



Food and Agriculture Organization  
of the United Nations

Kenya

# Returns to investments in fertilizers production in Kenya

An analysis in support of the new  
“Agriculture Sector Growth and Transformation Strategy”

POLICY REPORT



# Returns to investments in fertilizers production in Kenya

An analysis in support of the new  
“Agriculture Sector Growth and Transformation Strategy”

---

## POLICY REPORT

A joint publication by Food and Agriculture Organization of the United Nations (FAO)  
and Joint Research Center of the European Commission

*by*

*Jean Balié and Lucia Battaglia*

*Monitoring and Analysing Food and Agricultural Policies, FAO*

*Pierre Boulanger, Hasan Dudu, Emanuele Ferrari and Alfredo Jose Mainar Causapé*

*Joint Research Center, European Commission*

Required citation:

Balié, J., Battaglia, L., Boulanger, P., Dudu, H., Ferrari, E. & Mainar Causapé, A.J. 2019. *Returns to investments in fertilizers production in Kenya. An analysis in support of the new "Agriculture Sector Growth and Transformation Strategy"*. A joint publication by Food and Agriculture Organization of the United Nations (FAO) and Joint Research Center of the European Commission. Rome, FAO. Licence: CC BY-NC-SA 3.0 IGO.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2019



Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons license. If a translation of this work is created, it must include the following disclaimer along with the required citation: "This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original [Language] edition shall be the authoritative edition.

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL) as at present in force.

**Third-party materials.** Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

**Sales, rights and licensing.** FAO information products are available on the FAO website ([www.fao.org/publications](http://www.fao.org/publications)) and can be purchased through [publications-sales@fao.org](mailto:publications-sales@fao.org). Requests for commercial use should be submitted via: [www.fao.org/contact-us/licence-request](http://www.fao.org/contact-us/licence-request). Queries regarding rights and licensing should be submitted to: [copyright@fao.org](mailto:copyright@fao.org).

## Contents

Acknowledgements .....	v
Introduction .....	1
1. Public expenditure on agriculture in Kenya.....	3
1.1. Main agricultural policy frameworks .....	3
1.2. A changing institutional framework.....	4
1.3. Results of the agricultural public expenditure analysis .....	4
2. Boosting the fertilizer production in Kenya: an assessment with focus on agri-food production and food security .....	9
2.1. Agricultural inputs policy measures.....	9
2.2. Methodology: the STAGE_DEV model and Kenyan Social Accounting Matrix.....	9
2.3. Scenarios.....	11
2.4. Results of the simulations .....	11
3. Conclusions and way forward .....	17
References .....	19

## Figures

Figure 1.	Budgeted and actual public expenditure on agriculture in Kenya .....	5
Figure 2.	Composition of public expenditure on agriculture in Kenya .....	6
Figure 3.	Composition of agriculture-specific expenditures in Kenya .....	6
Figure 4.	Composition of the "Extension and inspection" expenditures in Kenya .....	7
Figure 5.	Percentage change in per capita calorie intake .....	16

## Tables

Table 1.	Disaggregation of agricultural expenditures across identifiable commodity groups .....	8
Table 2.	Fertilizer production, consumption, price and trade.....	12
Table 3.	Agri-food production by sectors .....	12
Table 4.	Production by regions and activity type.....	13
Table 5.	Export and imports .....	14

## **Acknowledgements**

This report is jointly produced by the Monitoring and Analysing Food and Agricultural Policies (MAFAP) of FAO the Joint Research Centre (JRC) and the Economics of Agriculture Unit of the European Commission.

The authors would like to thank the colleagues from FAO, JRC-Seville and the EU Delegation in Nairobi who contributed to this study, especially Leopold Ghins for his contribution to the first draft report, Emiliano Magrini and Valentina Pernechele for their comments on the final document. Moreover, the authors are thankful to the members of the Task Force established by the Kenyan Ministry of Agriculture, Livestock and Fishery and in particular to Mulat Demeke, policy officer at FAO Kenya, for coordinating the interactions between the institutions involved in the project.





## Introduction

Kenya Vision 2030 identified agriculture as a key economic sector, expected to drive the economy to a projected 10 percent economic growth annually. Agriculture is therefore central to the achievement of “a globally competitive and prosperous country with a high quality of life by 2030”. Agriculture is also expected to deliver on Kenya’s regional and global commitments, such as the Comprehensive Africa Agricultural Development Programme (CAADP), African Union (AU) Agenda 2063 and Sustainable Development Goals (SDGs).

The Ministry of Agriculture, Livestock and Fisheries (MOALF) of the Kenyan government developed the Agriculture Sector Development Strategy (ASDS) 2010-2020. However, ASDS has been defined recently as non-compliant with the new constitutional framework of the country. Thus, the government decided to take this chance to thoroughly review the whole strategy and update it to the new global dynamics of the agricultural sector.

Consequently, a new Agriculture Sector Growth and Transformation Strategy (ASGTS) and a new National Agricultural Investment Plan (NAIP) will be established as guideline for the period 2018-2030. To draft these documents, the ministry embarked on a consultative process to take advantage of the contribution of a multi-stakeholders approach that already proved effective in preparing agricultural growth and transformation strategies under similar frameworks.

In preparation to adopt the ASGTS and NAIP documents, a modelling exercise to explore ex-ante social economic impacts of alternative agricultural growth and development options is recommended to support the final decision of the MOALF.

A taskforce with thematic working groups has been created within the new strategy. The expertise of the European Commission - through its Joint Research Centre (JRC) and the Economics of Agriculture Unit - and of the Food and Agriculture Organisation (FAO) of the United Nations - through its Monitoring and Analysing Food and Agricultural Policies (MAFAP) programme- were requested to analyse alternative strategic interventions on the agricultural sector with economic simulation modelling tools.

The JRC is committed to provide support for: i) improvement of information systems on agriculture, nutrition and food security, ii) policy and economic analysis to support policy decision-making processes and iii) scientific advice on selected topics concerning sustainable agriculture and food and nutrition security. Policy design tool for the agricultural sector and for food and nutrition security will be made available to policy makers. These tools also allow to better understand the impacts of policies and to capture good practices, which can then be made available to base further policy decisions on thorough analysis.

In this framework, the Economics of Agriculture Unit of the Sustainable Development directorate is responsible to elaborate the methodology and the tools for the analysis of national and regional economic systems, including the assessment of the sustainability of policies in the sectors of agriculture, social transfers and fight against food and nutrition insecurity. The resulting analyses support the EU institutions, DG DEVCO and the partner countries in formulating policies and programmes related to sustainable agriculture and food and nutrition security through the provision of demand-driven technical and scientific advice. Among scientific tools, economic simulation models represent the complex economic reality in a simplified form and reveal the interrelationships between economic variables. These tools can be applied to quantify the impacts of policy changes (i.e. ex-ante policy analysis).

The MAFAP programme is implemented by the FAO in collaboration with the Organization for Economic Co-operation and Development (OECD) and national partners in participating countries. The programme seeks to establish country owned and sustainable systems to monitor, analyse and reform food and agricultural policies to enable more effective, efficient and inclusive policy frameworks in a growing number of countries. As such, it promotes the use of a set of indicators that help understand how different policies work in various contexts and how they affect agricultural value chain dynamics and production incentives in different countries. In addition, as part of its mandate, MAFAP supports decision makers in partner countries, such as Kenya, to articulate alternative policy options leading to sustainable policy reforms. To do that, the program engages actively with policy makers to ensure the analytical results and recommendations feed into national

policy processes. Moreover, MAFAP involves national stakeholders and development partners in policy dialogue, as part of a more inclusive policy reform process. As a result, an array of partnerships arises on an issue-by-issue basis with various agricultural policy research institutes such as the JRC of the EC or advocacy organizations. This active engagement process extends to the private sector, farmers, civil society, donors and other stakeholders with a view to support a robust inclusive and sustainable policy dialogue around key food and agricultural policy reform opportunities.

This report demonstrates in detail how the JRC and MAFAP can make use of their respective tools, their expertise and strengths to adequately address the request formulated by the Kenyan MOALF and provide the expected policy support.

The report is organized as follows. It first provides a rapid overview of the Kenyan policy context and proceeds with an analysis of the levels and composition of the Public Expenditures in support of Food and Agriculture (PEA) in Kenya during the period 2006-2016, based on the MAFAP methodology. It then provides a policy analysis based on a general equilibrium model framework developed by the JRC. The model has been developed to take into account the specificities of the Kenyan economy (e.g., high rates of subsistence and small-holder farming, multi-output structure of production, endogenous labour supply decision of households, segmented labour markets, migration etc.). The tailored version of a single-country Computable General Equilibrium (CGE) model for Kenya is calibrated to an original 2014 Social Accounting Matrix (SAM) for Kenya. The policy analysis provides insight into the impacts of agricultural policies on economic and sectorial performances in the country, and on its food security situation. The conclusion elaborates on future research that the JRC and MAFAP offer to provide in support of the MOALF to develop a new agricultural strategy within a more extensive timeline.

# 1. Public expenditure on agriculture in Kenya

Public finance for agriculture in Kenya has been affected by several substantial policy and organizational changes over the last ten years. The ASDS outlined several ambitious goals, including increased productivity, stronger market linkages, food security and improved livelihoods. ASDS's objectives were reflected in the sector's Medium Term Investment Plans (MTIPs) and Medium Term Expenditure Frameworks (MTEFs). At the same time, institutional setups were modified. For example, public resources are being channelled to agriculture through a broad set of organizations comprising ministries and public and semi-public agencies.

While acknowledging the complexity of this environment, this section attempts to identify key trends in the level and composition of public expenditures in support of food and agriculture (PEA) in Kenya, using a database compiled by the FAO's MAFAP programme.

Overall, it is found that budget holders have been diverting resources away from key agriculture-related ministries in recent years. Further, agricultural budgets have been focusing on agricultural services such as extension or research. Food crops and livestock have absorbed highest relative shares of PEA. Considering such evolutions, it is advised to increase spending on roads and marketing so that trade can be facilitated. This should go together with a revamp of analytical and monitoring frameworks of PEA, as is detailed in the conclusion.

## 1.1. Main agricultural policy frameworks

The introduction of the Economic Recovery Strategy 2003–07 renewed policy interest for agriculture in Kenya. A Strategy for Revitalizing Agriculture (SRA) was endorsed in 2004, spanning up to 2014 with the aim of creating a vibrant, business-oriented agricultural sector, producing jobs in rural areas and participating in regional and international trade. In June 2008, the new government, elected in 2007 after a year-long crisis, launched the Kenya Vision 2030 (GoK, 2007). The Vision foresees to attain a 10 percent annual economic growth rate, and considers agriculture as a major contributor to this objective. As part of national efforts to implement the Vision, the ASDS 2010–20 was adopted and replaced the SRA (GoK, 2010a; MDP, 2013).

The ASDS built from the Vision's diagnosis, which identifies four major challenges for Kenyan agriculture. First, persistently low productivity due to policy and structural constraints. Yields for cereals, roots and tubers or sugar cane indeed remained mostly stagnant over 2005–10 (FAO, 2017). Second, sub-optimal land use; demand for land is on the rise as population grows and the land used for pastoralism or forestry may become too small as harvested areas increase (KLA, 2003). Third, inefficient markets due to insufficient storage capacity and poor access to input or output markets. Fourth, low levels of value addition and largely informal value chains. This applies particularly for agricultural exports, which are dominated by semi-processed goods, such as tea, coffee or flowers (World Bank, 2017).

With the aim of addressing these challenges, the ASDS sets out strategic objectives for each agriculture subsector (crops and land, livestock, fisheries and cooperatives), and lists six major intervention areas: irrigation and water management, land use, development of Northern Kenya, natural resource management, development of river basins and forestry and wildlife (GoK, 2010a). The ASDS also includes a discussion on key enabling factors, and a coordination and implementation plan. The MTIP 2010–15 was developed as follow-up to the ASDS, to ensure effective implementation of the strategy. It was revised in 2013. At the core of this revised MTIP 2013–2017 is a Results Framework comprising six pillars, namely (i) increasing productivity and commercialization, (ii) promoting private sector participation, (iii) promoting sustainable land and natural resources management, (iv) improving agricultural services, (v) increasing market access and trade and (vi) promoting effective sector coordination and implementation (GoK, 2013).

## 1.2. A changing institutional framework

Over the last decade, Kenya's public and semi-public institutions in the agriculture sector have been subject to several organizational changes. The most ambitious and challenging institutional reform was the decentralization strategy brought in together with the updated 2010 Constitution. The decentralization effectively started in 2013 and led to the creation of two distinct public bodies: the national government and 47 county governments (Savage et al. 2016). As per the 2010 Constitution, at least 15 percent of national resources should be allocated to county governments through national institutions (MoF, 2012). For what concerns agriculture, county functions include crop and animal husbandry, livestock sale yards management, maintenance of county abattoirs, plant and animal disease control services and fisheries management.

The devolution agenda came together with several institutional and public finance changes. In 2013, the three separate ministries for agriculture, livestock development and fisheries development have been merged under the MOALF (GoK, 2010a). From 2014 on, however, the MOALF was split into three "state departments", respectively for "agriculture", "livestock" and "fisheries and the blue economy" under the supervision of a single minister. From the fiscal year 2014/15 onwards, no aggregate budget for the MOALF was reported in the budget laws since the budgets for each department were presented separately. This change likely derives from the Ministry of Finance's (MoF) willingness to better track resources transferred to each sub-sector (MoF, 2013; 2014).

Another relevant evolution arose from the Sectoral MTEFs produced yearly by the MoF. These exercises allowed budget holders to analyse public expenditures for agriculture looking beyond the MOALF only. Going through agricultural MTEFs over 2010-16 reveals that public support to agriculture in Kenya has been increasingly channelled through a broad set of institutions and agencies. In 2010, the MTEF for the *agriculture and rural development* sector covered the following ministries: (i) agriculture, (ii) cooperative development and marketing, (iii) fisheries development, (iv) livestock development and (v) lands and settlement (GoK 2010b). The 2016 MTEF for the *agriculture, rural and urban development* sector covered the following sub-sectors: state departments for (i) agriculture, (ii) livestock and (iii) fisheries and the blue economy, (iv) the Ministry of Lands and Physical Planning and (v) the National Land Commission. In addition, it covered 25 autonomous and semi-autonomous government agencies (SAGAs) and 9 training institutions (GoK, 2014).

In this context characterized by numerous reporting processes, monitoring and analysing PEA is not an easy task. The MTIPs should provide a detailed overview of projected PEA's trends and objectives. Items included in the MTIP 2013–17 Results Framework are however different from the list of programmes and sub-programmes included in the latest sector MTEFs (DANIDA, 2010). No assessment of PEA trends can be done without knowing which results framework should be used and, correspondingly, determining which expenditures should be looked at. Another difficulty stems from the devolution process; while budgeted expenditure for each county is provided in the MoF policy statements, there is no straightforward access to the budget composition of each county. The exact share and composition of PEA implemented at county level therefore remains unspecified.

## 1.3. Results of the agricultural public expenditure analysis

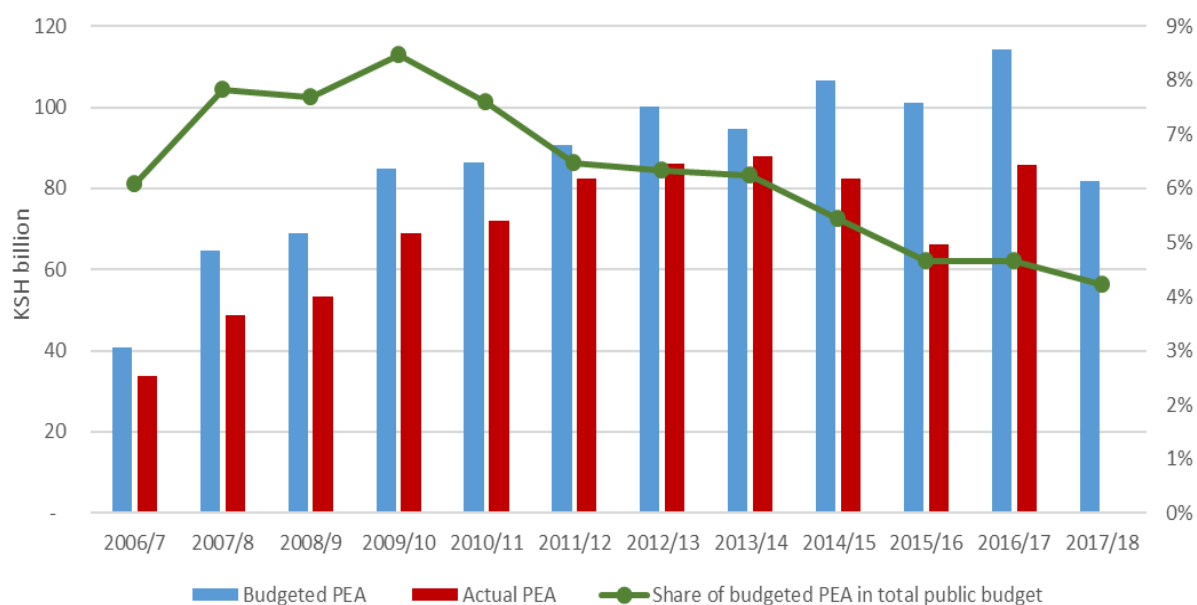
The PEA database for Kenya compiled by MAFAP covers the 2006-2017 period. Its use is subject to the aforementioned limitations. Links between expenditures gathered in the MAFAP database and MTIP or MTEF indicators should be considered provisional.

The MAFAP PEA methodology ([MAFAP Methodology on Public Expenditure](#)) is derived from the OECD's Producer Support Estimate (PSE) methodology ([PSE database](#)) and aims at providing a detailed disaggregation of PEA for the sake of policy analysis. The MAFAP definition of PEA encompasses two broad categories, namely agriculture-specific (expenditures that have a direct effect on agricultural development) and agriculture-supportive expenditures (expenditures with an expected indirect effect on agricultural development). MAFAP further classifies PEA across 30 sub-categories within these two overarching categories (see classification table in the [MAFAP Methodology on Public Expenditure](#)) In reference to the

MAFAP definition of PEA, expenditures from 13 line ministries were included in the database.<sup>1</sup> The data are from the Kenya National Audit Office (KENAO) and the budget estimate books. About 200 projects and programmes were identified and classified using the MAFAP list of expenditure categories. Expenditures incurred by the National Land Commission or SAGAs were not included. No precise distinction between national and county-level spending could be made. Further, no disaggregation of expenditures by source of funds (national or donor) was available, meaning no indicators on the role of aid in PEA could be computed.

**Resources allocated to agriculture are dwindling.** The analysis of general trends in PEA shows that the resources channelled to the food and agriculture sector increased in nominal terms over 2006/07–2017/18 (Figure 1). Disbursement rates worsened across time, going from about 83 percent in 2006/07 to around 70 percent in the 2015/16–2016/17 period. The share of budgeted PEA within the government’s total public budgeted followed a clear downward trend, showing that authorities have been reallocating resources away from the sector. The MAFAP PEA definition is broader than the African Union’s definition of public expenditures on agriculture ([African Union PEA Guidelines](#)). Therefore, it seems that, over the period analysed, Kenya has not been complying with the Maputo/Malabo 10 percent target.

**Figure 1. Budgeted and actual public expenditure on agriculture in Kenya**



Note: Actual expenditures for 2017/18 were not available.

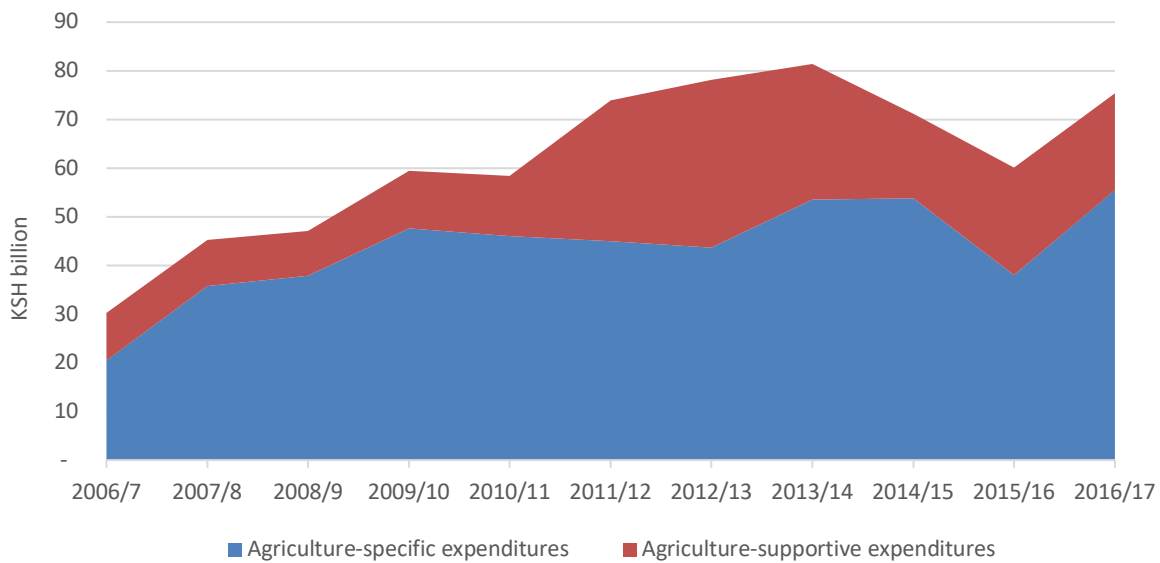
Source: Authors’ computations based on MAFAP database (October 2018 version).

The downward trend in the share of public expenditures devoted to agriculture is also observed when analysing budget allocations directly from the budget laws. The share of MOALF budget within the total public budget went from 3 percent in 2009/10 to 2 percent in 2014/15. Adding up budgets for the MOALF, the Ministry of Land, Housing and Urban Development and the National Land Commission, as implied by the MTEF’s definition of the agriculture, rural and urban development sector (see GoK, 2014), for fiscal year 2014/15 only drives up the percentage to 3 percent.

**Extension activities dominate agriculture budgets, followed by input subsidies.** Most PEA in Kenya were agriculture-specific expenditures during 2006/07–2016/17 (Figure 2).

<sup>1</sup> To measure the support to agriculture and rural development in Kenya, data from the Ministry of Water and Irrigation, Natural Resources and Environment, Forestry and Wildlife, Ministry of Regional Development Authorities, and Ministry of Lands have been considered. In addition, expenditure that supports development of the agricultural sector were also captured from the ministries of State for Development of Northern Kenya and Other Arid Lands, Ministry of Health, Ministry of Education, Ministry of Special Programmes, and Ministry of Roads.

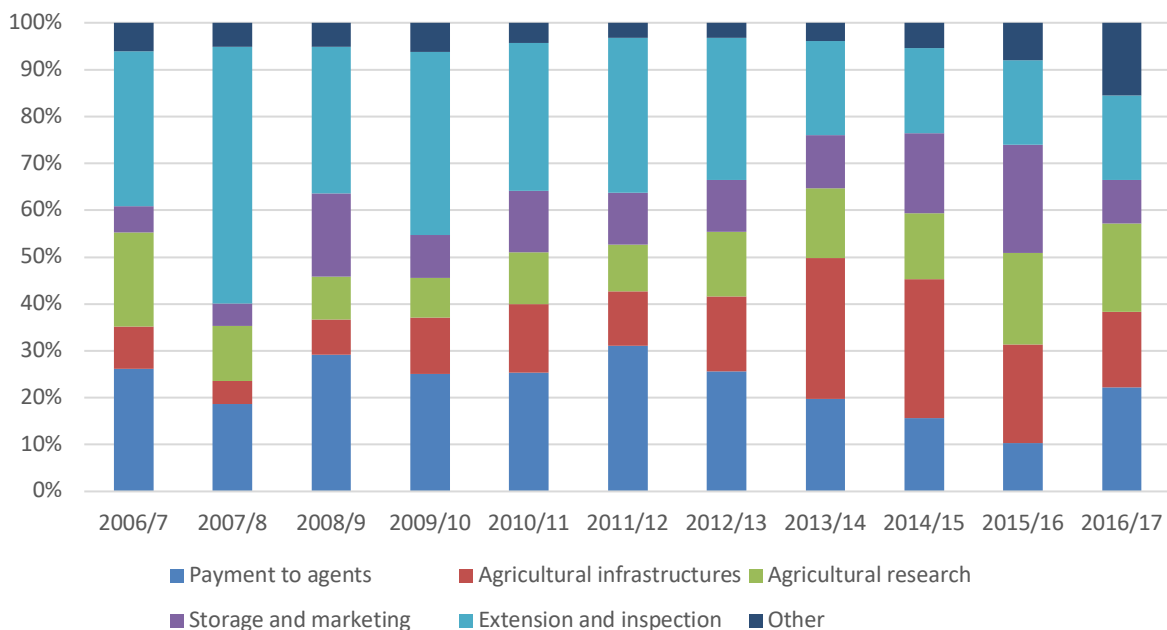
**Figure 2. Composition of public expenditure on agriculture in Kenya**



Source: Authors' computations based on MAFAP database (October 2018 version).

Agriculture-specific expenditures can be disaggregated into various categories of payments to agents (private goods) or general sector support (public goods). Most agriculture-specific expenditures in Kenya were dedicated to the provision of public goods during the last decade, as Figure 3 shows. Payments to agents averaged 23 percent of agriculture-specific expenditures, and mainly went to producers with input subsidies for on-farm capital (on-farm irrigation and livestock breeding programmes) or services (veterinary services, inspection, on-farm training). No payments targeted processors, traders, transporters or input suppliers directly. On average, as much as 44 percent of agriculture-specific expenditures over the period analysed went to general sector support category including expenses for extension services, inspections, trainings, agriculture research and technical assistance.

**Figure 3. Composition of agriculture-specific expenditures in Kenya**

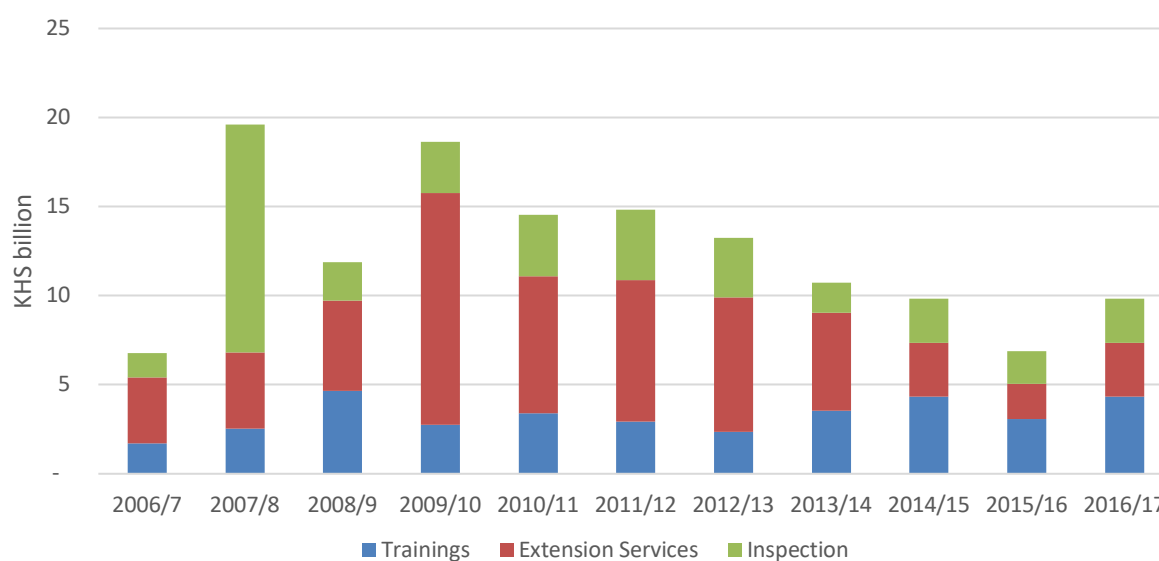


Source: Authors' computations based on MAFAP database (October 2018 version).

Expenditures classified under “Extension and inspection” in the MAFAP PEA database comprise the bulk of MOALF spending, which went to the National Agriculture and Livestock Extension Programme (NALEP) 2005 to present, and the Kenya Productivity and Agribusiness Project (KAPAP) 2004–2014. Expenditures on research represented on average 14 percent of agriculture-specific spending and was absorbed by the Kenya Agricultural and Livestock Research Organization (KALRO) in recent years, through the MOALF. This percentage represents the MOALF transfers to KALRO and do not include the funding that the organization receives through the donors funds. The sizes of the “storage” category remained relatively minor.

Figure 4 shows the repartition of the expenditures within the category “Extensions and inspections”. The increase in the agricultural-specific expenditures in FY 2007/08 is imputable to the increase in the resources allocated to the implementation of inspection programmes, while expenditures in extension services decreased over time.

**Figure 4. Composition of the "Extension and inspection" expenditures in Kenya**



Source: Authors’ computations based on MAFAP database (October 2018 version).

A similar disaggregation can be made for agriculture-supportive expenditures. Most of these expenditures were tagged as “Rural health” in the MAFAP PEA database and were related to rural nutrition and sanitation initiatives. The remaining expenditures were categorized as “Rural education”, “Rural infrastructures” and “Other agricultural-supportive” expenditures. The latter ones were mainly spent on emergency initiatives through the Ministry of Special Programmes and the MOALF for the maintenance of a strategic food reserve or disaster mitigation. The remainder of the agriculture-supportive expenditures chiefly went to rural health (27 percent) and rural infrastructures (16 percent) over 2006/07–2016/17 (Ministries of “Public Health and Sanitation” and “Roads”).

**Investments on key food crops have increased.** Agriculture-specific expenditures can be mapped according to commodity groups to determine which value chains are prioritised by budget holders. About 20 percent of agriculture-specific expenditures targeted groups of commodities over the period 2006/07 – 2009/10, namely “livestock and dairy” and “food crops” (Table 1). A very limited proportion of spending on commodity groups went to cash crops (tea, coffee, sugar cane and cotton), as funding for these value chains is channelled through specific semi-autonomous agencies.

The introduction of the ASDS seemingly led to some changes in commodity prioritization. The share of expenditures allocated to livestock and dairy diminished after 2010, to the benefit of food crops. Maize and beans were chiefly targeted (GoK, 2013). Based on the data available, the disaggregation of expenditures on food crops, across MAFAP PEA categories for the 2010/11–2014/15 period, shows that about 70 percent of these expenditures targeted on-farm irrigation. Expenses were mainly executed through the National Irrigation Board, an agency of the Ministry of Water and Irrigation.

**Table 1. Disaggregation of agricultural expenditures across identifiable commodity groups**

	SRA (2006/07–2009/10)	ASDS & MTIPs (2010/11–2014/15)
<b>Identifiable commodity groups</b>	20%	27%
<i>Innovative items</i>	5%	5%
<i>Livestock and dairy</i>	42%	28%
<i>Fish</i>	6%	8%
<i>Forestry</i>	14%	7%
<i>Food crops</i>	29%	35%
<i>Cash crops</i>	1%	1%

Note: innovative items include coconut, silk and horticulture.

Source: Authors' computations based on MAFAP database (October 2018 version).

The decline in the share of PEA within the total public budget comes out strongly from the analysis of the MAFAP indicators, and is confirmed when looking at the evolution of agricultural spending in the budget laws using different specifications (MOALF only, MOALF and Ministry of Lands and Physical Planning and National Land Commission, etc.). PEA composition has been rather stable over time, and mainly targeted extension services, input subsidies and agricultural research. While the proportion of resources allocated to food crops such as maize or beans rose following introduction of the ASDS, livestock and dairy remained among the main commodity groups targeted by agriculture-specific expenditures for the whole period under review.

This analysis can set the ground for a few preliminary policy recommendations. First, there is need for a clear and practical PEA reporting framework. MTIPs and MTEFs would benefit from more harmonisation of the content. Objectives and expenditure targets for each agriculture-related institution need to come out clearly. The respective roles of the MOALF and MoF in the monitoring and reporting processes are yet to be determined. Second, agriculture budgets in Kenya have been centred on agricultural services over the last ten years. One can confidently assume that component 4 “Improving agricultural services” of the MTIP 2013–17 has received higher resource shares than what was initially foreseen (planned shares stood between 5 percent and 10 percent of the agriculture budget) (GoK, 2013). More attention could be devoted to transport infrastructures (feeder roads) and marketing (cooperatives, processing). These expenditure categories are found to augment trade efficiency and to help in rising value addition across agricultural value chains. Moreover, PEA in Kenya seem affected by some budget inertia, with depleting shares of the PEA over the total budget. New orientations could allow improving budget efficiency and efficacy, and addressing emerging trends such as the importance of regional trade opportunities or growing food demand from urban centres.

Lastly, another key area of focus for the future relates to the consequences of the devolution on public expenditure allocations and composition in support of agriculture. It is becoming increasingly urgent to establish a sustainable mechanism to record and centralize disaggregated information on all agriculture related expenditures, budgeted and executed by the 47 district governments. This is a necessary condition to better capture the overall policy effort in agriculture in the country and to inform alternative spending and investment scenarios, such as the future sector specific or economy-wide investment plans.



## **2. Boosting the fertilizer production in Kenya: an assessment with focus on agri-food production and food security**

### **2.1. Agricultural inputs policy measures**

Persistently low productivity is one of the four major challenges identified by Kenya Vision 2030 for Kenyan agriculture. Poor access to input markets and the consequent low use of fertilizers is another of the identified cause preventing Kenyan agriculture reaching its potential. Increasing fertilizer use has been on the agenda of the Kenyan government for the last couple of decades. The liberalization of fertilizer markets in 1990s was relatively successful (Freeman and Omiti, 2003) and fertilizer use increased by more than 50 percent between 2000 and 2010 (Ariga and Jayne, 2011), while fertilizer use per hectares of arable land increased by 73 percent between 2010 and 2013 (World Bank, 2014). The prices of fertilizer fell by almost 50 percent between 1990 and 2007 and after the upsurge in world prices in 2008, they remained lower than pre-1995 (Ariga and Jayne, 2011).

As highlighted in the section on budget allocation, input subsidy programmes, such as the National Accelerated Agricultural Inputs Access Programme (NAAIAP) (Ariga and Jayne, 2011), is one of the main targets of government PEA. Despite successfully increasing the fertilizer use, input subsidies represent a financial burden on the GoK of almost EUR 27 million yearly, which cannot be devoted to areas that could improve agricultural efficiency (e.g. transport infrastructure and marketing). Further, the increase in fertilizer use is sustained by imports (Ariga and Jayne, 2011) which, due to lack of investments on infrastructure and rural roads, are characterized by high trade and transport costs (estimated to be as high as 40 percent in Kenya).

Increased domestic production of fertilizers seems to be a solution to multiple issues. It reduces the price of fertilizers, as they will be produced with lower trade and transport associated costs, making fertilizers more accessible for small-holder farmers. A higher fertilizer use boosts agricultural productivity, production and rural income. Lower prices also reduce the need for an extensive input subsidy programme, freeing resources for other purposes. Dependency on imports would be reduced easing the Kenyan vulnerability to fluctuations on world price markets.

With this in mind, GoK supported the construction of a roughly EUR 1.1 billion fertilizer plant in Eldoret in the framework of a fertilizer cost reduction strategy aiming at "stabilizing fertilizer prices and making fertilizer more accessible through local manufacturing, blending and bulk procurement" (Business Daily, 2014). The factory started its blending operations in August 2016 and should double Kenya fertilizer production by 2018. In this phase, the factory is expected to increase the availability of fertilizers in the country, but not to lower significantly their market price (due to the dependency on raw materials imports) until the completion of the second phase in 2020 (Mutai, 2016).

This section evaluates the impact of the construction of this plant on food and nutrition safety in Kenya employing an economy-wide computable general equilibrium model. Results suggest that increasing domestic production of fertilizers do not fully achieve the objectives of reducing rural poverty and increasing agricultural production without complementary policies that help small-holder farmers to overcome the backward technology trap and give them better access to input and output markets.

### **2.2. Methodology: the STAGE\_DEV model and Kenyan Social Accounting Matrix**

This analysis is performed with a variant of the single-country STatic Applied General Equilibrium (STAGE) model (McDonald, 2007), called STAGE\_DEV (Aragie *et al.*, 2017). The STAGE\_DEV model incorporates a series of additional behavioural relationships that better account for economic relationships in developing countries, in particular the least developed and Sub-Saharan African (SSA) countries. To model properly agriculture and food security issues in Kenya, the model depicts key structural characteristics of the economy and of the agricultural sector. Among them one of the most relevant is the dual role of semi-subsistent agricultural households, which play the non-separable double role of producers and consumers. The introduction of a Home Production for Home Consumption (HPHC) module within STAGE\_DEV is a crucial added value to the original STAGE-DEV model. Other additions to the model, including nested consumption

function, endogeneity of the functional distribution of income, domestic migration and factor market segmentation, are fully documented in Aragie *et al.* (2017).

To explicitly incorporate the issues discussed above and in particular HPHC in an analytical model, a consistent way to organise the information in the underlined database should be found. This requires introducing additional sets of columns and rows as sub-columns and sub-rows as explained in the following sub-section.

The model needs to be calibrated to a specific SAM that requires an ad hoc structured database. To this purpose, a virtually new SAM for Kenya (base year 2014) was estimated with an original structure. The 2014 Kenya SAM is a novel contribution as it is estimated from the new rebased National Accounts (including a short version of Supply and Use Tables) for Kenya (KNBS, 2015a, 2015b), including micro-data from the Kenya Integrated Household Budget Survey (KIHBS) 2005/06 (Kenya National Bureau of Statistics, 2007). Other relevant databases related to agriculture (Government of Kenya, 2015a), and labour markets (Kenya National Bureau of Statistics, 2015a) and (Kenya National Bureau of Statistics, 2015b) revealed to be important to update the production structure of previous SAMs elaborated by IFPRI (Kiringai *et al.*, 2007; Thurlow *et al.*, 2007; Thurlow and Benin, 2008).

The new SAM, although based on a standard structure, deviates from other classical SAM in terms of structural assumptions. The HPHC concept is introduced in the SAM by assuming that each household has a corresponding "productive activity". Besides the classic Representative Household Groups (RHG) that collect household behaviour as consumers of goods and services and as providers of factors of production (and receptor-contributors of transfers), the Kenya 2014 SAM has accounts showing the behaviour of households as units of production. These accounts incorporate the economic behaviour of households as producers of food commodities (agricultural and livestock products for food) as well as cash crops. This requires also separate accounts for commodities produced by these households for their own consumption (HPHC as input or as a final product) and the same marketed commodities (produced both by households and by conventional productive activities). Rows of these commodity accounts reflect HPHCs use as intermediate inputs in the productive activities of households and their consumption in final demand of households (RHG). The individual sums of the rows must be equal to the sums of the columns that summarize the contributions of the activities of households to each of these goods. Similarly, columns of the households activities show how they use inputs (HPHC and marketed), while rows show the destination of their production as inputs, own-consumption goods or marketed commodities. Households considered as producers have been broken down regionally (according to the criteria that will be mentioned later), while commodities produced are homogenous at national level. The breakdown of commodities and activities is summarised in Appendix.

The agricultural regional breakdown in the 2014 Kenya SAM is based on agro-ecological characteristics. The country has been divided into seven AEZs, in addition to the two major metropolises, i.e., Nairobi and Mombasa. Based on previous studies (Mabiso *et al.*, 2012); Thurlow and Benin, 2008; Kiringai *et al.*, 2006) and own assumptions, AEZs distinguish the primary sector production in different regions of the country enabling specific analysis of the effects of different policies focusing on territories, products or specific activities. The nine regions considered are (i) Nairobi, (ii) Mombasa, (iii) High Rainfall, (iv) Semi-Arid North, (v) Semi-Arid South, (vi) Coast, (vii) Arid North, (viii) Arid South, and (ix) Turkana. This regional breakdown has been applied to both households, as productive units or activities, and households, as institutional units.

In terms of agricultural production, the SAM accounts for three types of production agents. There are nine agricultural household activities (one per each AEZ region), that produce 18 "subsistence commodities" not marketed and consumed at home and 17 marketed crops. Three regional households produce one or more of the six exported cash crops (cotton, sugar, coffee, tea, tobacco and other crops mainly flowers). Then, the business enterprise sectors which at national level produces food and cash crops. These activities represent the market oriented larger holder producers.

The Representative Household Groups (RHG) have been further disaggregated into rural and urban, according to the area of residence. Moreover, the two metropolises Nairobi and Mombasa have been broken down by income quintiles. As a result, the 2014 Kenya SAM contains 24 RHG, a number allowing for a good analysis of redistributive aspects and specific impact of different policies.

According to the classification of work by education, there are three types of labour in the SAM: skilled, semi-skilled and unskilled labour. Each labour factor is also regionalized, giving the nine regions of reference plus a rest of the world account. Hence, the SAM takes into account 30 different types of labour.

In summary, the 2014 Kenya SAM consists of 193 accounts: 54 activities (12 of them accounts of households as producers) producing 52 marketed and 18 HPHC commodities using three types of labour (skilled, unskilled and semi-skilled) in 10 regions (30 labour accounts), three types of capital (agricultural, non-agricultural and livestock) and two types of land (irrigated and non-irrigated). Regarding taxes and subsidies, five types of taxes have been disaggregated: direct, indirect, sales, factors and imports taxes. Also, 24 regionalized RHG have been obtained. Finally respective accounts for margins, saving-investment, enterprises, government and rest of the world are also included.

### 2.3. Scenarios

Scenarios and possible policy options are implemented stepwise to give a clear picture of their impacts. The main scenario (*Fertilizer*) simulates the construction of the new fertilizer factories. These plant doubles fertilizer production thanks to an investment of 4 billion Ksh, financed by foreign direct investments, added to the capital stock of the fertilizer-producing sector. Four policy options are simulated on top of the main one.

1. **Removing subsidies** (*Subsidies*): Simulates the removal of the subsidies on fertilizers, which are around 4.78 percent of the value of fertilizers used.<sup>2</sup>
2. **Introducing protection** (*Protection*): Decreases the dependence of Kenya on imported fertilizers by imposing tariffs to halve fertilizer imports.
3. **Better market access** (*Market*): Most farmers cannot buy fertilizers because of poor infrastructure (such as road network) or poorly organized distribution channels. This is reflected by high trade margins. This scenario reduces domestic trade and transport margins by 30 percent as a result of 4 billion Ksh. public investments to improve infrastructure. As better infrastructure improves delivery of agricultural products to the markets also trade margins for these commodities decrease by 30 percent.
4. **Extension services** (*Extension*): Simulates the impacts of better extension services that make the use of fertilizers more conscious with better farming practices and spread new techniques and technologies, productivity of fertilizers is shocked by 5 percent and labour by 3 percent.

### 2.4. Results of the simulations

**Fertilizer markets.** Doubling the production of fertilizer decreases the supply price by around 2 percent (Table 2) (close to the targeted price defined by GoK). However, increasing demand for fertilizers limits the transmission of price fall to the market prices since imports still dominate the fertilizer consumption. This is consistent with the immediate developments after the opening of the factory. As reported by Mutai (2016), GoK does not expect an immediate fall in the prices of fertilizers as the blending activities depends heavily on imported inputs. The given decline of domestic prices Kenya increase exports to more than 6 percent of the production. This is below the targeted amount due to the increase in domestic demand from the farming sectors. Hence demand for imports declines only slightly. New factories can only accommodate the domestic demand leaving a very low margin for exports.

---

<sup>2</sup> Due to lack of data, we impose a uniform distribution of subsidies across regions.

**Table 2. Fertilizer production, consumption, price and trade**

	Base <i>level</i>	Fertilizer <i>level</i>	Subsidy	Protection	Market	Extension
			<i>% change from fertilizer scenario</i>			
<b>Production</b>	7.82	100.0	-4.7	-14.5	2.7	2.9
<b>Consumption</b>	26.45	37.4	-7.5	-44.7	3.9	4.9
<b>Supply price</b>	0.33	-21.5	-1.8	-5.6	1.0	1.1
<b>Purchaser price</b>	0.35	-7.5	-0.6	15.7	-0.6	0.4
<b>Export</b>	0.27	224.2	-0.9	-2.8	1.2	0.4
<b>Import</b>	18.90	17.2	-8.7	-57.3	4.5	5.8
<b>Exports/production</b>	0.03	62.1	3.9	13.7	-1.5	-2.4
<b>Import/consumption</b>	0.71	-14.7	-1.4	-22.8	0.5	0.9

Source: Model results.

Removal of subsidies affects fertilizer sectors adversely, by reducing production. The declining demand due to lower subsidies reduces imports significantly with a further decline around 1.4 percent. Highest impact on fertilizer production is observed under Protection scenario. First, government needs to impose a 33, 34 and 24 percent tariff on N, P and K fertilizers to halve their imports. This causes fertilizer a 15.7 percent increase in fertilizer prices, on average and reduces the demand by 44 percent. As a result, domestic production also falls by 14.5 percent. Protection also harms the exports with 2.8 percent lower exports compared to the initial scenario.

**Agricultural markets.** Increased availability of fertilizers benefits commercial agricultural producers (Table 3 and Table 4). Coffee, tea, sugar and tobacco producers as well as the farmers producing export commodities benefit from the increased production of fertilizers. On the other hand, cotton production by semi-arid North regions increases around 2.6 percent at the expense of cotton plantations' production (-0.8 percent). However, as most of the cotton is produced by farms in the semi-arid North, production of cotton increase by 2.1 percent. On the other hand, benefits for small-holder farmers from the doubling of fertilizer production are quite limited since their fertilizers use is low (or at least not sufficiently high) in the base year to trigger a substantial change.

**Table 3. Agri-food production by sectors**

	Base <i>billion Ksh</i>	Fertilizer <i>% change from base</i>	Subsidy	Protection	Market	Extension	
			<i>% change from fertilizer scenario</i>				
<b>Total</b>	Agri-food	2 363.21	0.8	-0.2	-1.2	0.4	1.6
	Agriculture	1 721.08	0.9	-0.2	-1.6	0.4	1.9
	Crop	1 332.98	1.0	-0.2	-1.9	0.3	1.9
	Export crops	328.40	2.7	-0.6	-6.3	-1.8	3.5
	Food staples	1 004.58	0.5	-0.1	-0.5	1.1	1.4
	Livestock	388.10	0.5	-0.1	-0.4	0.4	1.8
	Food	642.13	0.4	-0.1	-0.3	0.5	1.0
<b>HPHC</b>	Agri-food	300.41	0.4	-0.1	-0.4	0.8	2.1
	Agriculture	289.30	0.4	-0.1	-0.4	0.8	2.1
	Crop	219.35	0.4	-0.2	-0.5	0.7	1.8
	Food staples	219.35	0.4	-0.2	-0.5	0.7	1.8
	Livestock	69.95	0.4	-0.1	-0.4	1.3	2.8
	Food	11.12	0.4	-0.1	-0.3	1.1	2.2
<b>Marketed</b>	Agri-food	2 062.79	0.8	-0.2	-1.4	0.3	1.6
	Agriculture	1 431.78	1.0	-0.2	-1.8	0.3	1.9
	Crop	1 113.63	1.1	-0.2	-2.2	0.3	1.9
	Export crops	328.40	2.7	-0.6	-6.3	-1.8	3.5
	Food staples	785.23	0.5	-0.1	-0.5	1.2	1.3
	Livestock	318.15	0.5	-0.1	-0.4	0.2	1.5
	Food	631.01	0.4	-0.1	-0.3	0.5	1.0

Source: Model results.

**Table 4. Production by regions and activity type**

		Base	Fertilizer	Subsidy	Protection	Market	Extension
		<i>billion Ksh</i>	<i>% change from base</i>	<i>% change from fertilizer scenario</i>			
<b>Small holder marketed</b>	Nairobi	12.9	0.2	0.2	0.2	0.8	-1.1
	Mombasa	4.7	0.9	0.0	-0.6	-0.2	0.2
	High rainfall	695.4	0.5	-0.2	-0.5	0.7	1.8
	S.arid north	106.3	0.5	-0.2	-0.5	0.5	1.4
	S.arid south	94.2	0.4	-0.2	-0.3	1.9	4.0
	Coastal	113.2	0.6	-0.2	-0.5	0.1	1.3
	Arid north	12.7	0.5	-0.1	-0.4	-0.3	4.6
	Arid south	5.4	0.2	-0.1	-0.2	0.6	3.1
	Turkana	1.0	0.3	-0.1	-0.2	0.4	6.9
	Total	1 045.8	0.5	-0.2	-0.5	0.7	1.9
<b>Small holder HPHC</b>	Nairobi	2.7	0.2	0.2	0.2	0.9	-1.2
	Mombasa	1.3	0.9	0.1	-0.6	-0.1	0.0
	High rainfall	199.2	0.5	-0.2	-0.5	0.7	1.7
	S.arid north	33.6	0.4	-0.2	-0.5	0.5	1.3
	S.arid south	44.6	0.4	-0.1	-0.3	1.9	3.8
	Coastal	11.6	0.6	-0.2	-0.5	0.1	1.0
	Arid north	5.8	0.5	-0.1	-0.4	-0.1	4.5
	Arid south	11.0	0.2	-0.1	-0.2	0.8	2.9
	Turkana	2.8	0.3	-0.1	-0.2	0.5	6.5
	Total	312.7	0.4	-0.1	-0.4	0.8	2.1
<b>Export oriented</b>	High rainfall	151.3	2.8	-0.6	-6.6	-2.2	3.7
	S.arid north	44.6	2.6	-0.6	-6.3	-2.3	3.6
	S.arid south	1.8	2.6	-0.6	-6.2	-1.6	3.2
	Total	197.7	2.8	-0.6	-6.5	-2.2	3.6
<b>Market oriented</b>	Food crops	201.2	0.6	0.2	-0.6	2.1	-0.9
	Cotton	0.3	-0.8	0.0	2.7	2.3	-1.1
	Sugar	6.4	2.3	-0.7	-5.8	-2.0	3.5
	Coffee	7.3	4.0	-0.5	-8.5	-1.9	3.6
	Tea	99.9	2.7	-0.6	-6.5	-2.5	3.8
	Tobacco	1.8	2.5	-0.6	-5.9	-1.5	3.0
	Other crops	14.9	0.6	0.1	-1.1	8.2	-0.2
	Livestock	48.6	0.6	0.0	-0.2	-0.9	0.0
	Dairy	23.3	0.6	0.0	-0.4	-0.7	0.9
	Total	7087.1	0.2	0.0	-0.2	-0.1	0.1

Source: Model results.

The impact on agricultural production changes under the *Market* and *Extension* scenarios, which simulate complementary policies targeting smallholder farmers. In the *Market* scenario, production of smallholder farmers increases by 0.7 percent comparing to the fertilizer one with farmers in the semi-arid and arid regions benefiting most.<sup>3</sup> This is showing how, particularly in arid areas, isolated intervention like increase of fertilisers supply without additional structural changes such

<sup>3</sup> Note that, the production structure in the model do not take into account the complementarity between irrigation and fertilizers. This issue will be addressed in the new scenarios.

as improvement of rural infrastructure (or better access to irrigation) do not represent a concrete solutions to increase the agricultural production in those areas.

However, export crops' production declines by 1.8 percent. Tea, coffee and sugar cane are the most affected crops. Only the production of other crops, which is mostly composed of cut flowers increases. Vegetables, wheat and root and tubers are the commodities of which production increase most. Underlying reason for the increase is the higher production of marketed products rather than the production for home consumption as expected. However, availability of food staples for home consumption also increases especially for vegetables, wheat, root and tubers indicating the importance of complementary policies for food security.

Both export crop producers and smallholder farmers increase their production under the *Extension* scenario, thanks to the technological change. The difference between *Market* and *Extension* scenario points out the importance of and (need for) breaking the backward technology trap. The *Market* scenario enables smallholder farmers to expand their activities at the cost of export crop producers due to the competition for factors: They become more competitive and able to use more of the factors in the economy. On the other hand, when a factor saving technological change is introduced, the competition for factors disappears and both types of agricultural activities can expand.

Exports of agricultural commodities follow the production trend (Table 5). Under the *Fertilizer* scenario, exports of main export commodities, particularly coffee and cotton, expand in line with the increasing production. The results do not change much under export and subsidy scenarios. However, exports decline significantly after the introduction of tariffs for fertilizers: coffee, cotton, sugar, tea and tobacco, which uses fertilizers extensively, are the most affected crops

Under the *Market* scenario, exports of main staples (maize, wheat, oilseeds) increase. However, exports of coffee, sugar and tea decline following the trend in production. Finally, under *Extension* scenario, exports of all agricultural products increase as Kenyan agriculture become more competitive with the increase in productivity of fertilizers, seed and labour.

**Table 5. Export and imports**

		Base level	Fertilizer % change from base	Subsidy	Protection	Market	Extension
		% change from fertilizer scenario					
Exports	Agrofood	377.25	1.1	-0.2	-4.3	-2.7	1.2
	Agriculture	349.09	1.2	-0.2	-4.7	-3.0	1.0
	Crops	348.10	1.2	-0.2	-4.7	-3.0	1.0
	Food staples	34.87	0.1	-0.2	0.0	2.3	3.2
	Export crops	313.23	1.3	-0.2	-5.2	-3.6	0.8
	Livestock	0.99	0.0	-0.2	0.0	0.1	2.6
	Food	28.16	-0.2	-0.3	0.3	0.7	2.8
	Other	577.07	-0.4	0.0	0.5	1.2	0.0
	Total	954.32	0.2	-0.1	-1.4	-0.4	0.5
	Imports	Agrofood	243.06	0.3	0.4	-0.3	1.1
Agriculture		202.12	1.0	0.4	-0.4	1.3	0.3
Crops		201.02	1.0	0.4	-0.4	1.3	0.3
Food staples		176.19	0.3	0.4	-0.1	1.6	0.3
Export crops		24.83	0.3	0.2	-2.6	-0.7	0.8
Livestock		1.10	0.4	0.5	0.0	-0.3	-0.1
Food		40.94	0.3	0.3	0.0	-0.1	0.2
Other		1 732.92	0.4	0.3	-0.4	-0.2	0.5
Total		954.32	0.2	0.1	-1.3	-0.2	0.6

Source: Model results.

**Households and food security.** Lower food prices and increased availability of staples improve the welfare of Kenyan households (Table 6) not uniformly. Poorest 20 percent in urban areas, Rural and urban households in high rainfall regions are the most benefiting group while rural households in arid regions are the least benefiting.

**Table 6. Household welfare**

	Population <sup>1</sup> <i>Thousand person</i>	Fertilizer <i>Ksh per capita</i>	Subsidy <i>change from fertilizer scenario (Ksh per capita)</i>	Protection	Market	Extension
Urban	5 641	1 722	41	-233	134	473
Big cities	3 685	1 611	36	-276	135	352
Poorest 20% in cities	1 433	2 956	133	-294	-82	14
Others in big cities	2 252	755	-26	-264	273	567
Other urban	1 957	1 931	50	-153	132	699
Arid	118	1 534	-113	-1 389	1 035	756
High rainfall	1 437	2 059	69	-57	57	624
Semi-arid	401	1 590	32	-134	135	953
Rural	7 759	1 155	-98	-1 164	631	2 185
Arid	498	70	-64	-158	308	1 864
High rainfall	5 470	1 214	-99	-1 226	508	1 968
Semi-arid	1 791	1 274	-103	-1 253	1096	2 937
Grand total	13 400	1 394	-39	-772	422	1 464

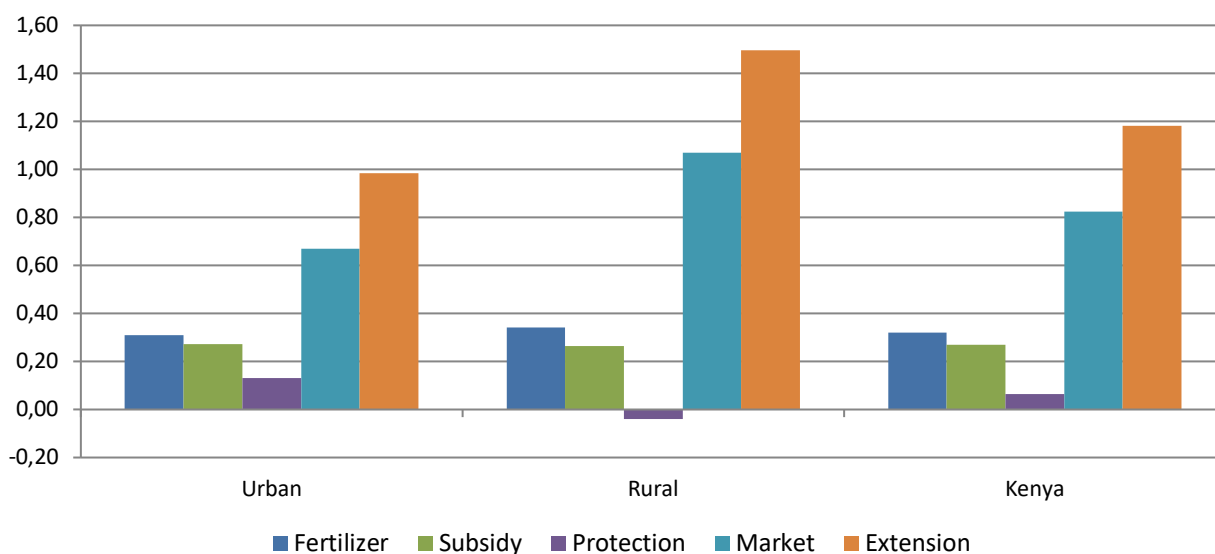
<sup>1</sup> Number of employed persons estimated by the model.

Source: Model results.

*Protection* scenario damages rural households in all regions while the urban households in arid regions are particularly affected, turning welfare gains into loss. The opposite is observed under the *Market* scenario as households in big cities lose all their gains in the initial scenario with poorest households actually losing. Increasing market access benefits the rural households in the semi-arid regions most. As expected, *Extension* scenario improves the welfare of all household groups but mostly the rural households in the semi-arid regions.

According to the model simulations, doubling fertilizer production has only a limited impact on nutrition (Figure 5). Per capita calorie, fat and protein intake do not change significantly. Complementary policies increases national calorie intake only by 1.2 percent. Rural households, especially in semi-arid regions, are slightly better off with an increase in their calorie intake by more than 1.4 percent.

**Figure 5. Percentage change in per capita calorie intake**



Source: Model results.

Increasing the fertilizer production is a policy objective in Kenya. The opening of fertilizer factories is likely to realize it. Results suggest that, doubling the fertilizer production benefit Kenyan agricultural sector mostly through the export crops who are the main users of fertilizers. Thus, households producing export crops benefit most from the increasing fertilizer production. On the other hand, to help smallholder farmers, Kenyan government should pursue some additional policies such as increasing the market access for fertilizers and agriculture by improving the rural infrastructure or improving the extension services to train smallholder farmers about fertilizer and land use. Smallholder farmers are likely to lag behind other farmers without such policies that will improve their productivity and market orientation. Results suggest that trying to protect the fertilizer markets by introducing an import tax would harm export oriented producers of Kenya.



### 3. Conclusions and way forward

Indicators on the level and composition of agricultural public expenditures in Kenya presented here show that the share of public resources allocated to the sector has been declining over time. Moreover, the agriculture budget is dominated by extension services, inputs subsidies and agricultural research. Introduction of the ASDS and investments plans (MTIPs and MTEFs) since 2010 seemingly had little effect on the allocation of agricultural spending across major expenditure categories. It is recommended to improve the consistency of reporting frameworks used to monitor progress in agricultural, rural and urban development. A reflection on how to ameliorate the composition of public expenditures on agriculture is also suggested. Some rebalancing of the spending in favour of roads and marketing, together with a diversification of targeted commodities, could for instance help maximize spending impacts.

The CGE assessment outlined above also yields useful recommendations for what concerns public finance management and agricultural policy design. While investing in fertilizer production is likely to have a positive effect on agricultural output and farmer livelihoods, such expenditures need to go hand in hand with improvements in the status of rural infrastructures and the quality of extension services. CGE results also suggest that adopting an import tariff for fertilisers would have negative effects, through an expected increase in farmer production costs. Agricultural transformation can only be achieved by adopting coherent and well-balanced intervention packages.

There are clear linkages between the public expenditure analysis and the CGE work. While extension expenditures seemingly reign over agricultural budgets in Kenya, their impact on productivity growth so far has not yet delivered the expected results in terms of productivity growth, which is still lagging behind in most of the country. Nevertheless, the CGE study shows that investments in extension should remain in place, as the possible positive effects on the Kenyan agriculture look significant. Both approaches recommend turning support to infrastructures such as feeder roads up. At this stage, it is proposed to build from the gathered evidence in order to refine the results and propose more concrete recommendations to the Kenyan MOALF and budget holders. This would involve carrying out a number of additional studies, as detailed below. Relevant timeline and expected content are to be discussed with the MOALF. However, further developments of the work sketched in these pages published in Boulanger *et al.* (2018) includes the following:

#### ***Value chain analysis and multipliers analysis of job multipliers.***

A description of the Kenyan economy, with focus on the agricultural and food value chains, is based on the existing SAM, developed by the JRC. Well-known multi-sectoral analytical tools like linear multipliers, key sectors analysis, and Structural Path Analysis (SPA) and value chain participations are used to this end.

The relevance in the generation of output, employment and value added of the agricultural and food industry sectors is analysed, focusing on the link between both groups of activity. The analysis checks the importance of the primary sector in the creation of wealth and employment and seek the relationship with other sectors capable to create wealth and employment in agriculture indirectly.

Checking the relative importance of agricultural and food industry sectors in growth and jobs generation key sectors of Kenyan economy are determined. Then, the analysis determines impacts (in output, employment and value added) which are caused directly (from final consumption in the same sector) and indirectly (from final consumption in other sectors).

With a similar method, the value chains of agri-food sectors in the Kenyan economy are analysed.

#### ***A comprehensive analysis of options for reform of agricultural policies with high impact on the living conditions of the population.***

A set of policies scenarios is simulated with the recursive dynamic version STAGE\_DEV to quantify their impact in terms of general welfare and economic growth, agricultural production, agricultural factor markets, food security, poverty reduction, export revenue, self-sufficiency.

Results are compared against a business as usual (BaU) scenario where over 10 to 15 years horizon (2030), allocation and amount of spending in agricultural are kept constant. In particular, a few key targets are analysed such as agricultural GDP growth and job creation in agriculture. The baseline projects the growth paths for Kenya economy using GDP and

population growth as quantified in the Shared Socioeconomic Pathway (SSP) second scenario or middle of the road scenario (SSP2).

Scenarios include provision of extension services, production and input subsidies, better access to irrigation, investments in rural transport infrastructure and investments in rural health and education. Starting from the hypothesis that the government reaches the MAPUTO objective of allocating 10 percent of the national budget allocation to agriculture development, a combination of possible policy interventions available to increase public investment in agriculture are taken into account. Additionally, the model analyses possible effects of expanding intra-Africa trade in agrifood commodities.

Additional sets of scenarios estimate the required productivity improvement to increase agricultural GDP by 6 percent annually, the impact of doubling agricultural productivity by 2030 and the impacts of tripling the intra-African Trade.

***A knowledge transfer programme that includes transfer of the database and methodology to carry out similar analyses in the future.***

This includes the capacity building activities starting with training on using a simplified version of the model and leading to transferring knowledge on the use, maintenance and development of the SAM database and CGE model.

## References

- Aragie, E., Dudu, H., Ferrari, E., Mainar Causape, A., McDonald, S. & Thierfelder, K. 2017. *STAGE\_DEV: A Static Applied General Equilibrium Model for Developing Countries*. EUR 28627 EN. Joint Research Centre Technical Report. Luxembourg, Publications Office of the European Union.
- Ariga, J. & Jayne, T. 2011. Fertilizer in Kenya: Factors Driving the Increase in Usage by Smallholder Farmers. In P. Chunan-Pole & M. Angwafo. *Yes Africa Can: Success Stories from a Dynamic continent*, pp. 269–288. Washington DC, World Bank.
- Boulanger, P., Dudu, H., Ferrari, E., Mainar Causapé, A.J., Balié, J. & Battaglia, L. 2018. *Policy options to support the Agriculture Sector Growth and Transformation Strategy in Kenya. A CGE Analysis*, EUR 29231. Luxembourg, Publications Office of the European Union.
- Business Daily. 2014. *Toyota pact with Kenya paves the way for Sh103bn fertilizer plant* [online]. [Cited 26 March 2019]. [www.businessdailyafrica.com/corporate/Toyota-Kenya-Sh103bn-fertiliser-plant/539550-2448364-98nvec/index.html](http://www.businessdailyafrica.com/corporate/Toyota-Kenya-Sh103bn-fertiliser-plant/539550-2448364-98nvec/index.html)
- Business Daily. 2016. *State changes tune on Eldoret fertiliser plant price reduction* [online]. [Cited 26 March 2019]. [www.businessdailyafrica.com/State-changes-tune-on-Eldoret-fertiliser-plant-price-reduction/539546-3478764-15snv7mz](http://www.businessdailyafrica.com/State-changes-tune-on-Eldoret-fertiliser-plant-price-reduction/539546-3478764-15snv7mz)
- DANIDA. 2010. *Kenyan Agricultural Sector Programme Support – Lessons Learned Report*. Copenhagen.
- FAO. 2017. FAOSTAT database [online]. Rome. [Cited 25 July 2017]. [www.fao.org/faostat](http://www.fao.org/faostat)
- Freeman, H. & Omiti, J. 2003. Fertilizer use in semi-arid areas of Kenya: analysis of smallholder farmers' adoption behaviour under liberalized markets. *Nutrient Cycling in Agroecosystems*, 66(1): 22-31.
- Government of Kenya (GoK). 2007. *Kenya Vision 2030 – The Popular Version*. Nairobi.
- GoK. 2010a. *Agricultural Sector Development Strategy 2010-20*. Nairobi.
- GoK. 2010b. *Medium Term Expenditure Framework 2010/11-2012/13 – Agriculture and Rural Development Sector*. Nairobi.
- GoK. 2013. *Medium-Term Investment Plan: 2013-17 for Agricultural Sector Development Strategy*. Nairobi.
- GoK. 2014. *Medium Term Expenditure Framework 2015/16-2017/18 – Agriculture, Rural and Urban Development Sector*. Nairobi.
- Kenya Land Alliance (KLA). 2003. *Land use in Kenya: the case for a national land-use policy. The case for a national land use policy*. Nairobi.
- Kenya National Bureau of Statistics. 2007. *Kenya Integrated Household Budget Survey (KIHBS), 2005/06*. Nairobi.
- Kenya National Bureau of Statistics. 2015a. *Economic Survey 2015*. Nairobi.
- Kenya National Bureau of Statistics. 2015b. *Statistical Abstract 2015*. Nairobi.
- Kiringai, J., Thurlow, J. & Wanjala, B. 2006. *A 2003 Social Accounting Matrix for Kenya*. International Food Policy Research Institute (IFPRI) in collaboration with the Kenya Institute for Public Policy Research and Analysis (KIPPRA). Washington DC, IFPRI.
- Kiringai, J., Wanjala, B., Waiyaki, N., Mutunga, C., Njenga, G. & Nafula, M. 2007. *Social Accounting Matrix for Kenya: Methodological Note*. Nairobi, Kenya Institute for Public Policy Research and Analysis (KIPPRA).

- Mabiso, A., Pauw, K. & Benin, S.** 2012. *Agricultural Growth and Poverty Reduction in Kenya: Technical Analysis for the Agricultural Sectoral Development Strategy (ASDS) - Medium Term Investment Plan (MTIP)*. ReSAKSS Working Paper #35. Washington DC, International Food Policy Research Institute.
- McDonald, S.** 2007. *A Static Applied General Equilibrium Model: Technical Documentation STAGE Version 1*. Technical Report. Oxford, UK, Oxford Brookes University.
- Ministry of Devolution and Planning (MDP).** 2013. *Comprehensive Public Expenditure Review 2013: Eye on Budget - Spending for Results*. Nairobi.
- Ministry of Finance (MoF).** 2012. *Medium Term Budget Policy Statement*. Nairobi.
- MoF.** 2013. *Estimates of recurrent and development expenditure of the National Government for the year ending 30 June 2014 – programme based budget*. Nairobi.
- MoF.** 2014. *Programme-based budget of the National Government of Kenya for the year ending 30 June 2015*. Nairobi.
- Savage, A. & Lumbasi, L.** 2016. *The impact of decentralisation in Kenya*. Master thesis submitted at Trinity College Dublin, supervised by Tom O'Connor. Dublin, Trinity College.
- Thurlow, J. & Benin, S.** 2008. *Agricultural Growth and Investment Options for Poverty Reduction in Kenya. Preliminary report prepared for Kenya's Comprehensive Africa Agricultural Development Programme (CAADP) Roundtable Discussion*. ReSAKSS Working Paper #35. Washington DC, International Food Policy Research Institute.
- Thurlow, J., Kiringai, J. & Gautam, M.** 2007. *Rural Investments to Accelerate Growth and Poverty Reduction in Kenya*. Washington, DC: IFPRI Discussion Paper 00723. Washington DC, International Food Policy Research Institute.
- World Bank.** 2014. *World Development Indicators*. In: *The World Bank* [online]. Washington DC. [Cited 12 December 2014]. <http://goo.gl/6wNq1W>
- World Bank.** 2017. *World Integrated Trade Solution; Kenya profile*. In: *The World Bank* [online]. Washington DC. [Cited 25 July 2017]. <http://wits.worldbank.org/CountryProfile/en/Country/KEN>



## MONITORING AND ANALYSING FOOD AND AGRICULTURAL POLICIES [MAFAP]

The Monitoring and Analysing Food and Agricultural Policies (MAFAP) programme seeks to establish country owned and sustainable systems to monitor, analyse, and reform food and agricultural policies to enable more effective, efficient and inclusive policy frameworks in a growing number of developing and emerging economies.

### CONTACTS

[www.fao.org/in-action/mafap](http://www.fao.org/in-action/mafap)

[mafap@fao.org](mailto:mafap@fao.org)

MAFAP is implemented by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Organisation for Economic Cooperation and Development (OECD) and national partners in participating countries. It is financially supported by the Bill and Melinda Gates Foundation, the Government of The Netherlands, the United States Agency for International Development (USAID) and Germany.

The Joint Research Centre (JRC) is the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.



Some rights reserved. This work is available under a CC BY-NC-SA 3.0 IGO licence