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**Strengthening Seed Systems and Market Development in Kenya:
Perspectives on Political Economy and Policy Processes**

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by

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Tegemeo Institute

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Abstract

Seed systems in Africa south of the Sahara are a topic of much interest in the public discourse on policy options for agriculture and rural development. The seed systems of countries in the region have followed different trajectories that can be partly explained by differences in farming systems, agroecological conditions, stages of market development, and other variables. But political economy factors may also play an important role in outcomes. This study uses a political economy lens to assess the pace and dynamics of policy change and how those factors affect the development of maize and potato seed systems and of markets in Kenya. We review key policy, regulatory, and strategic documents relevant to seed system and market development in Kenya. We then review progress made in strengthening those seed systems and markets and examine the political economy factors that have influenced policy adoption and outcomes. Findings suggest that Kenya's devolution process and the Jubilee government's Big Four Agenda—alongside political economy factors related to agricultural extension, seed regulations, and public financing—have had and continue to have a considerable effect on the implementation of various policies, potentially constraining progress on several fronts.

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List of Abbreviations

ASDS	Agricultural Sector Development Strategy (ASDS)
ASTGS	Agricultural Sector Transformation and Growth Strategy
CAADP	Comprehensive Africa Agriculture Development Programme
CIP	International Potato Center
ERS	Economic Recovery Strategy for Wealth and Employment Creation
FAO	Food and Agriculture Organization of the United Nations
JASCCOM	Joint Agriculture Sector Consultation and Cooperation Mechanism
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
MOU	Memorandum of understanding
MoALF	Ministry of Agriculture, Livestock, and Fisheries
NAAIAP	National Accelerated Agricultural Inputs Access Program
PRSP	Poverty Reduction Strategy Paper
QDS	Quality declared seed
SFR	Strategic Food Reserve
SPVA	Seeds and Plant Varieties Act (revised 2012)
SRA	Strategy for Revitalizing Agriculture
TASAI	The African Seed Access Index
USAID	United States Agency for International Development

1. Introduction

Seed systems in Africa south of the Sahara have been a central topic in the public discourse as part of wider conversations on policy options for agriculture and rural development. Although seed systems in the region have followed different development trajectories, they do seem to be affected by a number of political economy, farming system, agroecological, and market development factors that policymakers and stakeholders must address if the systems are to thrive (Tripp and Ragasa 2015; Mabaya and Mburu 2016). A number of political economy issues appear to shape the debate, including limited support for agricultural research, restrictive regulations and inadequate capacity of regulatory agencies, and weak vertical and horizontal coordination among different key actors. Policy and regulatory reforms are purported to facilitate increased production, delivery, and uptake of improved seeds and technologies. Influencing government agencies to initiate the review of existing policies and enact new policies involves many stakeholders (seed companies, regulatory agencies, parliament, agricultural technical groups, government policy directorates, public and private research agencies, seed associations, and politicians).

This study seeks to assess progress in strengthening seed systems and markets by focusing on the policy change process in Kenya, and by identifying policy and regulatory options that can accelerate progress. The study examines the context within which policy designs are revised and adopted, how policy is implemented, and where in the policy process there is potential for improving both design and implementation. The study's specific aim is to identify ways to enhance the pace and nature of seed policy change, balance trade-offs, improve metrics for assessing performance of the seed sector, and promote adoption of improved seeds. Specifically, the study (1) reviews progress in strengthening seed systems and markets in Kenya by focusing on the policy change process; (2) examines what political economy drivers and factors have influenced policy adoption and outcomes; and (3) provides recommendations for improving seed market development outcomes based on the study findings. Emphasis is placed on two crops—maize and potato—because of the opportunity provided to both compare and contrast the political economy factors at play.

In the next section we describe the conceptual and methodological framework guiding the study. That is followed by a review and synthesis of the literature on Kenya's agricultural and seed strategies, policies, and regulations in Section 3. Section 4 presents production and productivity trends and discusses the key political economy issues affecting the seed systems. A synthesis of political economy issues affecting seed systems follows in Section 5. Finally, Section 6 concludes with several policy recommendations.

2. Background

This study adopts a political economy approach to the policy change process in seed systems and market development. It draws on the policy analysis frameworks developed by Resnick et al. (2018) and by the Future Agricultures Consortium (Chinsinga 2011; Amanor 2010; Odame and Muange 2011a). This requires understanding policy processes by looking at the intersection of several overlapping elements: actors/networks/practices, their discourses/narratives, and politics/interests. The interplay of these factors shapes policy pathways and outcomes of seed systems and markets (see, for example, Scoones and Thompson 2011).

A key question of interest for this study is this: Do scientists and policy analysts have the ability to influence seed policy to support more open and inclusive seed systems given a technological lock-in to certified seeds (for example, of maize and potato) and the narrow interests of powerful actors in the sector? This leads us to other closely related questions: From where do policymakers obtain information? How do different interest groups compete to provide information and influence decision-making through different channels? And how do relatively unorganized farmers fare against highly organized industry groups? (See, for example, Chari et al. 2019.)

In many countries, political leaders use subsidized seed and fertilizer as a mechanism to secure farmers' support and votes, which, in turn, allows these leaders to maintain their control over economic rents. Such arrangements can remove the incentive for policy change toward greater market orientation or greater inclusivity in seed markets. On the other hand, these same leaders rely on seed systems to ensure adequate food supply, such that they often pursue paternalistic policies designed to prevent private seed providers from profiting off of the supply of what might be deemed an essential good of national importance. Indeed, the plight of smallholder farmers tends to become a subject of public debate and political interest during every election cycle in Kenya, and seed is a key part of the discussion.

Absent from many discussions about seed system and market development are the roles played by the agricultural scientist and the policy analyst. Recent advances such as DNA fingerprinting have the potential to radically improve seed regulation by identifying and filtering out low-quality seed providers from the market (Centre Development Research 2018; CGIAR 2014; FAO 2013). Meanwhile, policy analysts have developed potentially game-changing strategies to improve the targeting and delivery of seed subsidies using a range of data-driven methodologies (Obeyelu 2017). However, such innovations in technology and policy are also potentially disruptive, as they threaten to redistribute the rents captured by powerful economic interests and political incumbents.

These issues are present in Kenya, where the formal seed business is big money and where the wider seed system is a hotly contested space dominated by public enterprises such as the Kenya Seed Company (maize seed) and the Agricultural Development Corporation (seed potato). The

Kenya Seed Company holds an estimated 70 to 80 percent share of the maize seed market. Other key participants include several large multinationals and emerging and mid-sized Kenyan companies. Behind these public companies and multinationals are networks of influential policy and business interests. The Kenya Institute for Public Policy Research and Analysis argues that trade policies in the country are strongly influenced by such interests in a manner that subordinates broader public priorities (Omiti et al. 2007). Is there an analogous problem in Kenya's seed system?

3. Methods and data

This study takes a qualitative case study approach. It draws on the policy analysis frameworks developed by Resnick et al. (2018) and by the Future Agricultures Consortium (Amanor 2010; Odame and Muange 2011a). The case study approach allows for an in-depth assessment of the contextual conditions related to seed system and market development in Kenya, especially in terms of policy environments and policy approaches, problems, policy adoption mechanisms, adoption of regulations, and implementation performance. The case study approach also allows for more crop-specific dimensions on the topic by focusing on maize and potato, each of which offers certain similarities in terms of commercialization and regulation, but also differences in terms of reproductive biology, stage of market development, and historical experience.

Data are drawn from both primary and secondary sources. Secondary data were collected through a review of literature and key informant interviews, as well as statistical data from FAOSTAT and household survey data from the Tegemeo Institute of Agricultural Policy and Development. A review of existing literature provided an understanding of the policymaking landscape, policies, strategies, and development plans that guide policy and development interventions in the agriculture sector in general, and the seed sector in particular, and policies and regulations in the seed sector, with a focus on how they affect the seed systems for maize and potato.

Primary data were mainly collected through key informant interviews and focus group discussions. Key informants included selected seed system stakeholders involved in and/or knowledgeable about policy processes in the maize and potato seed system value chains (Table 1). The selection criteria for the key informants were based on well-informed and willing-to-participate stakeholders and representation of different organizations. This was to ensure collection of information and insights for in-depth understanding of processes underlying policy and regulatory changes, including political, economic, commercial, and sociocultural drivers of change.

The interviews were conducted in three phases between July 1 and August 6, 2019. The initial phase focused on policymakers in the national government—that is, officers at the Ministry of Agriculture, Livestock, and Fisheries (MoALF)—and other stakeholders, including research and development organizations, farmer organizations, industry associations, and nonstate actors,

based in Nairobi. The second phase targeted policymakers and implementers in selected counties relevant to maize and potato (Trans Nzoia and Bungoma for maize and Nyandarua and Meru for potato) and seed companies, seed traders, and seed producers and users (farmers) located in the counties. The third phase of data collection focused on seed system regulatory bodies/agencies and other stakeholders that the initial phase in Nairobi did not reach.

Data collection instruments (checklists of questions) were adapted to the specific roles of informants including policymakers/advisers, agricultural research organizations, policy stakeholders, seed companies, seed traders (agro-dealers), and seed producers and users (farmers). The instruments covered the following topics: overview of organization, seed quality assurance, demand creation, market assessment, and policies and regulations.

Table 1: Key actors interviewed and their roles in the maize and potato seed sectors in Kenya

Function in the value chain	Key actors by crop	
	Maize	Potato
Variety development and improvement	KALRO, universities, CIMMYT, CIP, AGRA, AATF, KSC, other seed companies	KALRO, CIP, ADC
Variety approval, registration, and regulation	KEPHIS—IP and variety performance	KEPHIS—IP and variety performance
Breeder and foundation seed production	KALRO, universities, CIMMYT, KSC, 69 other seed companies	KALRO, CIP, ADC, Kisima Farm
Certified seed production	KSC, other seed companies, community organizations	ADC, Kisima Farm, KALRO, community organizations
Seed processing and packaging	KSC, seed companies	ADC, Kisima Farm, KALRO community organizations
Variety promotion and marketing	Seed companies, SMEs	ADC, Kisima Farm, community organizations
Seed distribution and sales	SMEs, seed merchants, agro-dealers	ADC, Kisima Farm, community organizations
Public participation in policy formulation	County governments	County governments
Evidence generation for policy design and programming	KBS, MoALF, Tegemeo Institute, CABE	KBS, MoALF, Tegemeo Institute, CABE
Grant funding for seed value chain development	USAID, Bill & Melinda Gates Foundation	GIZ, Dutch and Irish governments

Source: Authors' compilation.

Note: KALRO = Kenya Agricultural and Livestock Research Organization; CIMMYT = International Maize and Wheat Improvement Center; CIP = International Potato Center; AGRA = Alliance for a Green Revolution in Africa; AATF = African Agricultural Technology Foundation; KSC = Kenya Seed Company; ADC = Agricultural Development Corporation; KEPHIS = Kenya Plant Health Inspectorate Service; IP = Intellectual Property; SMEs = small and medium enterprises; KBS = Kenya Bureau of Standards; MoALF = Ministry of Agriculture, Livestock, and Fisheries; CABE = Centre for African Bio-Entrepreneurship; USAID = US Agency for International Development; GIZ = German Agency for International Cooperation.

The interviews covered a range of stakeholders in the maize and potato seed systems as summarized in Table 2. Public policymakers, advisers, and regulators; public research agencies, institutes, centers, and stations; individual and small-scale seed entrepreneurs; seed companies; industry associations; and donor agencies and charitable foundations. A total of 96 individuals in 29 organizations (including farmer groups) were interviewed, either in teams or individually.

Table 2: Actors and number of individuals interviewed

Category	Actor	No. of key informant interviews conducted with ...	
		Organizations	Individuals
Public policymakers, advisers, and regulators	National government	1	7
	County governments	4	12
	Regulators	1	3
Public research agencies, institutes, centers, and stations	National agricultural research organizations	1	5
	International agricultural research organizations	1	2
Individual and small-scale seed entrepreneurs	Small-scale maize seed users	2	25
	Small-scale potato seed growers/users	2	20
	Agro-dealers	3	3
Seed companies	Maize	3	7
	Potato	3	4
Industry associations	Farmer associations	1	1
	Advocacy groups	5	5
Donor agencies and charitable foundations		2	2
Total		29	96

Source: Authors' compilation.

Data synthesis and presentation

To synthesize and analyze the data, we first developed key messages from the key informant interviews in each actor category. We then identified typologies to help cluster emerging political economy issues on which to focus. That was followed by an examination of all the interview notes to isolate and select key quotes around the typologies. The key quotes, information from the literature review, and empirical secondary data were used as supporting evidence to the arguments in the typologies. The typologies identified were (1) devolution and coordination; (2) the Big Four Agenda; (3) extension; (4) regulations; and (5) financing. We introduce each in turn.

Devolution. In 2013, Kenya adopted a devolved system of government, comprising the central government and 47 semiautonomous county governments, as part of the implementation of the 2010 constitution. Within the agriculture sector, policy implementation and service delivery were assigned to county governments while the national government through the ministry in charge of agriculture was assigned the roles of formulating policies and providing capacity-building support to counties. However, coordination and collaboration between the two levels of government in discharging their responsibilities in the agriculture sector has been weak, with some roles not clearly understood. Among the broad issues emerging in the public discourse on Kenya's decentralization is the concern that the national government is developing policies and regulations that are not cascading down to counties, while it has yet to develop the necessary systems and standards to enable counties to formulate their own policies and regulations. To be sure, these problems highlight a broader set of concerns related to the risk inherent in decentralization, including excessive multiplication of administrative costs, duplication of tasks leading to inefficiencies and high transaction costs, incoherence across policies, and a failure to realize scale economies in governance. But despite the risks, decentralization has emerged in Kenya as a widely supported reform because of its focus on improving citizen participation, addressing territorial inequalities, promoting equal access to opportunities, and strengthening and expanding democracy by penetrating to the local level.

Big Four Agenda. The Big Four Agenda was a political pronouncement/manifesto of the president pertaining to the following sectors: agriculture (achieve 100 percent food and nutrition security); manufacturing (increase manufacturing to 20 percent of gross domestic product [GDP]); health (achieve 100 percent universal health care); and housing (build 1 million new affordable homes). The agenda acts as a catalyst in the agriculture sector for the implementation of the Agricultural Sector Transformation and Growth Strategy (ASTGS), a 10-year strategic plan for Kenya's agricultural development. The agenda can stimulate policy actions that affect seed systems for maize and potato, given that the two value chains are prioritized as part of efforts to deliver 100 percent food and nutrition security in the next five years.

Agricultural extension and advisory services. The role of agricultural extension and advisory services is to deliver technology and information to farmers and other actors along the value chains (for example, the maize and potato value chains). Technologies include seeds, fertilizer, and agrochemicals whereas information consists of information on markets, agronomy, the weather, and so forth. Extension also plays the important role of linking research with end users on the one hand and policymakers with end users on the other. The existing weak forward and backward linkages result in inappropriate technologies and information reaching end users.

In Kenya, both the public and private sectors provide extension and advisory services. For smallholder producers, public extension is very important. This raises the question of how to make public extension more effective and efficient. Pluralistic extension is a current norm—especially following the expansion of extension and advisory services provided by private-sector

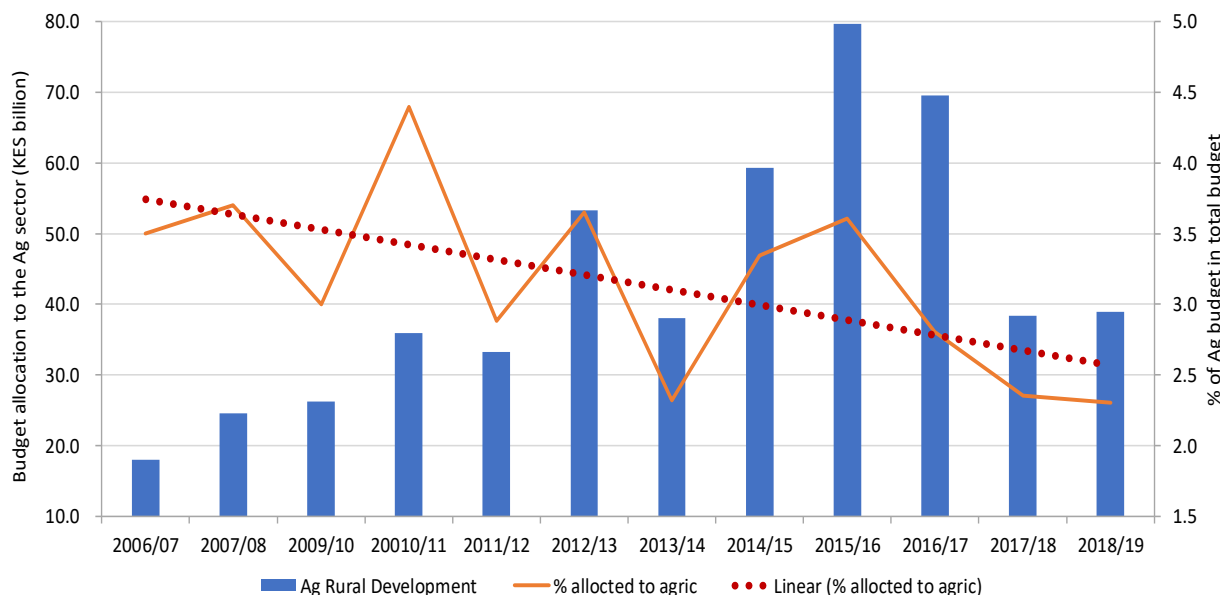
and nongovernmental organizations (NGOs). However, such extension is project-based and may not be sustainable. Following devolution, public extension was supposed to be revamped although that has not happened.

Seed market regulation. Policy and regulatory frameworks influence production, delivery, and uptake of improved seeds and technologies. Facilitative seed policies and regulations are critical in fast-tracking development and farmer uptake of new varieties, and subsequent varietal turnover among farmers. Influencing development and review of seed policies and regulations requires a multisectoral approach involving many actors (such as seed companies, regulatory agencies, parliament/politicians, agricultural technical groups, government policy directorates, public and private research agencies, and seed associations). But policy development and policy review are complex and slow processes involving political, economic, technical, networking, and advocacy dimensions. Therefore, an effective policy process is necessary to accelerate varietal development and sustained farmer uptake.

A policy process includes laws, regulations, and guidelines as well as taxes, subsidies, market interventions, and public investments designed and implemented by the government to achieve some social or economic goal. A progressive/facilitative policy process incentivizes farmers to continuously replace, and benefit from the replacement of, improved varieties with newer releases in a sustainable manner while ensuring improved quality of seed. Facilitative policies are characterized by the following principles: (1) increasing access to early-generation seed and improved genetics; (2) accelerating varietal registration and release; (3) improving quality assurance systems; (4) leveraging transparent and professional subsidy programs; (5) strengthening seed market development; and (6) leveraging facilitative seed policies and regulations.

Public financing of agricultural development. Financing to agriculture affects research and extension. Research is key to seed variety development while extension is an important interface between research (variety development) and seed use (demand). Budgetary allocation to the agricultural sector in Kenya has been generally low, with the share of that allocation in the total national budget declining over time (Figure 1).

Figure 1 Trends in national budgetary allocation to Kenya’s agricultural sector



Data on public expenditure for the period between the 2013/14 and 2017/18 financial years show that the share of agricultural sector expenditure in total public expenditure averaged 5.2 percent (World Bank 2019), which is well below the 10 percent target under the Maputo/Malabo Comprehensive Africa Agriculture Development Programme (CAADP) commitments. Further, the share posted a negative growth rate (-3 percent) during the five-year period, meaning a decline in public expenditure in agriculture in relative terms. Across counties, to which the agriculture function has been devolved, the share of expenditure in agriculture in total county expenditure varied greatly and ranged from an average of 2 percent to 32 percent, with less than 10 percent of total expenditure going to the agricultural sector in 17 of the 47 counties.

Funding for agricultural research and extension and advisory services is also woefully low, with targets often not met. For example, the World Bank (2019) reports that the share of expenditure on agricultural research in total expenditure for the agricultural sector averaged 3 percent against a target of 12 percent outlined in the medium-term plan for the sector. Similarly, expenditure share on extension and advisory services in the agriculture sector’s total expenditure averaged 3 percent against a target of 6 percent.

Donor funding makes up a significant share of public expenditure in the agricultural sector. Donors accounted for approximately 24 percent of public expenditure in the agricultural sector for the period between the 2013/14 and 2017/18 financial years, the largest of which was the World Bank (World Bank 2019). Donors and NGOs are active in funding research and extension through specific projects. Examples of donor-funded projects in the agriculture sector include the Kenya Climate Smart Agricultural Project and the National Agricultural and Rural Inclusive Growth Project, both funded by the World Bank; the German Agency for International

Cooperation's adaptive research and extension in various parts of the country (for example, Bungoma); the United States Agency for International Development's (USAID's) Kenya Crops and Dairy Market Systems activity; the Integrated Agricultural Research for Development Project; the Feed the Future Kenya Agriculture Regulatory Capacity Building Program; and the European Union-funded Kenya Cereal Enhancement Programme.

4. Agricultural policies and strategies in Kenya

4.1. Overview of policymaking landscape

The evolution of Kenya's agricultural policy and regulatory systems can be traced through three periods: postindependence (1960s–1980s); liberalization (1980s–1990s); and stakeholder participatory approach (from 2001) (Gitau et al. 2008). Postindependence policies were driven by autonomy, and their focus was on rapid economic growth as a pathway to improved welfare of the populace. Agriculture was accorded a prominent role, and the government devoted resources to activities aimed at expanding production and productivity, including credit provision, research, extension, and irrigation, in an effort to achieve that growth and self-sufficiency (Gitau et al. 2008). Accompanying those efforts was heavy involvement by the government in input and output markets through established parastatals that exercised centralized control of distribution of inputs and production and marketing of major crops, including price controls and restricted movement of produce. The result was a heavily regulated agriculture sector governed by many pieces of legislation (more than 130; Argwings-Kodhek 2005), with little competition and scarce involvement of the private sector in production and marketing activities.

Gitau et al. (2008) and Argwings-Kodhek (2005) note that mismanagement of the state parastatals led to their inefficiencies and indebtedness and a decline in services delivered to farmers—with liberalization being the response to these problems. The liberalization period was marked by external influence toward market-led reforms, with the main external players being international financial institutions—the International Monetary Fund and the World Bank—which advocated for removal of state control and expanded private sector involvement in commercial activities. The policy reforms downscaled the government's role to mainly providing public goods and managing the macroeconomic environment (Gitau et al. 2008). The scope of the state's involvement in provision of support services such as extension and credit was also reduced, and planning and implementation of development programs was decentralized from ministerial headquarters to district levels.

Despite these reforms, several challenges emerged that stymied progress during the liberalization period (Gitau et al. 2008; Argwings-Kodhek 2005). Policymaking was neither participatory nor consultative. In addition, the private sector had neither the capacity nor the right incentives to take up some of the roles abandoned by the state, such as, for example, provision of credit and extension services. There were also not enough structures to support the systems after the state's

downscale. The result was a decline in general economic performance and deterioration in the agriculture sector, including in subsectors such as maize, coffee, sugar, cotton, and dairy (Argwings-Kodhek 2005). Argwings-Kodhek (2005) suggests that the decline was exacerbated by a dated regulatory system and economic governance structure that did not match the economic realities of the time. It is worth noting that the quest for policy and regulatory changes originated more from external influence than from an internally recognized need for reforms, and thus the state's political will for liberalization was largely lacking.

The era of the participatory approach to policymaking began in 2001 with the development of Kenya's initial Poverty Reduction Strategy Paper (PRSP) for the period 2001–2004 (Gitau et al. 2008; Republic of Kenya 2001). Although externally influenced by the International Monetary Fund, the World Bank, and major donors, the PRSP was the government's response to the need to address the twin problems of an ailing economy and attendant widespread poverty. The development process of the PRSP required public consultation and participation as a principle, and the international financial institutions required that the public and private sectors and civil society participate in the process. The PRSP had among its objectives to ensure alignment of policy, planning, and budgeting and to identify national development objectives and priorities through a consultative process. In agriculture and rural development, the PRSP prioritized the creation of opportunities that enable rural communities and the private sector to effectively and competitively engage in economic activities and the acceleration of policy and institutional reforms, especially legislative and regulatory reforms, which were acknowledged to be lagging (Republic of Kenya 2001). Consequently, the government developed the Kenya Rural Development Strategy 2002–2017 (Republic of Kenya 2002), a comprehensive policy framework to guide development interventions by a wide spectrum of stakeholders in the agriculture and rural sector. The theme of the Kenya Rural Development Strategy was to improve the productivity and competitiveness of Kenya's agriculture through increased adoption of appropriate technologies and practices.

The new administration elected at the end of 2002 and subsequent administrations have embraced the consultative and participatory approach to policymaking and development programming initiated in the development process of the first PRSP. In addition, Kenya's constitution promulgated in 2010 requires public participation and involvement in policymaking and development programming processes both at the national and county levels.

Economic Recovery Strategy for Wealth and Employment Creation, 2003–2007 (ERS).

Developed through a consultative process, the ERS drew some of its content from the PRSP and policies in the ruling coalition's manifesto (Republic of Kenya 2003). The ERS identified the productive sector, comprising agriculture, tourism, and trade and industry, as the core of the economic recovery strategy. It detailed agriculture sector interventions including legal and institutional reforms, reform of agricultural research and extension, improving access to credit, improving irrigation, reviving livestock production and marketing, and improving the fishing

industry. Targeted reforms in the agriculture sector included enacting a unified legislation for the agriculture sector, developing a new extension policy, and reforming agricultural research institutions.

Strategy for Revitalizing Agriculture, 2004–2014 (SRA). Developed in response to the ERS as a policy framework to promote and guide development interventions in the agriculture sector, the SRA set a target of 3.1 percent annual growth of agricultural GDP during the first five years and to reach 5 percent by 2007 (Republic of Kenya 2004). It identified five critical areas of intervention: legal and regulatory reforms; promotion of research and technology development; reform of the extension service systems; development of credit and input markets; and promotion of agro-processing. These interventions aimed to raise agricultural productivity and farm incomes and ensure availability of and access to food. The strategy's legal and regulatory reforms reiterated the government's continued divesture from commercial activities and expansion of private sector involvement in the activities. The interventions planned included progressive removal of import duties on maize, rice, and sugar; facilitation of cross-border trade to boost food security; review of policies and legislation regarding input and output marketing; review and harmonization of agricultural legislation into a single agriculture act; review of legislation on and the restructure of commodity boards; and development of the capacity of farmer organizations and other stakeholders' associations to take a more active role in service delivery and regulatory services. These, among other interventions, were envisaged to revitalize growth in the agriculture sector.

Kenya Vision 2030. Developed in 2007, the Kenya Vision 2030 is the current long-term development blueprint for the country (Republic of Kenya 2007). Vision 2030 aims for Kenya to be a middle-income, rapidly industrializing country by 2030. It was generated in a consultative and participatory manner involving experts (both local and international), ordinary Kenyans, and various Kenyan stakeholders. Vision 2030 is anchored by three key pillars: economic, social, and political governance. The economic pillar, under which agriculture falls, aims to achieve an average annual economic growth rate of 10 percent. With respect to agriculture, Vision 2030's First Medium Term Plan (2008–2012) (Republic of Kenya 2008) sought to reverse the decline in and fast-track agricultural growth through a range of programs, including enactment of a legal framework to streamline the development, regulatory, licensing, processing, lobbying, and marketing roles of agricultural parastatals; improvement of the quality of seed and breed for traditional crops and livestock, including promotion of multiplication of quality seeds for crops that cannot attract commercial seed companies, such as sorghum, legumes, millet, cassava, and potatoes; and adoption of a holistic approach to agricultural extension that involves public and private service providers and linkages to markets and value addition. The vision's Second Medium Term Plan (2013–2017) (Republic of Kenya 2013) prioritized increasing area under irrigation; mechanization of agricultural production; revival and strengthening of farmer organizations; and provision of farm input subsidies, including for fertilizer, agrochemicals, and certified seeds, to increase productivity. The Third Medium Term Plan (2018–2022) (Republic of

Kenya 2018) prioritized food and nutrition security and established the following areas for investment: expansion of irrigation; expansion of area under crop production; fertilizer subsidy; and expansion of the Strategic Food Reserve Trust Fund, which includes a range of foodstuffs—maize, beans, rice, fish, powdered milk, and corned beef—as opposed to the contents of the Strategic Grain Reserve prior to 2015, where only grains, mainly maize, were included.

Agricultural Sector Development Strategy (ASDS). The Kenya Vision 2030 tagged agriculture as critical among the sectors under the economic pillar for the envisioned 10 percent annual economic growth rate, and the ASDS (2010–2020) was developed with that critical role in mind. The strategy envisioned a food-secure and prosperous nation and articulated a mission to create an innovative, commercially oriented, and modern agricultural sector. It set a strategic goal of average annual agricultural growth of 7 percent over five years from 2010. Two strategic aims lay at the heart of the strategy: increasing agricultural productivity, commercialization, and competitiveness and developing and managing key factors of production.

Among the challenges in the agriculture sector identified by the ASDS were an inadequate budgetary allocation to agriculture, which totaled 4.5 percent of the national budget in 2008 against the 10 percent stipulated in the Maputo Declaration; ineffective extension services; low adoption of modern technologies, including fertilizer and improved seed; the high cost and compromised quality of farm inputs; an inappropriate legal and regulatory framework; inadequate storage and processing facilities; and an inadequate markets and marketing infrastructure. The ASDS attributed poor adoption rates of improved seed to the poor seed distribution system and monopolistic operations of the Kenya Seed Company, which concentrated its seed supply to high-rainfall areas.

The ASDS sought a range of interventions to address some of the challenges: formulation and implementation of appropriate policy and regulatory frameworks; strengthening research, extension, and training; improvement of access to markets; improvement of land use and crop development; enhancement of farmer access to affordable inputs and credit; and enhancement of efficiency in service delivery. Regarding policy and regulatory frameworks, the strategy aimed to formulate and implement policies that, among others, support private sector–led agricultural development and enhance plant protection and quality assurance services. The strategy particularly committed to review and enhance enforcement of laws that regulate plant protection services.

Agricultural Sector Transformation and Growth Strategy (ASTGS). The central theme of the ASTGS (2019–2029) is food and nutrition security. This is in synchrony with Kenya’s constitution, which establishes each person’s right to adequate food of acceptable quality. The ASTGS seeks to improve food and nutrition security by transforming Kenya’s agriculture sector into one that is vibrant, commercially oriented, and modern. The strategy thus goes hand in hand

with the mission of the ASDS—to create an innovative, commercially oriented, and modern agriculture.

The ASTGS has three anchors: increasing incomes of small-scale farmers, pastoralists, and fisherfolk; increasing agricultural output and value-added; and increasing household food resilience. The strategy also recognizes and seeks to address the challenges women and youth face in agriculture and pays attention to the role of counties in implementation and delivery of interventions. Nine ideas (flagships) are identified for implementation: (1) target selected farmer-facing small and medium enterprises that supply agricultural inputs (including seeds) by providing equipment, processing, and postharvest aggregation; (2) restructure the nationwide subsidy program to target high-needs farmers with agricultural inputs, including seeds and crop protection; (3) use digital technologies; (4) establish large-scale agro- and food-processing hubs using a public–private partnership approach; (5) expand land area under agricultural production and sustainable irrigation; (6) restructure the management of the Strategic Food Reserve; (7) foster community-driven design of interventions in arid and semiarid lands; (8) develop skills among public servants and private service providers in the agriculture sector; (9) strengthen research and innovation and the monitoring of risks in the food system.

The ASTGS identified 13 value chains with the highest potential for transformation that will be at the center of the nine flagships. Those include maize, potatoes, rice, and beans among the staples; fruits and vegetables; beef, poultry, sheep/goats, dairy, and camels among livestock; and fish. The ASTGS’s inclusion of maize and potato among its priority value chains indicates the critical role those crops play, and the importance of the proper functioning of their seed systems, in food and nutrition security.

Big Four Priority Agenda. The Big Four Priority Agenda is a presidential development initiative for the period 2017–2022. As the name suggests, it establishes four priority areas for action: (1) increase the contribution of manufacturing to GDP to 20 percent; (2) reach 100 percent food and nutrition security; (3) achieve 100 percent universal health care; and (4) build 1 million affordable homes. Toward 100 percent food and nutrition security, the Big Four Agenda focuses on enhancing large-scale production through increasing area under production for selected commodities (maize, potato, rice, cotton, aquaculture, and feeds), expanding irrigation, promoting use of appropriate fertilizers, and reducing postharvest losses. The initiative also seeks to increase smallholder productivity and agro-processing and reduce the cost of food through a range of interventions.

Interventions in the Big Four Agenda that bear directly on potato include increasing potato seed production, building potato processing factories, and building cold storage for potato. The initiative also proposes to develop phytosanitary standards for potato. Regarding maize (and other cereals), the initiative seeks to reduce postharvest losses by waiving duties on drying

equipment and hermetic storage devices. In addition, the initiative seeks to enforce all critical agricultural regulations and legislation.

National Agriculture Investment Plan. Kenya’s National Agriculture Investment Plan (2019–2024) is a five-year investment plan under the 10-year ASTGS. It outlines investment priorities in the agriculture sector, considering the strategic development areas of focus in the Third Medium Term Plan, the ASTGS, the Big Four Agenda, CAADP, and the United Nations Sustainable Development Goals.

Food and Nutrition Security Policy. The overall goal of the Food and Nutrition Policy is to ensure that every person in Kenya has access to adequate food and water of acceptable quality at all times. The policy seeks to achieve adequate nutrition for all persons; improve access to adequate and affordable food supplies to all persons at all times; and protect the vulnerable persons in the society through sustainable safety nets. It recognizes the need for a diversity of food commodities to enhance food and nutrition security and not an overemphasis on maize as has been before. The policy thus outlines a range of interventions to increase the supply of and access to a diversity of foods of acceptable quality.

4.2. Seed policies and regulations

The current national policies and regulations that bear on Kenya’s seed systems are a product of the institutional, policy, and regulatory reforms outlined in the SRA and the ASDS. They are the National Seed Policy of 2010; the Crops Act no. 16 of 2013 (revised in 2016); the Kenya Agricultural and Livestock Research Act no. 17 of 2013 (revised in 2018); the Seeds and Plant Varieties (Amendment) Act, 2012; and the Seeds and Plant Varieties (Seeds) Regulations, 2016. The provisions in the policies and regulations affect seed and planting materials, research, breeding, multiplication, and distribution and marketing—and thus the seed systems for different crops may be affected differently.

National Seed Policy, 2010. The National Seed Policy of 2010, which is currently operational, sought to address a range of issues in Kenya’s seed industry, among them, insufficient supply of certified seeds, adulterated seed in the market, a nonharmonized legal and regulatory framework, and inadequate funding for research and extension services. The policy provides a framework for the development and delivery of high-quality seeds to farmers and harmonized activities in the seed industry.

It is notable that the policy views Kenya’s seed system through a dichotomous lens—formal versus informal. The formal seed system is governed by a legal and regulatory framework that guides varietal development (breeding) and inspection and certification for quality control. The informal system, which supplies seed to the majority of farmers, has no legal and regulatory framework to govern it, and thus quality control of seed in this system is absent. The policy articulates the need for embracing the formal seed system as one way to ensure the development

and delivery of quality seed, and as one of the interventions to be implemented it outlines the transformation of the informal system to a formal system through provision of advisory services. In this, the policy seems to regard the informal seed system as problematic and focuses its energy on developing the formal system.

On the legal and regulatory framework front, the policy sought to review the Seeds and Plant Varieties Act (SPVA) so as to adequately govern the liberalized seed industry in Kenya. It specifically sought to review laws and regulations so as to allow authorization and registration of private seed inspectors and seed testing services, facilitate self-regulation by seed industry players in the liberalized business environment, and encourage production of breeder seed and variety maintenance.

The policy states that seed quality control is accomplished through certification, and it elaborates the certification process thus: registration of seed merchants, seed growers, and seed crops; field inspection; processing; sampling; laboratory testing; sealing and labeling; lot examination; and pre- and post-control testing. Strengthening the capacity of the national designated authority, in this case the Kenya Plant Health Inspectorate Service (KEPHIS), to carry out the certification process is one of the means to ensure that quality seed is made available to farmers. The services of the designated authority are to be complemented by private seed inspectors and seed testing services.

To address inadequate funding of research and extension services the policy provides for increasing public and private sector funding going to research, extension, variety development, and technology transfer, and the coordination of public and private research and extension service providers.

Seeds and Plant Varieties Act (Cap 326). The Seeds and Plant Varieties Act (SPVA) of 1972 (chapter 326, as amended up to Act no. 53 of 2012) deals with, among other things, transactions in seeds, including seed testing and certification; introduction of new varieties; importation of seeds; and breeders' rights. In its current amendment, the SPVA enacts some of the interventions stipulated in the 2010 National Seed Policy. Specifically, section 3B of the act provides that KEPHIS "(a) shall appoint seed inspectors, seed analysts and plant examiners; and (b) may authorize competent private or public persons to perform specified functions under this Act on its behalf." Thus KEPHIS is mandated to authorize and register private seed inspectors, an activity that the regulator has begun to implement.

To encourage the production of breeder seed and variety maintenance, the SPVA has enhanced and strengthened breeders' rights by adopting the provisions in the 1991 International Convention for the Protection of New Varieties of Plants. Section 19 of the act stipulates that "breeders' rights shall be granted for a fixed period of twenty years from the date of the grant, except in respect of trees and vines where the said period shall be twenty-five years from the date of the grant." Section 20 of the act provides that certain actions regarding a protected variety

shall not be performed without permission from the right holder, and that “within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, farmers may use the product of the harvest which they have obtained by planting, on their own holdings, the protected variety.” This provision, however, may be a direct constraint to seed transactions in the informal seed system.

Crops Act no. 16 of 2013 (revised in 2016). Broadly the objectives of the Crops Act were to promote agricultural growth and development, improve farm productivity and incomes, promote agribusiness, and develop agricultural trade. To achieve those objectives, the act sought to consolidate or repeal several statutes relating to crops. In relation to seed, the act provides a list of scheduled crops to which its provisions apply, grouping those crops into three categories: crops with a breeding program under compulsory certification (17), crops with a breeding program under voluntary certification (20), and crops with no breeding program (76). Maize and potato are among the scheduled crops and fall under the group of compulsory certification.

The act directs the Food and Agriculture Authority, in consultation with the National Biosafety Authority, to advise the government about aspects of the introduction, handling, and use of genetically modified species of plants and organisms; establish experimental stations and seed farms for varietal development of scheduled crops; and establish programs that facilitate growers of and dealers in scheduled crops to access affordable farm inputs, including quality seeds. In addition, the act gives the cabinet secretary the power in matters relating to agriculture to restrict the movement of seeds or any planting to prevent the spread of disease or pests; make regulations about seed and planting materials for export and import; and make regulations on standards, testing, and certification of seeds and planting materials.

Kenya Agricultural and Livestock Research Act of 2013. The Kenya Agricultural and Livestock Research Act of 2013 (revised in 2018) provides for establishment of an organization for the coordination of agricultural research activities in Kenya. Consequently, the Kenya Agricultural and Livestock Research Organization (KALRO) was established to regulate and coordinate research activities in regard to crops, livestock, genetic resources, and biotechnology, as well as diseases for crops and livestock. The act provided for establishment of several research institutes (currently 16) under the organization to carry out its functions. In establishing KALRO as the regulator and coordinator of agricultural research, the act implies that seed multiplication and distribution lie outside the mandate of the organization, although it continues to act in those areas especially for crops with little commercial interest to the private sector.

Seeds and Plant Varieties (Seeds) Regulations, 2016. Under the SPVA the cabinet secretary is responsible for matters of agriculture powers to regulate the production, processing, testing, certification, and marketing of seeds, after consultation with representatives of interested organizations. It is through this power that the 2016 Seeds and Plant Varieties (Seeds) Regulations were passed. The regulations established a Seeds Regulation Committee, with

membership drawn from the directorate responsible for crops in the State Department of Agriculture (chair), KALRO, KEPHIS, the Seed Trade Association of Kenya, the Agriculture and Food Authority, the Council of Governors, the Kenya National Farmers' Federation, the Plant Breeders Association of Kenya, and two members to represent interests that may from time to time be determined. The Seeds Regulation Committee advises the cabinet secretary on matters regarding seed policy and regulations and industry performance; determines seed certification standards and fees; determines actions against cases of malpractices in the seed industry; hears and determines appeals by aggrieved parties; and develops guidelines for authorization. The regulations require that a seed merchant and a seed grower be formally registered with KEPHIS for a fee.

The regulations specify seed certification standards and six classes of seed. Maize and potato are listed among the crops for which seeds are under mandatory certification. For maize (hybrid) seed, the classes are breeder seed, pre-basic, basic, and certified first generation, while the classes for potato seed are stock seed/mini-tubers, pre-basic, basic, certified first generation, and certified second generation. The regulations thus do not provide for quality declared seed (QDS).

4.3. Key takeaways

A number of messages emerge from the review of existing literature and policy documents that are critical to understanding the seed system and market development in Kenya. First, beginning with Kenya's initial PRSP, which bore the stamp of external influences, policy and strategy development processes have been progressively participatory. The momentum was sustained in the subsequent government regimes. The current constitution explicitly requires public participation in all policy and regulatory processes. Despite the participatory nature of the policymaking process, the seed policy landscape in Kenya still predominantly favors the formal seed system. Attempts are currently underway to review the seed policy to accommodate farmer seed systems.

Second, successive development strategies during the last one and a half decades have identified low agricultural productivity, legal and regulatory reforms, and research and extension as key areas for intervention in Kenya's agriculture sector. This is true for most agricultural value chains. Therefore, an understanding of seed systems and market development is a first and critical step to identifying needed development programmes and policy and regulatory reforms in the identified areas of interventions. Legal and regulatory reforms arising from the development strategies have resulted in an elaborate policy and regulatory framework governing Kenya's seed systems, with agencies having clearly stated roles in enforcing regulations. Nevertheless, inadequacies exist. Moreover, recent agricultural strategies have recognized the role of other food crops in addition to the traditional maize crop, particularly potato, in food security. Also worth noting is that potato seed has gained attention in both the ASTGS and Big Four Agenda, and that should provide an impetus for promoting development of the seed system.

5. Maize and potato seed systems in Kenya

5.1. Maize seed system

Maize traditionally is the main food crop in Kenya, occupying 56 percent of cultivated land and being grown by about 98 percent of smallholder agricultural households (Kirimi et al. 2011), who operate farms of size 0.2 to 3 hectares and account for more than 70 percent of total maize output (Republic of Kenya 2010). Maize is also the most important food staple, providing 65 percent of caloric intake in the diets of Kenyans (FAO 2009). Because of that prominence, maize has always received the attention and support of the government, donors, and the private sector. For example, here are some of the government-led and donor-led policy and programmatic interventions spanning the farm and input and output markets:

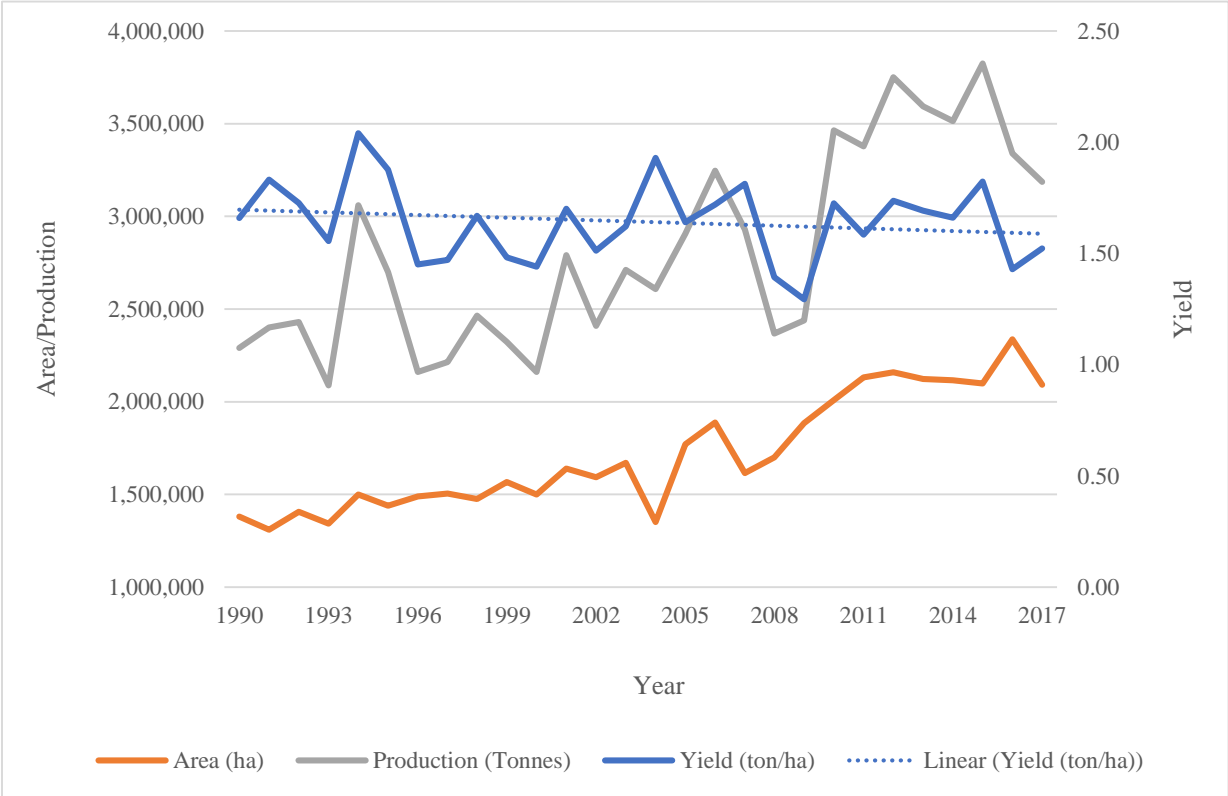
- Kenya Maize Development Programme (2002–2010) and Kenya Agricultural Value Chain Enterprises (2013–2018) funded by USAID
- Government input subsidy programs—the National Accelerated Agricultural Inputs Access Program (NAAIAP) and through the National Cereals and Produce Board
- Producer price supports through the Strategic Grain Reserve (SGR) and an import duty on maize grain
- Government-led large-scale irrigation of maize production in Galana Kulalu—5,145 acres of land between 2015 and 2018
- Establishment of trade in fertilizers, maize milling, and seed
- A strong push for seed research and development through the Kenya Agricultural Research Organization (formerly the Kenya Agricultural Research Institute) and subsidy in seed through the NAAIAP and the Kenya Seed Company

Despite the interventions aimed at increasing productivity, maize yield has stagnated at around 1.6 metric tons per hectare during the last almost three decades (Figure 2). Smale and Olwande (2014) highlighted several reasons: little yield advantage over previous hybrid releases, declining farm sizes and attendant soil fertility decline because of rising population, uncertainty created by the structural adjustment program, and partial liberalization of the seed sector that has constrained the supply of hybrid seed.

Despite the stagnant yield, total maize production increased largely due to increased total acreage. Between 2004 and 2017, demand for maize seed increased from about 40,000 metric tons to about 63,000 metric tons (Figure 3). Using household panel survey data, Mathenge, Smale, and Olwande (2014) show a consistent increase in the percentage of households growing hybrid—from 61 percent in 2004 to 73 percent in 2007 to 82 percent in 2010. Along with the

increase in demand for seed, the number of maize seed varieties released also increased: 40 percent of the 349 varieties released between 1960 and 2019 were released during the period 2000–2009 while 53 percent were released during the period 2010–2019 (Table 3). The number of registered seed companies (or merchants) producing maize seed has risen dramatically from only one (the Kenya Seed Company) prior to 1997 (Swanckaert 2012) to 16 by the end of 2018 (Waithaka et al. 2019). These statistics show that although Kenya’s maize seed market has expanded, this has not been accompanied by increased maize yield as one would expect.

Figure 2: Trends in maize area, production, and yield



Source: Authors’ computation using data from FAOSTAT.

Figure 3: Trends in quantities of maize seed planted



Source: Authors' computation using data from FAOSTAT.

Table 3: Number of seed varieties released for maize over time

Period	Maize
1960–69	4
1970–79	2
1980–89	8
1990–99	9
2000–09	141
2010–19	185
Total	349

Source: Kenya Plant Health Inspectorate Service, National Crop Variety List.

The African Seed Access Index (TASAI) reports that commercialization of recently released varieties of maize is quite low. The number of varieties sold in 2017 accounted for only 21 percent of the number of varieties released between 2000 and 2017 (Waithaka et al. 2019). TASAI further indicates that the average age of maize varieties in the market was 12.6 years in 2017. Using household panel survey data, Smale and Olwande (2014) estimated the area-weighted average age of hybrid and open pollinated varieties planted by farmers to be 15.4 years in 2004, 14.9 years in 2007, and 17.3 years in 2010. These statistics suggest a slow rate of maize varietal turnover on Kenyan farms despite the dramatic increase in the number of new varieties released during the last two decades. Indeed, one of the oldest hybrid varieties (H614, released in

1986) was planted on 55 percent of all the maize plots in 2004, on 44 percent in 2007, and on 43 percent in 2010 (Smale and Olwande 2014).

Despite the dismal performance in maize yield over the past two decades, it is worth noting that strategic planning for development in the agriculture sector has been a consistent practice since the advent of Kenya's Strategy for Revitalizing Agriculture in 2004, suggesting that the expansion in acreage under maize and the associated increase in seed demand, number of varieties released, and number of registered seed companies are outcomes of that initiative, including its legal and regulatory reforms.

A historical review of the maize seed system development in Kenya since independence shows key policy moments over the years. We summarize four main policy moments:

- 1963: The government of Kenya mandates that the Kenya Seed Company, established in 1956 by European settlers, produce seeds for pasture and produce and distribute maize seed.
- 1996: The government liberalizes the maize seed industry, allowing new seed companies entry to the industry. The first company to enter the maize seed market is the Western Seed Company in 1997. Currently, 16 companies, 15 of which are privately owned, operate in the maize seed industry. Evidence suggests that while the sector is fairly competitive, it is highly concentrated. For example, in 2017 four seed companies accounted for 96 percent of maize seed sold in the formal market (Waithaka et al. 2019). Further, government-owned seed companies/merchants held 64 percent of the market. This suggests that, although the seed industry is liberalized, government-owned entities are still the dominant players in seed production.
- 2010: The National Seed Policy is created, establishing a framework for review of the Seeds and Plant Varieties Act (Cap 326) to conform to the realities of a liberalized seed industry.
- 2012: The Seeds and Plant Varieties Act (Cap 326) is revised, directing KEPHIS to authorize and register private seed inspectors as a path toward self-regulation. The revised act expands the scope of breeders' rights to encourage production of breeder seed and variety maintenance. Expansion of breeders' rights, however, means that farmers' practice of exchanging and selling farm-saved seeds for a protected variety is prohibited under the act, constraining transactions in the informal seed system.

Political economy issues in the maize seed system

Alongside the policy moments, the maize seed system and market development has been, and is, affected by a number of political economy factors. We examine these in turn.

Devolution and coordination

Despite devolution's many teething problems, it has emerged as a popular system of governance. It provides an opportunity for county governments to identify problems affecting maize production and local solutions. For example, faced with declining yields as a result of poor soil conditions, the county government of Trans Nzoia, a key grain basket, initiated soil analyses and realized that pH levels were around 4 to 5, which is pretty low, so they decided to (1) increase soil organic matter and (2) look for fertilizer to fix the problem. The county also advised the national government to switch to blended subsidized fertilizer, since they do not acidify the soil.

Bungoma County, another grain basket, has developed and implemented an input support plan to subsidize inputs so that farmers enhance production and productivity on a sustainable basis. The county has purchased soil labs so that farmers can test their soil nutrients and pH. Despite this subsidized service, only a small percentage of farmers have tested their soil.³

A key challenge for devolution is the coordination of activities at the two levels of governance. Under the new dispensation, the national government retains its roles in policy formulation and research and capacity building, while the role of county governments is to implement the policies. Oftentimes, confusion arises when policies are formulated without implementation plans. For example, the recently completed maize taskforce report is yet to be implemented because there is no clear implementation plan.

Big Four Agenda

One of the pillars of the Big Four Agenda is food and nutrition security, with a goal to achieve 100 percent food and nutrition security between 2017 and 2022. Maize and potato are priority value chains in both the Big Four Agenda and the ASTGS. Two major instruments for ensuring food and nutrition security are the price stabilization policy and the Strategic Food Reserve. The food reserve is used as a buffer to high food prices and as a relief food distribution in response to emergency situations. The food reserve is also used as part of a price support to farmers.

The country's commodity markets are managed by the government and other stakeholders with the objective of supporting and complementing the national food security policy. Their main function is to make sure that all players in a value chain have enough margin to enable them to continue with their respective businesses. More important, the price stabilization policy is complemented by two major interventions to boost domestic production: (1) investment in rural infrastructure (irrigations systems, and (2) dissemination of a technology package, including high-yield varieties, fertilizer, pesticides, and technical advice. However, the National Cereals and Produce Board in Kenya is not managed efficiently, and it has not achieved the goal of improving national food and nutrition security.

³ The county staff who work in this lab were trained by SoilCare. County governments report that this initiative increases per acre yields by as much as 70 percent.

Regarding maize, the Big Four Agenda focuses on marketing and storage, area expansion, irrigation, and fertilizer use. The warehouse receipt system is expected to address some of the challenges in the marketing of maize grain, which in turn would stimulate seed demand. Under the agenda, direct intervention in grain marketing should be less common in Kenya. Rather, the government is expected to take different measures that facilitate access to market or storage services (including warehousing and commodity exchange) for priority crops such as maize and potato.

With respect to other value chains, the maize seed sector is well developed, with certified seeds being available. However, expansion of the area under maize requires proper planning and coordination with seed companies. There is therefore a need for a mechanism for allocating seed production across agroecological zones according to the planned area expansion and for establishing an organized system for development of seed merchants for seed distribution. The focus on maize and its expansion can provide an opportunity to support the growth of small-scale seed companies and expansion of the seed market, but it can also contribute to addressing the problem of low varietal turnover among farmers, boosting demand for newer varieties and expanding the maize seed market.

Extension

Extension and advisory services are intended to enhance demand for seed and inputs and services. The weak extension system contributes to low varietal turnover in maize seed. For instance, the H614 maize variety has “staying power” because of producer familiarity. The extension providers are supposed to sensitize farmers regarding newly available varieties so as to create demand. That demand acts as feedback for research into the development of the early-generation material. For this to be meaningful, an effective feedback mechanism must exist among the stakeholders along the value chain, but it is often lacking. But according to the county government of Trans Nzoia, “seed varieties in Kenya are too tall, which makes it a challenge to use mechanized weeding and harvesting.” This raises the question of whether farmer feedback is getting to researchers.

The disconnect between research and extension has led to researchers producing seed but little effort being made to disseminate that seed to farmers. Also, the newer varieties may lack the traits farmers want. These and other factors have led to many maize seed varieties being released but not taken up by farmers.

The implication of weak demand is the low varietal turnover. Of the 349 maize varieties released in Kenya by 2018 only 21 percent have been commercialized (Waithaka et al., 2019), and consequently varietal turnover in maize seed is low.

The situation raises the question *Why continue breeding new maize varieties when farmers are not adopting them?* One compelling answer is that developing and deploying many varieties is

good because it allows farmers to make choices. However, at issue is whether the varieties align with the needs of farmers. Part of this is how farmers are sensitized and prepared to receive and use the new varieties—this relates to building farmers’ capacity to adopt new technologies. That is the responsibility of the national government, but this mandate is not being fulfilled by the extension directorate of the national government.

Agricultural service delivery is pluralistic, involving civil society and private sector operations in addition to public extension agents. Public extension, however, is weak. In addition, a gap exists between researchers and farmers, often leading to a mismatch between the seed traits the farmers demand and what breeders deliver. Innovative approaches are therefore needed to bridge the gap between farmers and researchers.

It is important as well to develop a framework with which to monitor adherence to high standards of professionalism and performance by extension and advisory service providers in this pluralistic extension system. Guidelines and standards for agricultural extension and advisory services have been formulated. But guidelines for extension metrics are needed (essentially standard indicators for extension services).

5.2. Potato seed system

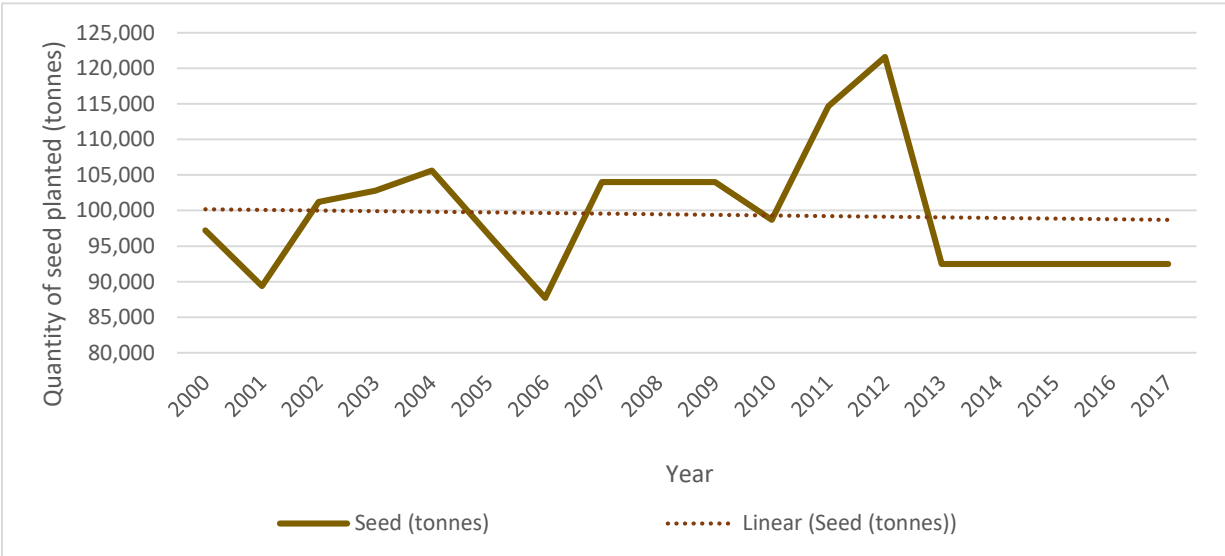
Potato is second only to maize in terms of importance as a staple food in Kenya. It was introduced in the country by European settlers in the 19th century. For a long time, the government has promoted maize yield and production as a way of ensuring a secure domestic food supply. But in recent years, the dismal performance of maize yield and production in the face of increasing consumption demand as the population grows has triggered a change in Kenya’s strategy vis-à-vis its food security policy. The Food and Nutrition Security Policy recognizes the need for a diversity in food commodities as one of the ways of enhancing food and nutrition security. The ASTGS and the Big Four Agenda both prioritize investing in the potato value chain as Kenya attempts to meet its target of 100 percent food and nutrition security. Yet despite such policy and strategic intentions, potato production and productivity are still low and the use of certified seed is dismal.

Farmers get potato seed from both the formal and the informal (farmer-based) systems. The former produces certified seeds according to the regulations in the Seeds and Plant Varieties Act (Cap 326), which classifies potato as among the crops for which seeds require mandatory certification. The formal seed system for potato breaks down into three types—public, public–private, and fully private (or closed value chain) (KEPHIS 2016). In the public system, the public sector performs all activities, from seed breeding to distribution. The Kenya Agricultural and Livestock Research Organization (KALRO) conducts these activities. The public–private formal seed system involves both public and private sector entities, with the public entity, essentially KALRO, doing the breeding and the private entities conducting seed multiplication and distribution. In the fully private system, private sector firms perform all the activities, from

breeding to seed distribution. The supply of seed in the formal system occurs through two channels: (1) local production of certified seed right from breeders’ seed, and (2) multiplication of certified seed from imported basic seeds. An industry player involved in the latter channel expressed to us their sentiments that the regulator recommends the former channel as one way of managing high disease pressure on potato. The informal system, on the other hand, is unregulated, and two kinds of seeds are found there—clean seed and farm-saved seed. Clean seed is obtained from the harvest from planting certified or basic seed, while farmers produce farm-saved seeds independently without involving other industry players (KEPHIS 2016).

It is estimated that less than 2 percent of potato farmers plant certified seeds and 4 percent plant clean seeds while the rest (approximately 95 percent) plant farm-saved seeds (KEPHIS 2016). These statistics point to a huge potential demand for certified potato seed, a factor that could influence key political economy issues regarding the potato seed value chain. The quantity of improved (certified and clean) seed potato planted increased considerably between 2006 and 2012 but declined sharply thereafter (Figure 4). It is recognized that pests, diseases, and a lack of adequate clean planting material are the main reasons for low and declining potato yields and production in Kenya. These problems have persisted for several decades.

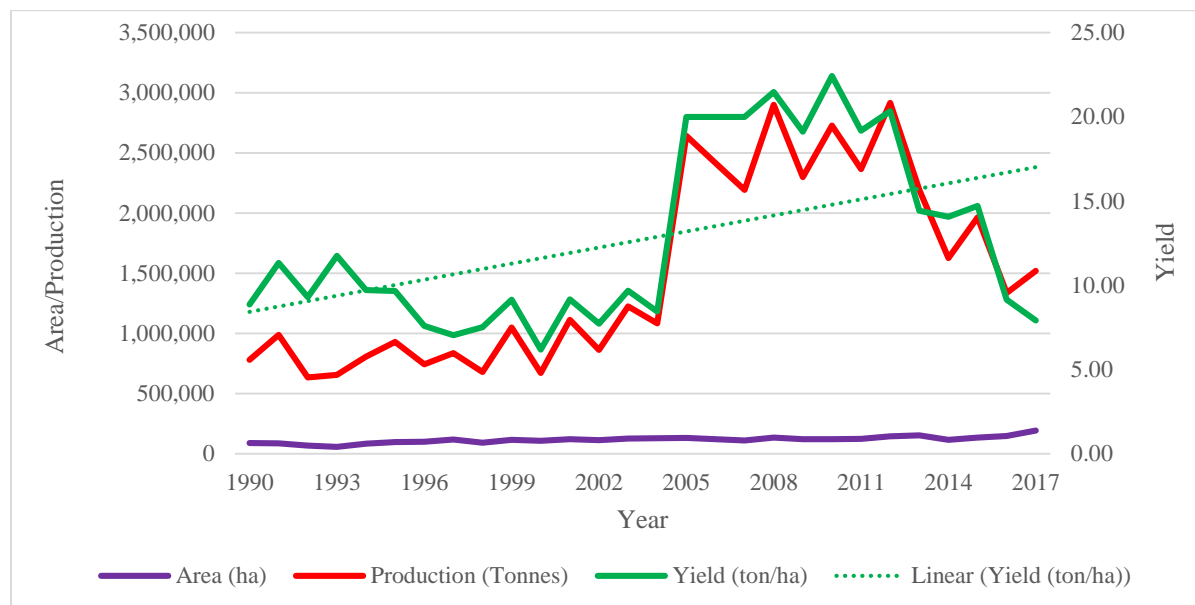
Figure 4: Trends in quantities of potato seed planted



Source: Authors’ computation using data from FAOSTAT.

The area under potato production has more than doubled during the last almost three decades, from approximately 88,000 hectares in 1990 to 192,000 hectares in 2017 (Figure 5). Over the same period, we see an upward trend in potato yield, with yields rising tremendously between 2004 and 2012, but then a consistent decline thereafter, with, in 2017, yield levels reaching those experienced in the 1990s. Patterns in total production have followed those in yield, suggesting that there have been little gains, if any, in total production from area expansion.

Figure 5: Trends in potato area, production, and yield



Source: Authors' computation using data from FAOSTAT.

Varietal research, breeding, and production of potato seed in Kenya began in 1903, with the varieties released initially obtained from Western Europe. Because the varieties suffered a lot of disease pressure, the government established a potato development program in 1967 to address the problem. This saw establishment of research facilities in the main potato-growing areas—Kiambu (at Limuru), Nyandarua (at Njambini), Nakuru (at Molo), and Meru (at Marimba)—to produce breeder seed locally for further multiplication (Republic of Kenya 2016).

The Republic of Kenya (2016) reports that KALRO (then known as the Kenya Agricultural Research Institute) and the International Potato Center (CIP) collaborated in adaptive breeding of potato between 1986 and 1997 to develop varieties that could resist late blight, tolerate bacterial wilt to some level, and have acceptable agronomic and postharvest qualities. That effort led to the release of three varieties—Tigoni 1 for processing into chips and Kenya Furaha and Asante, both for domestic consumption. Other varieties have been released in subsequent collaboration between KALRO and CIP, including Shangi, a variety most popular among farmers, released in 2015.

Since 1960, 60 potato varieties have been released in Kenya, with 49 (82 percent) of those released during the last decade (Table 4). Despite the long-term presence of a potato-breeding program in Kenya, many of the released varieties originated from screening imported varieties from Western Europe and advanced germplasm from CIP (Republic of Kenya 2016). Currently, 15 registered seed merchants deal in certified potato seed production.

Table 4: Number of seed potato varieties released in Kenya over time

Period	Potato
1960–69	2
1970–79	5
1980–89	2
1990–99	2
2000–09	0
2010–19	49
Total	60

Source: Kenya Plant Health Inspectorate Service, National Crop Variety List.

Political economy issues in the potato seed system

Like the maize system, the potato seed system is affected by a number of political economy issues. We group those issues under five main domains: devolution, the Big Four Agenda, extension, regulation, and financing.

Devolution

Devolution ushered in a new system of governance, with agriculture included among the sectors devolved. Under the new dispensation, the national government retains four main functions—policy formulation, food and nutrition security, national research, and capacity development. Each county is responsible for its own development planning for and implementation of policies and programs in the sector. Such autonomous and decentralized planning and implementation of policies and programs has its positives, negatives, and contestations. Devolution has resulted in the potato value chain being mainstreamed in the development plans of some counties where potato is a major crop; in so doing, those counties have focused especially on the seed system (see the accompanying impact stories). Demand for certified potato seed has increased among county governments, which procure seeds from seed companies (for example, the Agricultural Development Corporation) to distribute to farmers—for example, in the counties of Nyeri, Meru, Bungoma, and Nyandarua.

Impact story 1

Nyandarua County, the leading potato-producing county in Kenya, has identified low farmer adoption of certified potato seed (at 5 percent) as a major constraint to growth in yield and production of potato. Its strategy to address the problem includes establishing a seed multiplication facility and a potato processing factory. The county has obtained donor financial support to build a laboratory and a potato seed and ware storage facility. Its strategy also includes collaborating with the Agricultural Development Corporation (in seed multiplication) and KEPHIS (in soil testing) to start seed multiplication in the county. The planned processing factory is designed to ensure a stable market for ware potatoes, which would further stimulate demand for seed. These initiatives are expected to gradually increase farmer adoption of certified potato seed to 50 percent. Concerning the potato processing factory, a question arises as to whether potato production in Nyandarua County alone can sustain the factory, and if not, whether the county should engage other counties in plans for a factory.

Impact story 2

The Meru County government has identified potato as a flagship crop in its development plan and has identified seed as an area of intervention. The county government has provided farmer groups with certified seed (from the Agricultural Development Corporation) to multiply into clean seed and has also trained them on positive selection of seed. Seven farmers' cooperatives have formed a cooperative union for potato marketing. The union is also expected to be a seed merchant. The union has negotiated with the county government to be allocated public land (about 121 hectares) for potato seed production. Operations on the land have not yet begun, but there are plans to engage the regulator (KEPHIS) to train the union on seed multiplication. Farmers in the county are also receiving donor-sponsored training on potato seed production through apical cuttings.

On the flipside, the coordination of activities both between the national and county governments and among the county governments is weak. For example, a county government received certified potato seed from the national government to distribute to farmers for planting. However, there was no proper planning and coordination between the national and the county governments concerning the procurement, delivery, and storage of the seed. The seed generally had problems with breaking dormancy and much of it rotted before germinating. The entire consignment (28 metric tons) eventually was destroyed while in storage by the county government.

Another issue affecting both the seed and ware potato marketing systems are levies charged on consignments that move across counties. Counties charge levies to raise revenues; however, the levies charged are not imposed in a coordinated manner and each county independently

determines the amount it charges. A discussion with officers at the Seed Trade Association of Kenya and the Kenya Private Sector Alliance revealed a need for payment of levies to be done only at the source and at the end market but not in between, and negotiations are ongoing among counties through the Council of Governors.

There is controversy about the national government's preferential treatment of some counties with regard to distribution of resources for its programs. Cases of unbalanced treatment with regard to Big Four Agenda resourcing have often been reported. For example, a county government official reported that selected counties are receiving financial resources from the national government for implementation of Big Four Agenda priorities, specifically potato seed production and multiplication. The system's success depends on fairness and a clear strategy for distributing resources for the Big Four Agenda.

Big Four Agenda

As already stated, potato is a priority crop for food and nutrition security reasons according to both the Big Four Agenda and the ASTGS. This is a departure from previous government strategies and policies regarding food security that emphasized grains, mainly maize. The agenda puts special emphasis on seed multiplication and distribution to address the problem of inadequate certified seeds for potato.

Expected opportunities for the potato seed system include a likely increase in demand for certified potato seed, which is already high. For example, under the Big Four Agenda, the national government gave farmers in Meru County, through the county government of Meru, 28 metric tons of certified potato seed for the 2018 long-rains season. But because of weak coordination and improper planning for delivery and distribution, the seed consignment was destroyed and could not be distributed for planting. With better planning and coordination between the two levels of government, increased demand could create opportunities for new investments in potato seed production.

The Big Four Agenda also seeks to redesign the input subsidy program the national government currently uses, which mainly targets maize farmers with subsidized chemical fertilizers and maize seed. The redesign would establish a flexible subsidy model where resource-poor farmers get e-vouchers that they can spend on a range of inputs they choose from among those eligible. The eligible inputs include seed, chemical fertilizers, and extension services among others. With expansion of the portfolio of inputs eligible for subsidy and the targeting of resource-poor farmers, demand for certified potato seed by farmers who otherwise could not afford it would be expected to increase, expanding opportunities for seed production.

But there are several challenges to investment in potato seed production. First, potato seed production requires a substantial amount of land because of the requirement for regular rotation to manage soil-borne pests and diseases, and land is limited in Kenya. Second, farmers' demand

for potato seed may be unstable—they may not consistently purchase certified seed for planting every season because of its high cost. The current price of certified potato seed is between KES 2,500 and KES 3,000 for a 50-kilogram bag, and a hectare requires an average of 37 bags of seed (15 bags/acre). Third, potential potato seed producers (farmers) have limited knowledge and skills, and hence limited technical capacity, about potato seed production. Fourth, there is lack of cold storage facilities for tubers and ware potatoes. Finally, weak coordination between the national and county governments may affect implementation of Big Four Agenda initiatives in the counties.

Regulations

Domestic versus foreign seed

Seed regulations have allowed for importation of basic potato seed for multiplication in the country and importation of germplasm for production of basic and subsequent classes of seeds. However, controversies have arisen over the importation of foreign varieties for multiplication locally. First, some tubers imported from the Netherlands for multiplication (about 500 metric tons) failed the regulator's test for pests and diseases and were rejected. Importers of foreign potato seed tubers felt victimized by this action of the national regulator. The view is that the regulator's stance of zero tolerance for pests and diseases on imported potato tubers is too restrictive since some of the pests and diseases (for example, potato cyst nematode) are already in Kenya. But the regulator is of the view that diseases pose a major challenge to importation of potato from overseas. A stronger sentiment about this was expressed by an officer from a civil society organization, who was of the view that "importation of potato seed from Europe into East Africa should be discouraged altogether because the agro-ecologies of the two regions are starkly different." An officer from a local seed company held a similar view: "Research and development on potato seed should be done here in Kenya for appropriate adaptation of seed to local agro-ecological conditions. Tubers should not be imported because of the threat of diseases." The flipside to this controversy is that the Kenyan government signed a memorandum of understanding (MOU) with the Dutch government concerning importation of potato seed from the Netherlands because of the paucity of certified seeds in Kenya. That MOU also entailed strengthening the capacity of the regulator in Kenya in terms of upgrading the skills of staff and equipping the laboratories through funding from the Dutch government.

Second, there are concerns that imported potato seeds are not of high quality as some of the seeds brought in for multiplication are up to seventh generation (according to the certification standards of the countries of origin). Some think that Kenya should regulate the generation allowable for imported seed for multiplication. The controversy regarding importation of potato seed thus seems to be a contestation between domestic and foreign seed.

Formal versus informal seed

Potato is a scheduled crop in the Seeds and Plant Varieties Act (Cap 326), implying that seed potato must undergo mandatory certification in the formal system. A civil society official observed that “the seed regulations are not realistic for potatoes because they are biased in favor of grains” and that seed certification protocols need to be reviewed to accommodate the needs and dynamics in the vegetatively propagated crops. For example, a local seed company observed that there are no policy guidelines regarding technologies for in vitro plants.

The supply of certified potato seed is quite low, and most farmers obtain seed from the informal system. As a result, and due to the high cost of certified seed to farmers and the prevalence of diseases, some stakeholders in the seed system have proposed allowing quality declared seed (QDS). For example, officers from a research organization said that regulations should allow for “QDS for potato and other vegetatively propagated crops as well as other crops such as grasses.” The officers noted that this is especially necessary for potato because “certified seed for potato is too costly for many farmers to afford.” The regulator, on the other hand, holds the view that QDS could potentially spread pests and diseases and should not be allowed. Ministry of Agriculture officials recommend that there needs to be a balance between opening the seed system for QDS and the need to ensure effective control of pests and diseases in potato.

Another group of stakeholders suggests scaling up the use of apical cuttings in potato seed production through encouraging farmers’ adoption of the technology. However, some stakeholders observe that apical cuttings are quite fragile and sensitive to disease infection when bruised. In addition, the cuttings are not easily available and require specialized equipment and skills to manage and thus need high financial investment. A local seed company holds the view that operation of apical cuttings in large scale may not be feasible because of these challenges.

The foregoing points of view suggest a contestation between those who support the regulatory requirements for the formal seed system for potatoes and those who recognize that the current regulations are not realistic for potato seed and that the magnitude of the problem of inadequate supply of quality planting materials warrants their review, and that the informal seed system can help address the problem. Reviews of policies and regulations should be based on the circumstances that prevail.

Regulator versus seed producers

Several seed potato producers and a stakeholder affiliated with potato seed importers are of the view that the regulator does not have enough capacity to carry out its mandate of seed inspection. For example, one seed company experienced delays in the inspection of its seed in the field, leading to damaged potatoes and subsequent rejection. Seed producers and senior officials at the Ministry of Agriculture blame the inadequate capacity on a shortage of staff. Importers also say the regulator has too few staff to deal with a range of pest and disease issues in a range of crops. However, the problem is being addressed in the Seeds and Plant Varieties Act (Cap 326) and the 2016 Seeds Regulations, which give the regulator power to authorize independent seed

inspectors. The proposal to change the regulations to allow for authorization of independent seed inspectors was a collective effort by various industry players, including the Seed Trade Association of Kenya. The regulator has thus begun to train independent inspectors. However, independent inspectors still fear that they might be victimized if they inspect the seed of a company and those seeds fail. This fear may point to a lack of trust between the regulator and the seed companies.

Financing

Despite potato being the second most important staple food crop in Kenya after maize, it has not been given enough support institutionally and in budgetary allocations. This statement partly reinforces the widely acknowledged fact that public financing of Kenya's agriculture sector is severely wanting. Specifically, public financing of the development of foundation seed (essentially seed research), a critical stage in seed system and market development, is weak. Yet because of the risks involved, the private sector has little incentive to invest in the development of foundation seed.

Given the inadequate public funding, public research organizations depend heavily on donors to fund research. For example, potato seed research and production has often received funding from the Dutch and Irish governments through the Agricultural Development Corporation. Public research programs also have often received funding from the World Bank, the European Union, and USAID. In addition, the Alliance for a Green Revolution in Africa has funded training of breeders and production of foundation seed. Research is thus donor driven, and donors may have greater influence on setting the research agenda. Yet research is too important to be donor driven, and the government should be at the forefront in funding research and bulking/multiplication of seed after variety release.

But foreign governments—often among the main donors in Kenya's agriculture sector—are changing their approach to emphasizing trade and providing support to private firms in their countries to penetrate markets in areas of their interest. Examples are the Dutch and Irish governments in potato seed. The Kenya–Netherlands Seed Potato Development Project, born out of the MOU between the two governments, is modeled on a public–private partnership, where Dutch private companies partner with private companies for potato seed in Kenya and import potato seed from the Netherlands for multiplication and domestic distribution by the private companies in Kenya. The initiative also involves capacity strengthening of Kenya's seed sector regulator and is working together with its counterpart in the Netherlands on matters of quality assurance according to their respective regulations. The initiative has a strong focus on importation of certified seed of Dutch potato varieties from the Netherlands, hence providing a market in those varieties. The Irish government is also funding the production of potato seed and ware potato market development through a project being implemented through a consortium of public and private sector organizations, coordinated by the International Fertilizer Development

Center. The consortium includes private companies in Ireland and Kenya partnering to multiply seed in the country. A private company, formed through a partnership between Kenyan and Irish private companies, is currently producing potato seed, with emphasis on obtaining germplasm from Ireland.

6. Political economy issues affecting seed systems and market development

How have devolution, the Big Four Agenda, extension, regulatory reforms, and public sector financing affected seed system and market development in Kenya? What lessons, if any, can be learned and what needs to be done to improve the seed system? In the previous section, we discussed how these factors have affected the maize and potato seed systems. We take a more incisive look at how the broader political economy has affected the development of a vibrant seed system in Kenya.

6.1. Devolution and coordination

Seed policy development and review is a political process. Its success is achieved if the process is spearheaded by the government agencies. For instance, the 2010 National Seed Policy arose as an initiative spearheaded by the Ministry of Agriculture. The then Agriculture Sector Coordination Unit (ASCU) comprising the permanent secretaries of more than 10 agriculture-related ministries as its steering committee provided a powerful platform for policy development and reviews. Among the policies was the National Seed Policy of 2010. However, following devolution, there seems to be little political will to review the National Seed Policy despite acknowledged recognition of the need for its review following devolution and the need to address concerns that the regulations governing the seed sector are not adequately addressing vegetatively propagated crops. A process of reviewing the policy has been ongoing, but little progress has been made to date.

Instead, MoALF is developing a Seed Master Plan to facilitate implementation of the Big Four Agenda on food security and nutrition, which has identified seed to be critical. The Seed Master Plan is expected to cover targeted crops under the Big Four Agenda. It focuses on the multiplication and distribution of seeds for the targeted crops and counties. This process shows gaps in the horizontal coordination at both the national and county levels but also gaps in the vertical coordination between the national and counties.

In terms of coordination, after devolution ASCU was rendered redundant. Instead, the coordination function is now carried out by the Joint Agriculture Sector Consultation and Cooperation Mechanism (JASCCOM), which is a constitutional body and only works within MoALF. JASCCOM is constrained by bureaucracy and limited to coordinating national government agencies. As a result, there is inadequate coordination between the national and county governments. JASCCOM does not bring the private sector and civil society on board as required by the CAADP process to support the National Agricultural Investment Plan. As a

result, efforts are being made to bring together all key stakeholders to discuss how to structure policy dialogue. The stakeholders have proposed the need to set up a platform for policy dialogue that brings together all stakeholders, including the county governments.

Besides, there is need for proper representation of various stakeholders in the implementation of policies and investment in agriculture, including representation from the national government, county governments, the private sector, and farmers. The government agencies that influence the agriculture sector coordination include MoALF, KEPHIS, KALRO, the Agriculture and Food Authority, the Agricultural Development Corporation, and extension services. The agencies meet on an ad hoc basis as opposed to having organized meetings. An often missing stakeholder in the processes is the farmer—mainly because county governments do not invite farmers to the table while discussing policies, strategies, and regulations. This needs to change, and farmers' voices need to be heard in such forums and platforms.

Until the development of the National Seed Policy (2010), the seed system was governed by the Seeds and Plant Varieties Act (Cap 326), which was revised in 2012. The seeds and plant varieties regulations were revised in 2016. The Plant Protection Act (Cap 324), the Suppression of Noxious Weeds Act, and the National Biosafety Act are yet to be reviewed. It is important to learn more from MoALF about the status and plans for review of seed acts in conformity with the 2010 National Seed Policy. There is also need for the national government to look beyond policy formulation and focus on policy implementation, rather than looking at the number of policies developed as an indicator of progress. In addition, policy review should be done based on the circumstances that prevail.

In 2013, the management of KALRO was decentralized into research institutes. However, it is unclear how KALRO prioritizes its research agenda postdevolution. There is a need to clarify both how research priorities are set following devolution of the agriculture sector and how KALRO research institutes and research centers are working with county governments, especially in aligning research priorities and county government priorities on strengthening seed systems and market development. This is important information because all county governments are required to develop five-year County Integrated Development Plans to guide their investments and implementation plans.

The counties lack the capacity to align their policies/strategies with national policies and strategies and to domesticate the national policies. Data systems are wanting at both the county and national levels. This affects proper planning and implementation of policies and programs. Overall, the national government has the mandate to formulate policies. However, confusion accompanies this mandate because policy development takes a long time and is often inconsistent. Whereas most resources remain with the national government, it is up to counties to implement most of the functions/policies in agriculture.

6.2. Big Four Agenda

Prioritization of maize and potato in the Big Four Agenda, a major presidential political initiative, can help stimulate seed demand and supply in the value chains. The agenda's special focus on increasing maize production through area expansion and productivity improvement presents an opportunity for increased demand for maize seed. The interventions aimed at grain markets would also be useful in indirectly stimulating demand for seed. In potato, the twin strategies of supporting seed multiplication and distribution on the one hand and facilitating establishment of storage facilities for both potato seed and ware can be expected to increase both supply and demand for potato seed. However, there is a need to address the weak coordination between the national and county governments to ensure effective implementation of the Big Four initiatives in the counties. There is also a need to coordinate with seed merchants/companies to ensure that their activities take advantage of the opportunities for seed supply under the agenda and for delivering quality seeds to farmers.

6.3. Extension

Following devolution, public extension services were supposed to be revamped, but it has not happened. In fact, county governments have taken over agricultural training centers, but they have limited resources to manage the centers and increase capacity of farmers and other value chain actors. The issue of how farmers are sensitized and prepared to receive and use new varieties relates to farmers gaining enough capacity to adopt new technologies. This is a responsibility of the national government, yet the extension directorate of the national government is not fulfilling this mandate. The situation raises the question *Why retain an extension directorate at the national level?* One would have expected a small policy unit of extension at the national level. But there is jostling for power. For instance, the national government is holding onto authority over capacity building of counties and farmers without doing it. The Agriculture and Food Authority is in trouble, as there is talk of it and KALRO separating.

Extension should link research between end users on the one hand and policymakers and end users on the other. The existing weak forward and backward linkages result in end users receiving inappropriate technologies and information. At present, extension and advisory services are provided by both the public and private sectors. But for smallholder producers, public extension is very important. Pluralistic extension is a current norm—especially following the expansion of extension and advisory services provided by the private sector and NGOs. However, such extension is project based and may not be sustainable. As well, when the national government ceased providing adequate funds for research, farmers came up with their own innovations, some of which may be suboptimal in performance. Donor funding has driven the research agenda in Kenya. Donors wield financial and political influence in seed development and marketing. For instance, because of inadequate donor funding the multifunctional teams or

compacts of CGIAR are not working. For Kenya, the way forward lies in strengthening the agricultural training centers so that they may train farmers and other actors along the value chains and in strengthening the public research institutions so that they may test and disseminate appropriate technologies.

6.4. Regulations

Policies and regulations are critical drivers of the development, distribution, and farmer uptake of new seed varieties, and hence of the development of seed systems. Facilitative policies and regulations can fast-track seed system development. But policies and regulations can also stymie progress if they are not alive to the realities of the seed sector. Kenya has an elaborate policy and regulatory framework for seed systems governance. The 2010 National Seed Policy, formulated through a process involving wide stakeholder participation, was an important basis for the 2012 amendments to the Seeds and Plant Varieties Act (Cap 326), which now governs the seed sector. There are also the 2016 Seeds Regulations.

Liberalization of the seed sector has expanded private sector participation in the seed business. This is most pronounced in maize, although a government-owned company still controls a disproportionate share of the formal seed market. In potato, private sector investment in seed production is picking up, but government-owned entities are the dominant players in both seed development and multiplication. Because of the dominance of state-owned agencies in seed production for maize and potato, the state's interventions in the maize grain market, and the lack of provision for self-regulation by private seed companies, there is a view among private seed companies, especially in maize, that Kenya's seed sector is not liberalized. In Kenya, the seed industry is not truly liberalized and is highly concentrated. The industry is heavily regulated to the extent of protective controls. But the regulatory agencies dispute this view and cite the sheer number of registered seed companies in Kenya, currently 151 and the most in Africa, as evidence for a conducive policy and regulatory environment in the country for the seed business.

The policies and regulations in Kenya's seed sector do not allow space for the informal seed system, despite that system's importance in supplying seed to farmers, especially for some crops such as potato. The 2010 National Seed Policy recognizes the informal seed system as the major supplier of planting materials to farmers but suggests that it is unable to supply quality planting materials and advocates for converting it into a formal system. Both the Seeds and Plant Varieties Act (Cap 326) and the 2016 Seeds Regulations concern themselves with only the formal seed system.

The formal–informal divide and the lack of recognition of the informal seed system in the regulations seems to create a contest between stakeholders in the potato seed sector who hold the view that QDS can be useful in alleviating the problem of inadequate access to clean planting materials by farmers and those that hold onto the regulations that require mandatory certification for potato seed. The result is that QDS has no space in Kenya's seed system because the

regulations do not allow. The informal systems' sheer size in Kenya's seed sector suggests a need to consider developing guidelines for quality standards and control for the system.

Kenya's seed policy and regulations have been regarded as favoring grains at the expense of addressing the needs of vegetatively propagated crops. For example, seed producers have pointed out that regulatory guidelines for potato seed production through, for example, *in vitro* plants and apical cuttings, are lacking. The legal provision by which the regulator can authorize independent seed inspectors is meant to make seed certification more efficient and chart a path toward self-regulation. But there are two challenges to this initiative. First, the cost of training inspectors is high, which is a challenge to small seed merchants/companies. Second, private seed companies are still reluctant to engage their trained inspectors to inspect their seeds. This is because of victimization of independent seed inspectors by their companies if their seeds fail the inspection, suggesting lack of trust among the parties involved—the regulator, the seed companies, and the independent seed inspectors.

6.5. Financing

That not enough public funds go to Kenya's agriculture sector is not at issue, and because the sector relies heavily on donor funding, including for seed research, development, and production, there are concerns about donors' influence on the research and development agenda. However, foreign governments are shifting their priorities to trade rather than aid, and this is generating forms of collaboration and partnerships that could be useful in stimulating private sector investment in seed. The partnerships between the Dutch and Irish private companies and Kenyan private companies in the potato seed system, brokered by an MOU between the governments of the respective countries, are examples. But such partnerships may be jeopardized if there is a fight between backers of foreign seed and backers of domestic seed, as some stakeholders in the potato seed system allude to.

The view that the funding of seed research and development should not be disproportionately left to donors is valid. The government should be at the forefront of that effort, and it should also fund the bulking/multiplication of seed after variety release for crops whose seed systems are not well developed. As already noted, national seed research is too important to be left to foreigners—this can be dangerous.

7. Conclusions and recommendations

Kenya's seed industry has a well-developed, even elaborate policy and regulatory framework, arising from legal and regulatory reforms pushed through successive agricultural development strategies during the last one and a half decades. However, areas of inadequacy exist in the regulations, especially with regard to addressing the needs of vegetatively propagated crops. Recent agricultural strategies have recognized the role of other food crops, particularly potato, in addition to the traditional maize in food security. The Big Four Agenda and the ASTGS, in

particular, draw attention to the potato seed system, and that is expected to spur investment in potato seed supply and promote development of the system.

7.1. Maize

Kenya's maize seed system is fairly well developed, thanks to long-term government support to the maize sector in general and the seed system in particular and liberalization of the seed industry, which has opened up space for private investment. The market for maize seed has expanded during the last two decades, with seed demand increasing and the number and adoption of improved varieties rising. The number of maize seed merchants/companies have also increased. Nevertheless, state-owned seed companies still control the largest share of Kenya's formal seed market for maize. In addition, varietal turnover on farms is quite low, indicating little commercialization of newer releases and opportunity for investment. Mainstreaming maize yield improvement in counties' development plans in the main maize-growing areas could generate opportunities for expansion of the maize seed market. In addition to subsidized seed, county support to farmers in the form of soil fertility management and fertilizer subsidies could stimulate demand for improved maize varieties, which could offer opportunities for increased investment in seed supply. However, subsidy programs are known to be largely unsustainable and depend on the politics of the time, and thus may not be expected to provide a lasting impetus for maize seed market development.

The Big Four Agenda's prioritization of maize presents an opportunity for maize seed market expansion through demand creation. The agenda's focus on enhancing marketing and storage for grains, area expansion, irrigation, and fertilizer use should both directly and indirectly create demand for seed. That could provide the opportunity to support the growth of small-scale seed companies, and thus expansion of the seed market, and could also contribute to accelerating varietal turnover on farms. However, it would require proper planning and coordination to ensure a supply of seed to meet the potential demand. That calls for greater coordination between the national government (the initiator of the agenda), counties (implementation level of agricultural initiatives), and seed producers and distributors.

The need for a strong research–extension–farmer linkage cannot be ignored if research and technology are to be responsive to farmers' needs. The weak extension system in Kenya implies weak linkage between research and the farmer, and that has in part contributed to many maize seed varieties being produced by research but only a few being adopted by farmers. National and county governments both have a great responsibility to employ an effective extension system to build the capacity of farmers to adopt new technologies. Innovative extension service delivery approaches that bridge the gap between farmers and research are needed.

7.2. Potato

Potato's importance as a staple food in Kenya has only recently been recognized amid dwindling maize production and increased episodes of food shortage, despite its long presence in Kenya. The country had not put much effort into developing the potato seed system, and so it is not as developed as that for maize. But that is changing, as evidenced by the increase in the number of potato varieties introduced in the country in the last decade and the entry of private businesses into potato seed importation and production. Nevertheless, the supply of certified potato seed is far too low relative to the potential demand, indicating opportunities for investment in the seed system.

There seems to be little political will to review 2010's National Seed Policy despite acknowledged recognition of that need following devolution and the need to address whether the regulations governing the seed sector adequately address vegetatively propagated crops. The fact that the government is developing a Seed Master Plan, rather than reviewing the policy in place, to facilitate implementation of the Big Four Agenda on food security and nutrition attests to the difficulty in initiating and fast-tracking a seed policy review.

Devolution has helped create a focus on development of the potato seed system especially in counties where it is an important crop. Furthermore, by promoting the crop as important for food security, counties are helping spur demand for potato seed. However, poor coordination between counties and the national government in distributing potato seed may stifle farmers' access to and adoption of certified potato seed. Lack of coordination of marketing cess and levies among county governments can also impede trade in potato seed across counties and increase the cost of seed to farmers.

Prioritizing the potato value chain and emphasizing seed multiplication/distribution in both the Big Four Agenda and the ASTGS should give a big boost to the development of the potato seed system, given the political context of the Big Four Agenda. But weak coordination between the national and county governments and a lack of transparency in allocation of resources to counties for implementation of the agenda's initiatives may hinder implementation.

The scarcity of certified potato seed, lengthy process of seed production and multiplication, and bilateral negotiations between the Kenyan and foreign governments all have contributed to allowing importation of basic seed for multiplication and germplasm for production of basic and subsequent classes of seeds. However, opposition has emerged regarding importation of foreign potato varieties for multiplication locally. The actors that oppose the idea cite pests and diseases and problems with quality given the different agroecologies in Kenya and Europe, while those that support the idea view the opposition's argument as restricting business. These stances indicate both a contest between domestic and foreign seed and the existence of vast market opportunities in the local potato seed system.

Classifying potato as a scheduled crop whose seed must undergo mandatory certification in the formal system appears insensitive to the reality that the supply of certified potato seed is quite low and that most farmers could not afford such seed even if it were readily available. The suggestion to allow for QDS for potato seems to be reasonable but that would require changing regulations. It is unlikely that such a change would occur in the near term given the argument by some major players in regulation arena that formalizing QDS would work against efforts to control potato pests and diseases. Nevertheless, the need persists to review seed regulations to guide the use of vegetative propagation technologies such as apical cuttings.

Finally, efforts to address, in part, the weak capacity of the regulatory function, specifically related to seed inspection, include changes to the Seeds and Plant Varieties Act (Cap 326) and the 2016 Seeds Regulations to allow for authorization of independent seed inspectors. Although the seed companies advocated for such changes, the use of independent seed inspectors has not been fully embraced. This is because some companies have inadequate capacity to meet the costs of training, certifying, and retaining inspectors, and because among independent inspectors there is a fear that if the seed of a company were to fail the certification process they would be victimized. The latter suggests a lack of trust between the regulator and the seed companies, something to be addressed moving forward.

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