-	-

Source: Simulation results.
Note: RoW: Rest of World.

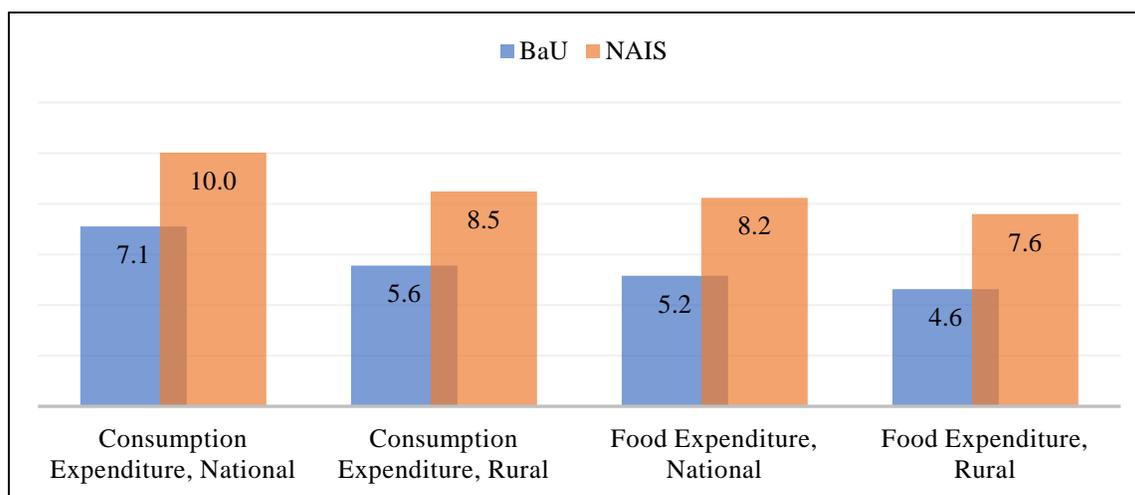
The increase in supply is reflected in downward pressure on consumer prices for food products (Figure 10). The decline in food prices is driven mainly by lower prices for local products as the prices of imported food products rise in both scenarios. Increased local food production and supply is expected to reduce the country's dependence on imports. The relatively higher demand and lower prices in the NAIS scenario compared to the BaU would increase the competitiveness of agriculture and factor remuneration, and ultimately increase income and consumption in rural areas (Figure 11).

Figure 10: Change in Food Prices, Annual Average (%)



Source: Simulation Results
 Note: CPI: Consumer Price Index.

Figure 11: Increase in Income and Food Consumption Expenditure , Annual Average (%)



Source: Simulation Results

Under the NAIS scenario, Rwanda would significantly improve the performance of the agricultural sector and would achieve many of the targets set by the CAADP agenda (Table 11). Beyond the objectives of agricultural productivity and production that were not being achieved under the BaU, the increase in public agricultural investments would improve the contribution of agriculture to the poverty reduction (Table 11). Private agricultural investment increases only slightly, explaining why total factor productivity and labor productivity remain below the CAADP target in the NAIS scenario. Increasing private investments in agriculture would still be a challenge for Rwanda. Agricultural growth is higher than the CAADP target but

not sufficient to achieve CAADP targets. The contribution of agriculture to GDP growth increases slightly but the small size of the agricultural sector relative to the overall economy renders the target of a 50% contribution from agriculture unrealistic for Rwanda. The NAIS scenario also allows Rwanda to make progress toward the Malabo poverty and hunger targets, although some targets will be difficult to achieve through increased agricultural growth alone, given the relatively small size of the sector. Rwanda will be off track to meet the extreme poverty and hunger goal, as measured by the food poverty headcount ratio, under both the BaU and NAIS scenarios; however, food poverty reduction accelerates under the NAIS scenario. There is little progress on the consumption of locally produced food in comparison to total food consumption. Stronger growth outside of the agricultural sector as well as social protection programs will be necessary to further reduce poverty and hunger.

Table 11: Progress towards Selected CAADP Goals, NAIS Scenario (Percent Cumulative 2015-2025)

Goal	Result	Metric	BaU Progress	NAIS Progress	CAADP Target
Increase Agriculture Investment	Increase Agricultural Public Investment	Public Agricultural Investment, Share of Total Public Investment	9.2	11.9	10.0
	Increase Agricultural Private Investment	Private Agricultural Investment	46.3	48.5	>
End Hunger	Increase Agricultural Productivity	Total Factor Productivity Agriculture	28.6	70.1	100.0
		Agricultural Land Productivity	62.9	106.4	100.0
		Agricultural Labor Productivity	34.9	73.1	100.0
	Increase Agricultural Post-Production Productivity	Total Factor Productivity, Domestic Trade	26.5	374.1	50.0
		Total Factor Productivity, Food Industries	19.2	507.3	50.0
	Increase Consumption of Locally Produced Food	Consumption Locally Produced Food, Ratio Total Food Consumption	0.4	0.9	>
	Reduction Extreme Income Poverty	Poverty Headcount Index, Food poverty line, Change (%)	-18.8	-25.5	-95.0
Halve Poverty	Accelerate Agricultural Growth	Agricultural GDP, Annual Growth	5.1	7.5	6.0
	Achieve Agriculture-led Poverty Reduction	Agricultural contribution to GDP Growth	19.8	22.0	50.0
	Reduction Income Poverty	Poverty Headcount Index, National poverty line	-16.7	-22.9	-50.0
Boost Intra-African Agricultural Trade	Increase Intra-Africa Agricultural Trade	Intra-Africa Imports and Exports of Agricultural and Food Commodities	84.5	260.4	200.0

Source: Simulation Results.

Note: Unless otherwise noted, values shown are cumulative growth rates from 2015 to 2025. Values for “Agricultural Share Public Investment” and “Agriculture Contribution to GDP Growth” denote average annual shares. Values for “Agricultural GDP, Annual” refer to average annual growth rates.

Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value.

The NAIS scenario is not enough to achieve two of the five SDGs considered in Table 12 but allows the country to substantially progress toward meeting the goals. Little progress is seen in Goal 1 on halving poverty. Although accelerated reduction in poverty measured by the national poverty line is expected under the NAIS scenario, Rwanda will still be off track in reducing poverty measured by the international line of \$1.90 a day PPP. Given the small share of agriculture in Rwanda’s overall economy, developments outside of the agricultural sector—in particular, increased nonagricultural growth and social protection—will be critical to further reducing poverty. The least progress is indeed registered for goal 10. Promoting inclusive

and sustainable industrialization goal measured by the share of manufacturing in employment in total employment is not met and remains nearly unchanged with the NAIS.

Table 12: Progress towards Selected SDGs, NAIS Scenario (Percent Cumulative 2015-2030)

Goals	Result	Metric	BaU Progress	NAIS Progress	SDGs Target
Halving poverty (Goal 1)	Eradicate extreme poverty	Proportion of population below the international poverty line of \$1.90 a day PPP	-21.1	-28.7	-95.0
	Reduce at least by half the proportion of population living in poverty	Proportion of population living below the national poverty line	-22.9	-29.9	-50.0
End hunger (Goal 2)	Double the agricultural productivity and incomes of small-scale food producers	Volume of agricultural production per labor	81.2	264.3	100.0
		Average income of food producers	136.1	202.0	100.0
Sustainable economic growth (SDG 8)	Sustain per capita economic growth	Annual growth rate of real GDP per capita	90.2	163.7	>
		Annual growth rate of real GDP	7.1	9.5	7.0
		Annual growth rate of real GDP per employed person	81.9	151.8	>
	Achieve full and productive employment and decent work	Average hourly earnings	221.8	369.5	>
		Unemployment rate, change	0.0	0.0	<6
Inclusive and sustainable industrialization (SDG 9)	Promote inclusive and sustainable industrialization	Manufacturing value added as a proportion of GDP and per capita	39.7	295.7	100.0
		Manufacturing employment as a proportion of total employment	21.0	21.2	100.0
Reduce inequality (SDG 10)	Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	Labor earning share of GDP	14.5	15.3	>

Source: Simulation Results

Note: Unless otherwise noted, values shown are cumulative growth rates from 2015 to 2030. Values for “GDP, Annual Growth” refer to average annual growth rates. Values for “Unemployment rate” are reported for the specific year, i.e. they are not cumulative.

Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value.

On the targets set in the Agenda 2063, the NAIS contributes to accelerating progress but does not allow attainment of any of the objectives that were not already attained in the BaU scenario. On the goal pertaining to poverty and hunger, Rwanda would be achieving little more 50% of the target. Inequality increases in both BaU and NAIS scenarios with higher consumption expenditure gap between urban and rural residents.

Concerning agricultural productivity and production, the NAIS scenario allows to attain two fifths of the targets only.

Table 13: Progress towards Selected Objectives of Agenda 2063, NAIS Scenario (Percent Cumulative 2015-2025)

Goal	Result	Metric	BaU Progress	NAIS Progress	Agenda 2063 Target
Poverty, inequality and hunger	Poverty Reduction	Proportion of population below the international poverty line of \$1.90 a day PPP	-29.3	-30.1	-95.0
		Proportion of population living below the national poverty line	-30.5	-40.6	-95.0
	Hunger Eradication	Food Import Dependency Ratio	-21.9	-47.0	-70.0
	Inequality Reduction	Rural-to-Urban Income Ratio	-37.0	-53.3	50.0
Incomes, jobs and decent work	Employment and Incomes	Unemployment Rate	0.0	0.0	6.0
		Per Capita Income Growth	156.7	314.6	>
Sustainable and inclusive economic growth	Inclusive Economic Growth	GDP, Annual Growth	7.1	9.5	7.0
	Intra-African Trade	Value of intra-Africa Trade	269.4	774.0	120.0
Agricultural productivity and production	Productivity Growth	Agricultural TFP	65.5	189.3	500.0

Source: Simulation Results

Note: Unless otherwise noted, values shown are cumulative changes from 2015 to 2035. Values for “GDP, Annual Growth” refer to average annual growth rates. Values for “Unemployment rate” are reported for the specific year, i.e. they are not cumulative. Green indicates that the goal is met (> 90%); yellow indicates that much progress is made toward the goal (>50% and 90%); orange indicates that little progress is made toward the goal (>10% and 50%); red indicates that very little progress is made toward the goal (10% or less); grey indicates that data are not available to assess the progress towards the target. For directional goals, i.e. goals without numeric target, the progress is assessed against the initial value. A positive value for inequality reduction means inequality is declining. Negative value refers to increase in inequality.

5. Conclusion

The 2014 Malabo Declaration on Accelerated Growth and Transformation for Shared Prosperity and Improved Livelihoods upheld the original Maputo commitment of achieving a 6 percent annual agricultural growth rate and a 10 percent agricultural expenditure share. In addition to this agenda, Rwanda pledged to the Agenda 2063 as well as the SDGs, which are committed to accelerating economic growth, eradicating poverty and inequality, among several other goals. However, a key challenge to implementing these commitments is the fact that they involve a large number of obligations and goals.

To address the CAADP/Malabo, the SDGs and the Agenda 2063 goals, a results framework 2015-2025; 2016-2030; and 2014-2035, respectively, has been developed as a key tool for translating Rwanda’s agricultural agenda into tangible outcomes. An economic modelling framework is built to assess the

strategic options available to Rwanda to accelerate growth and reduce poverty as envisaged by the MGDS III and committed under the Malabo Agenda, Agenda 2063 and SDGs. The framework consists of an economy-wide general equilibrium model and a microsimulation model. The two models are linked in a sequential manner. Thus, using these models, the study has assessed progress on both macro and micro variables of interest.

The BAU scenario shows that Rwanda is off-track to meet CAADP targets although agricultural GDP grows at 5.3% and 9.2% allocation of public expenditure to agriculture. Agricultural productivity and poverty reduction are below the targets set in the CAADP agenda. Production and consumption of locally produced food could contribute significantly to reducing hunger but remain low. Trade related goals with both African and non-African partners would not be achieved.

Concerning the SDGs, Rwanda would meet sustainable economic growth targets (goal 8) if the country stays on the BAU path. The country would make considerable progress on poverty reduction but would not achieve the industrialization goals by 2030. The contribution of the manufacturing industry to GDP and total employment would remain largely below target throughout the period. Under Agenda 2063, if Rwanda continues with business as usual, it is on track to meet incomes, jobs and decent work and sustainable and inclusive economic growth targets. The Agenda 2063 goal on poverty, inequality and hunger will not be met under the BAU scenario despite an increase in per capita income. There is little progress in inequality reduction as the rural-urban divide widens.

Given that the BAU growth strategy will miss most of the goals of these three commitments, the paper uses the simulation models to assess other strategies. First, the model tests which would be better, agriculture, industry or service driven growth, for the goals of the three commitments. The results reveal that public investment-led productivity increase in agriculture contributes more to the number of jobs created and poverty headcount reduction compared to industry and services.

The next question thus becomes “What is the best financing option for this agriculture led growth”? Looking at financing options, and comparing three options, revenue neutral; budget neutral and external financing, we test which option leads to the best results for financing investments in agriculture. Irrespective of financing option, an increase in budget allocation to agriculture brings about positive socioeconomic outcomes compared to the BAU. External financing of agricultural investments allows for the highest impact in terms of economic growth and socioeconomic outcomes to meet the targets of the three commitments. Public investment-led productivity increase in crops is the most effective in meeting the Agenda 2063 goals while livestock, fishery then forestry are more effective in attaining the Malabo targets and the SDGs. The Economywide Multimarket Model (EMM) is used to assess and to identify priority agricultural commodities based on their contributions across Malabo, SDGs and Agenda 2063. The analysis

reveals that nine commodities with the highest contribution are: Maize, sorghum, Irish potatoes, sweet potatoes, cassava, bananas, raw milk, fishing and green tea. .

In order to help guide the design of a financing strategy for agricultural development, alternative financing mechanisms and certain agricultural outputs in the value chain investment, are investigated. Agricultural productivity and GDP growth increase more under Malabo whereas agroindustry productivity increases more under SDGs and Agenda 2063. On the other hand, the results show that compared to Malabo, agricultural input subsidy leads to higher effectiveness under SDGs and Agenda 2063 outcomes.

The analysis also discusses the milestones necessary to achieve the results found in the simulations. It is advised that these milestones, which are actionable results, be monitored to track progress towards achieving the Malabo, SDGs and Agenda 2063 goals and targets. What is important to note is that, scaling up the supply side investments cannot be sustained without increasing the demand side, including the mid-stream investments, i.e. agroindustry and internal trading of agriculture commodities. Agroindustry productivity increase has a limit that needs to be compensated by internal trading of agriculture commodities. Therefore, a combination of transfers, cash and in kind, and investments in and for agriculture will be required. Specifically increasing productivity gives the highest effectiveness score compared to other forms of public investment followed by cash transfers and transfers in kind. Furthermore, although the external financing option yielded the best results, the share of external financing can only be 19%, requiring that the remaining 81 % come from domestic sources. The growth in agricultural investment will have to come mainly from private investment, without requiring a big increase as public agricultural investment is already close to CAADP targets in the baseline. To increase agricultural productivity sufficiently, intensity of input use needs to grow the highest, followed by total factor productivity and then agricultural production. In order to promote the required agricultural production growth, livestock and fishery will need to grow faster followed by forestry and crops.

Some of the goals that cut across the three commitments are poverty reduction and eradication of hunger. In order to reduce extreme poverty and end hunger, the falling local food prices will need to be complemented by higher consumer expenditure in rural areas. Furthermore, consumption of locally produced food will be critical in attaining poverty reduction goals. Stronger growth outside of the agricultural sector as well as social protection programs will help further reduce poverty and hunger. Private agricultural investment increases only slightly, explaining why total factor productivity and labor productivity remain below targets. Enhancing the role of the private sector will help in curbing supply side constraints. There is an increase in inequality between the urban and rural populations. The increase in rural household income relative to the urban results from a demand effect and the support to private investment in agriculture and price subsidies benefiting producers. Such investments have a positive impact on inequality as reflected by the model results.

If Rwanda were to successfully implement these recommendations, the results show considerable improvement in attaining the goals under Malabo, SDGs and Agenda 2013.

References

- African Union/New Partnership for Africa's Development (AU/NEPAD). 2003. Comprehensive Africa Agriculture Development Programme. Available online: <http://www.nepad.org/caadp/publication/au-2003-maputo-declaration-agriculture-and-food-security>. Accessed January 2019
- African Union/New Partnership for Africa's Development (AU/NEPAD). 2014. Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods. Available online: <http://www.nepad.org/caadp/publication/malabo-declaration-accelerated-agricultural-growth>. Accessed January 2019
- Fofana, I., Diallo, M.Y., Sarr, O., and Diouf, A., 2015. "2011 Social Accounting Matrix for Senegal." IFPRI Discussion Paper 1417. Washington, DC.: International Food Policy Research Institute (IFPRI). <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/128960>.
- Fofana, I., Omolo, M.W.O., Goundan, A., Domgho, L.V.M., Collins, J., Marti, E., 2019. NAIP toolkit for Malabo domestication: Economic modeling of agricultural growth and investment strategy, case study of Kenya. IFPRI Discussion Paper 01813. Washington DC.
- Food and Agriculture Organization of the United Nations (FAO). 2017. FAO Statistics. Available online: <http://www.fao.org/faostat/en/#data/PM>. Accessed on January 2019
- International Food Policy Research Institute (IFPRI). 2014. Rwanda Social Accounting Matrix (SAM), 2011. Washington, DC: International Food Policy Research Institute (IFPRI) [dataset]. <http://dx.doi.org/10.7910/DVN/28532>
- Lee, T. C., and C. G. Judge. 1996. "Entropy and Cross Entropy Procedure for Estimating Transition Probabilities from Aggregate Data." In *Bayesian Analysis in Statistics and Econometrics*, edited by D.A. Berry, K.A. Chaloner, and J. K. Geweke. New York: Wiley.
- Ministry of Agriculture and Animal Resources (2018). Strategic Plan for Agriculture Transformation 2018-24. Planning for Wealth.
- NEPAD, New Partnership for African Development. n.d. "The CAADP Results Framework (2015-2025)." <http://www.nepad.org/resource/caadp-results-framework-2015-2025>
- Pradesha, Angga; and Diao, Xinshen. 2014. A 2011 Social Accounting Matrix (SAM) for Rwanda. Washington, DC: International Food Policy Research Institute (IFPRI). <http://ebrary.ifpri.org/utis/getfile/collection/p15738coll2/id/128890/filename/129101.pdf>
- Regional strategic Analysis and Knowledge Support System. 2017. Tracking data indicators for CAADP across countries and regions. Available online: <http://www.resakss.org/index.php?pdf=45387>. Accessed on 19/01/2019.

- The Republic of Rwanda (2013). Economic Development and Poverty Reduction Strategy II. 2013-2018.
- The Republic of Rwanda (2017). 7 Years Government Programme: National Strategy for Transformation (NST 1). 2017 – 2024
- The Republic of Rwanda (2018). National Agricultural Policy
- United Nations (UN). 2015. Transforming Our World: The 2030 Agenda for Sustainable Development. Available online: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>. Access on 21/01/2019
- United Nations Conference on Trade and Development (UNCTAD). 2017. The Least Developed Countries Report. Available online: https://unctad.org/en/PublicationsLibrary/lcdr2017_en.pdf. Accessed on 19/01/2019
- World Bank. 2017. World Development Indicators. Available online: <https://databank.worldbank.org/source/world-development-indicators>. Accessed on January 2019.
- World Bank. 2018. World Bank Open Data Bank. Available online: <https://data.worldbank.org/>. Accessed on 19/01/2019

Appendix

Table A1: Effectiveness Score by Individual Agricultural Commodities

Agricultural Commodity	CAADP	SDGs	Agenda 63
Wheat	86%	69%	78%
Maize	86%	69%	89%
Paddy rice	79%	69%	78%
Sorghum	86%	69%	89%
Irish potatoes	86%	62%	89%
Sweet potatoes	86%	69%	89%
Cassava	86%	62%	89%
Other roots	86%	62%	89%
Pulses	86%	54%	89%
Other vegables	86%	54%	89%
Bananas	86%	62%	89%
Other fruits	71%	69%	67%
Oil seed	79%	69%	89%
Coffee	79%	69%	78%
Green tea	79%	85%	67%
Pyrethium	79%	62%	67%
Other export crops	86%	77%	78%
Bovine cattle, live	86%	69%	67%
Sheep and goats, live	79%	62%	67%
Swine, live	86%	62%	78%
Poultry, live	86%	62%	78%
Raw milk	86%	62%	89%
Eggs	86%	69%	67%
Other livestock products	86%	69%	67%
Forestry	79%	62%	89%
Fishing	86%	62%	89%

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