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Partnerships for improved food safety: MESPT's engagements in effective pesticides governance and management in selected counties in Kenya

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Pesticides continue to receive criticism due to their adverse impacts on the environment and human health, a food safety concern emanating from pesticide residues in food and the occupational pesticide exposure risks on farms. This usage has elicited increased attention from policymakers, consumer organizations, and the private and public sectors, pushing the authorities to strengthen pesticide governance and compliance. For instance, the East Africa Community (EAC) has borrowed heavily from the United States and European Union in revising its pesticide standards, which are currently under adoption among the six member states. The Pest Control Products Board (PCPB) in Kenya is at the frontline in the domestication and adoption of the EAC standards by developing new bills and reviewing regulations guiding pesticide usage. Furthermore, with agriculture being a devolved function, counties have woken up and are exploring avenues for promoting the wise use of pesticides. Counties are leveraging partnerships and multi-stakeholder collaboration to efficiently strengthen the pesticide policy-practice nexus. Micro Enterprises Support Program Trust (MESPT), a development organization in Kenya, is closely partnering with and building the capacity of 21 county governments to improve food safety and increase sustainable agricultural productivity through good agricultural practices (GAP) initiatives. This paper reviews the deliberate programmatic interventions by MESPT in facilitating investments within food safety control systems by key sector players. Furthermore, the paper highlights institutional efforts to strengthen farmer organizations to comply with and adapt sustainable agricultural practices that promote the reduced and safe use of pesticides in production. Through MESPT interventions, County Governments have established a functional food safety coordination mechanism and surveillance system backed by legal infrastructure. Additionally, the private sector has been capacitated on food safety compliance, thus influencing smallholder farmers to meet market standards, especially for formal markets. Across the counties, multi-stakeholder collaborations have been strengthened, fueling timely discussions on pesticide compliance toward improved food safety.

KEYWORDS

multi-stakeholders, collaboration, food safety, pesticides, governance

Introduction to food safety

Food and Agriculture Organization (FAO) describes food safety as a science-based discipline, process or action that prevents food from containing substances that could harm a person's health. Driving food safety conversation is critical to human existence—food is the third most basic human need, after air and water. Only when food is safe, can it contribute to our food security and health (FAO, 2019). According to WHO (2022), food safety, security, and nutrition are inextricably linked. Walls et al. (2019) emphasize that the trio are not only compatible but complementary in principle, with important synergies between them in terms of their impact on population health outcomes. Food safety aims to have food that is safe for consumption; healthy nutrition is about the nutritional quality of food/diets. In contrast, food security encompasses both food safety and healthy nutrition, as well as a wider set of concerns related to food availability, access, utilization and stability.

Food safety, security and nutrition are thus key parameters in building healthier and more sustainable food systems, enabling countries to meet their Sustainable Development Goals (SDGs) targets by ensuring sufficient and good health for the increasing global population (Munirah and Norfarizan-Hanoon, 2022; Vipham et al., 2020). From global to regional scale, food safety concerns have emanated primarily from the cumulative demand for food, which continues to skyrocket due to the unsustainable food production (inputs), transportation, storage and preparation amidst prevailing impacts of climate change and pest/parasites and diseases (Tilman et al., 2011).

Globally, food safety is very important and has strong public health and socioeconomic impacts. Every year, an estimated 600 million people worldwide (nearly one out of 10) fall ill due to food related contaminations resulting in upto 420,000 deaths. In low- and middle-income countries, food safety crisis results in US\$ 110 billion in lost productivity and medical expenses, with children under 5 years old bearing 40% of the burden, leading to 125,000 deaths annually (World Health Organization, 2024). Consequently, countries across the globe face significant financial implications in maintaining acceptable levels of food safety to protect their citizens (Focker and van der Fels-Klerx, 2020). According to Spalding et al. (2023), these translate negatively to the growth of economies. Thus, Food safety is among the major hindrances to development in developed and under-developed countries. This has been attributed to by the related costs in testing, surveillance, and treatment, among other unquantified effects on trade (through markets, causing destruction of edible products, shaking consumer confidence, and imposing economic losses upon participants across the implicated supply chain). For instance, WHO estimates indicate that the United States loses over 5 billion dollars because of food safety issues, especially foodborne diseases (WHO, 2015).

Bukachi et al. (2021), referring to the World Health Organization (WHO) statistics, reported that the food safety burden is highly pronounced in undeveloped countries, with Africa reporting more cases of deaths and hospitalization. Key food safety concerns in Africa, alongside other low-to-medium developing countries, include pesticides, fertilizers, food hygiene handling and household storage/food preservation (Liguori et al., 2022). Among these food safety concerns, pesticides are increasingly gaining

attention due to their devastating long-term impacts on human health and environmental health, which present themselves over the short and long term (Marete et al., 2021).

Pesticides and food safety

Food security ranks among the top agenda for every nation. However, food security progress is marred by climate change, environmental degradation, increasing population, and unsustainable agricultural practices, which translate into unsustainable global food systems (FAO, 2022). In the face of these unprecedented challenges, food systems actors have re-focused their actions on food security, creating opportunities and challenges for food safety. The prevailing challenges have exerted more pressure on producers, input suppliers, food manufacturers and processors to ensure food safety, prevent food waste and loss, preventing food contamination (Onyeka Kingsley and Ayibapreye, 2022). Pests, parasites, and disease control are inevitable to increasing agricultural productivity, thus paving the way for the use of agrochemicals (in the pre- and post-harvest stages), including pesticides.

The World Health Organization (WHO, 2010a) defines pesticides as substances or mixtures of substances used to prevent, destroy, or control pests that may cause harm during the production, processing, storage, transport, or marketing of foods and other agricultural commodities. The definition appreciates pesticide as an umbrella term housing referring to insecticides, herbicides, fungicides, animal repellents (including rodenticides and miticides), antimicrobial substances, and other growth regulators.

Worldwide, pesticides have gained entrance into farmlands due to their effectiveness in controlling pests and plant diseases, thus preventing crop losses, increasing crop yields, and maintaining product quality. They have also been useful in saving the production cost of agricultural products and in controlling other organisms that could harm human activities and structures, such as wooden structures (Antonini and Argilés-Bosch, 2017).

Current statistics indicate that South and North America are the giant consumers of pesticides, representing more than half of the agricultural pesticide consumption worldwide, followed by Asia and Europe, taking approximated shares of 27.7 and 14.3%, respectively. Pesticide consumption in Africa and Oceania combined remains low, accounting for <8% of the world's total pesticides (Robu et al., 2023). Rajmohan et al. (2020) describe pesticide usage as substantial, widespread, and continues to grow all over the world, with an estimated annual volume of more than two (2) million tons being applied globally to increase productivity through improved plant health in terms of insect pests and diseases control and reduce losses due to improved produce storage.

Pesticides usage and safety in Kenya

Kenya is among the countries located within the tropics of Sub-Saharan Africa. It is highly impacted by climate change, with the impacts on crop production and agricultural pests “running-off-the-mill” (Stefanovic et al., 2019). Agriculture is the main economic

activity, contributing up to 30% of the national gross domestic product GDP (Nyoro, 2019). The sector employs more than 40% of the total population and more than 70% of Kenya's rural people (Kilelu et al., 2019).

Kenya's agricultural landscape is extensive, ranging from high-input to low-input crops, subsistence farming and livestock production across diverse climatic conditions. These geographical landscapes present unique farming challenges and opportunities that have extensively increased the scope and application of pesticides over time (Odino and Ogada, 2021). With the staple crop corn, the country is also experiencing crop diversification to high-value crops such as export vegetables and fruits.

Under the changing climatic regimes (floods and droughts), crop production cycles and yields are heavily changing. Climate change has also altered life cycles of invasive insects/pests which negatively impacts agriculture. Skendžić et al. (2021) state that climate change has increased the risk of invasive insect species and insect-transmitted plant diseases. It has also altered the interaction of pests, host plants and natural enemies. As climate change persists within the tropics, there has been increased pest breakout such as Fall armyworm (*Spodoptera frugiperda*), False Codling Moth (FCM) (*Thaumatotibia (Cryptophlebia) leucotreta*, Desert Locust (*Schistocerca gregaria*) among others. This pest breakout calls for measures to heighten pest management strategies, including pesticide application (Ngolo et al., 2018).

According to Sarkar et al. (2021), pesticides have been relied upon to control pests for purposes of preventing agricultural losses. They have provided one way to increase agricultural yields; most farmers in Kenya consider pesticide usage the best way to protect their crops against pests and diseases. Pesticide use in Kenya has thus significantly contributed to the national food security. However, this has been a "blessing in disguise" as it continues to elicit fierce debate due to the high potential of pesticides to cause harm to human and environmental health.

Research has documented evidence that pesticides and pesticide residues cause long-term severe negative effects on human health and the environment. Negative impacts of pesticides include, but are not limited to, the following: impairment of human and animal health, contamination of surface and groundwater, pest resistance and resurgences, loss of biodiversity in soils and reduced microbial activities, elevated toxicity in food, water and air, reduction in natural enemy populations, and damage to fisheries, fauna, and flora (Macharia et al., 2013).

The impacts of pesticide use in Kenya are increasingly becoming more pronounced due to the wide knowledge gap on exposure routes to pesticide toxicity (Obonyo, 2017). Intensified negative impacts of pesticides on humans and the environment are also a factor of low knowledge between users and the safety practices, which includes the proper use of equipment/personal protective equipment (PPEs) (Yang et al., 2014). Inadequate extension services to sensitize the public on pesticide handling and disposal greatly contribute to human poisoning and environmental contamination (Tsimbiri et al., 2015).

In Kenya, farmers have greater access to pesticides, a case which applies to both large-scale commercial growers and smallholder farmers who dominate the agricultural sector (Sheahan and Barrett, 2017). According to Macharia et al. (2013), pesticide handling

practices relate positively to a strong bearing on the exposure and toxicity of active ingredients, usually as a result of inappropriate handling of pesticides, often due to deviation from recommended application and handling procedures.

Pesticide governance and regulation

Intensified pesticide usage across the globe calls for proper governance and regulation. This is an attempt to ensure controlled pesticide application and disposal and prevents pesticide abuse to protect human health and minimize environmental pollution/contaminations (Udeigwe et al., 2015). State agencies/regulatory bodies and national authorities take responsibility for controlling and enforcing maximum residue limits (MRLs) for pesticide residues. Hyder et al. (2010) define Maximum Residue Levels (MRLs) as trading standards that represent the maximum residue that could be found if pesticides are applied according to critical good agricultural practice (cGMP). Foodstuffs are monitored for MRL compliance, and exceedance can have economic, social and political consequences. The MRLs values have been set (though conclusive as they vary from region to region) by the Codex Alimentarius Commission (Codex) and Joint Meeting of the Food and Agriculture Organization of the United Nations (FAO) Panel of Experts on Pesticide Residues in Food and Environment and the World Health Organization (WHO) Core Assessment Group on Pesticide Residues (JMPPR) (Yamada, 2017).

Developed nations have exceptionally functional governance systems with more stringent regulations compared to the developing countries. According to Zikankuba et al. (2019), developing nations lack expertise, commitment, resources, and readiness to enforce legislation on pesticide residues. The "sad state of affairs" in developing countries is worsened by the failure to have a pesticide registry system, culminating in the importation/entry of highly toxic and illegal pesticides (Handford et al., 2015).

Pesticide governance in Kenya

Cases of importation of harmful pesticides and pesticides ingredients in Kenya have been on the rise. These includes pesticide compounds that has been banned and are under stringent observation within the European Union (PCPB, 2018). This is amidst the evidence that these products pose serious and long-term risks to human health and the environment (Ottiger et al., 2019; Sarkar et al., 2021). The most imported active ingredients include Glyphosate and its salts, Imidacloprid and Mancozeb. Onyando et al. (2023) refers to these ingredients as "highly hazardous pesticides" (HHP) as classified by the Pesticide Action Network (PAN). HHPs are either acutely toxic, have long-term toxic effects, are endocrine disruptors, pose a threat to the environment, or are known to cause a high incidence of severe or irreversible adverse effects (Ottiger et al., 2019).

In the country, major cases of pesticide fraud have been manifested through counterfeiting, mislabelling and substitution, with greed for money driving the business (Chukwugozie et al., 2024). Pesticide contamination, alongside its adverse effects on the natural environment, has manifested in food safety, contamination

of water resources, soils, and air, and impact on diversity (non-target organisms), thus making Kenyan food systems unsustainable (Odino and Ogada, 2021; Alavanja et al., 2013; Marete et al., 2021). Pesticide governance is thus key in providing oversight for judicious use of pesticides through registration of products into the country, licensing of actors, enacting laws for regulating pesticide usage and encouraging development and adoption of pest management practices such as organic pesticides, Integrated Pest Management IPM among others (Yanga et al., 2018).

In Kenya, since 1982, the Pest Control Products Board (PCPB) has effectively offered efficient regulatory service for the importation, exportation, manufacture, distribution, transportation, sale, disposal and safe use of pest control products and mitigate potential harmful effects on the environment (KOAN, 2020). According to Expert Taskforce (2021), Kenya's efforts are in accordance with the international code of conduct on the distribution and use of pesticides championed by the Food and Agriculture Organization (FAO) and the United Nations (UN) to address the impacts of uncontrolled use of pesticides.

PCPB facilitates inspection of actors, capacity development of a human resource to better execute its mandate, registration of new pesticides/products into the country, revision of acts and ensure enforcement to reduce environmental contamination, monitoring the integrity of existing pesticides and pesticide products in the market and encouraging stakeholders in the pesticides industry to have codes of practice. This is in accordance with adopted regional standards articulated in the East Africa Community (EAC) as well as aligned to the United States and European Union (PCPB, 2022) as an adherence requirement to the International Conventions that Kenya is a signatory to such as the United Nation Environment Program, UNEP (Lalah et al., 2022).

While considerable efforts to ensure the judicious use of pesticides have been instituted by PCPB, a monitoring report by Marete et al. (2021) cites a handful of drawbacks to pesticide usage in Kenya. According to KOAN (2020), there exist high cases of pesticide misuse and mishandling among value chain actors. Cases of illegal importation occasioned by porous geographical boundaries, occupational exposure, environmental contamination concerns of soils and water quality and increasing criticism from consumers for fear of human health impacts resulting from food contamination with pesticide residues (KOAN, 2020).

Micro Enterprises Support Program Trust (MESPT)

MESPT is a development organization that aims to grow smallholder farmers and Agri SMEs to increase productivity and income and enhance competitiveness for job creation, especially for youth and women (<https://mespt.org/>). This is achieved through capacity building, which includes skills development, technical assistance, business advisory, and financial and market linkages. MESPT has implemented its mandate through two key segments: value chain and enterprise development (VC&ED) and financial services (FS). VC&ED have focused on market systems development and green transformation. At the same time, financial services have been geared toward wholesale lending and technical assistance of financial intermediaries with an emphasis

on creating financial inclusion for marginalized groups, especially youth and women.

Dedicated to driving sustainable livelihoods and economic growth of MSMEs; MESPT's objective is achieved through inclusive green growth and agri enterprise development, enhanced access to sustainable agri-finance for MSMEs' investments, green transformation for reduced environmental externalities and effects of climate change, and working toward increased sustainable agricultural productivity and improved food safety among MSMEs.

MESPT's current interventions are felt across twenty-eight (28) counties within the Kenyan republic, out of which twenty-one (21) counties are direct beneficiaries of MESPT's programmatic outreach working with smallholder farmers. The additional six (6) counties primarily focus on access to finance through financial service intermediaries. The twenty-one (21) counties focusing on programmatic interventions are geographically characterized into economic blocks (as captured in Figure 1), which include:

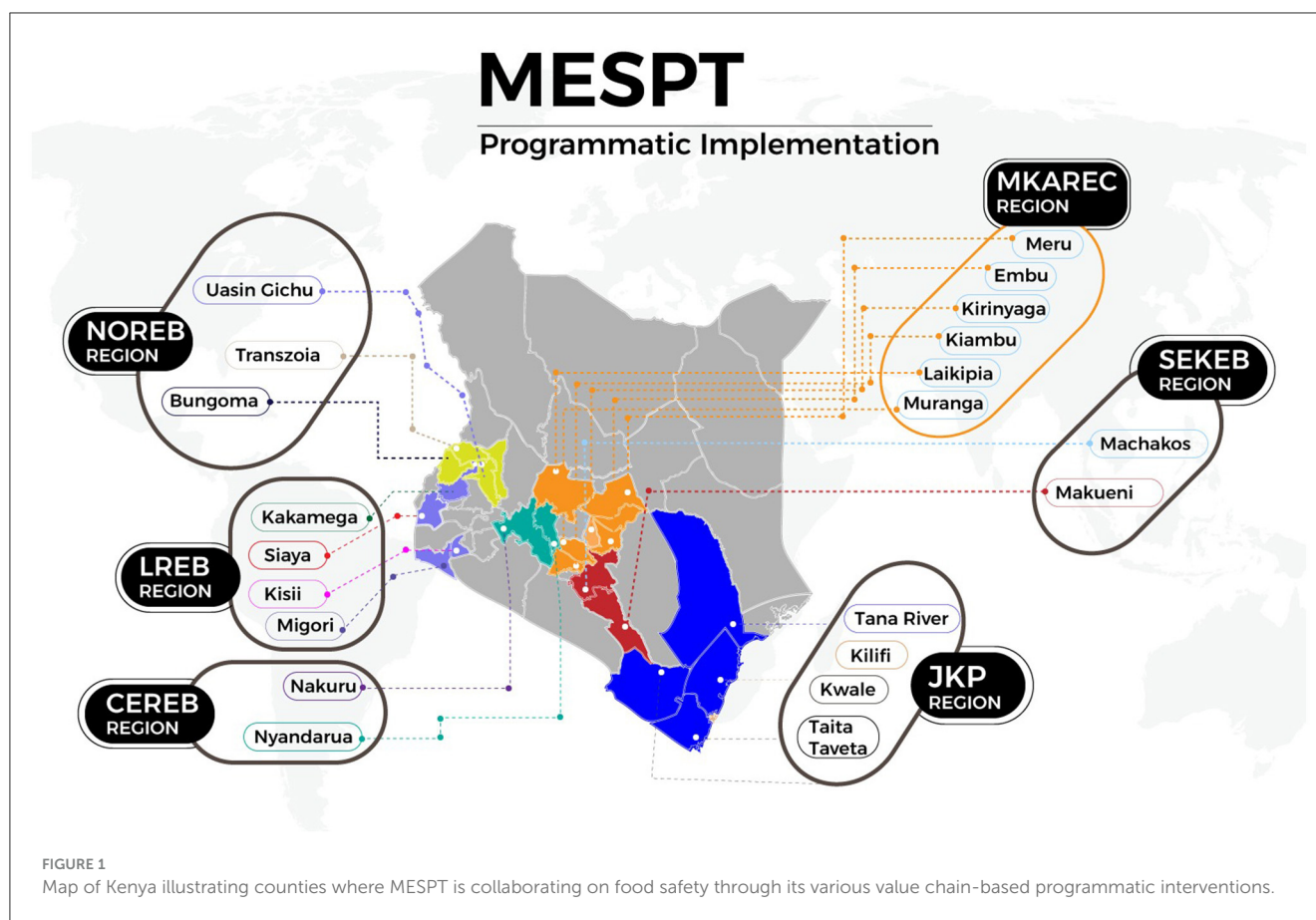
- i. North Rift Economic Block (NOREB) encompasses the Bungoma, Trans Nzoia and Uasin Gishu counties.
- ii. Lake Region Economic Block (LREB) encompasses the Migori, Kisii, Siaya and Kakamega counties.
- iii. Central Region Economic Block (CEREB) encompassing the Nakuru and Nyandarua counties.
- iv. Mount Kenya and Aberdares Region Economic Block (MKAREC) encompasses Laikipia, Muranga, Meru, Embu, Kirinyaga, and Kiambu.
- v. South-Eastern Kenya Economic Block (SEKEB) encompassing the Machakos and Makueni counties.
- vi. Jumuia ya Kaunti za Pwani (JKP) (with English translation of; counties along the Kenyan Coast) encompassing the Taita Taveta, Kilifi, Kwale and Tana River.

Over time, MESPT's programmatic interventions have focused on facilitating investments in food safety control system. This has been concentrated among the key sectoral players while strengthening farmer/producer organizations to ensure compliance and adoption of sustainable agricultural practices advocating for safe use of, and reduction of pesticides in production.

Multi-sectoral collaborations in pesticides governance and management in Kenya

Globally, monitoring efforts toward minimizing the risks arising from pesticide use remain complex. Pesticide products are toxicologically diverse, with varied risk levels depending on the circumstances under which non-target organisms are exposed to pesticides (Kumar et al., 2023). These calls for a proper risk management plan backed by policies through enforcement paving the way for restrictions on accessibility to the "highly hazardous pesticides" (HHPs) to reduce poisoning cases (Lalah et al., 2022).

According to WHO (2010b), Kenya could better strengthen pesticide governance through multi-stakeholder partnerships and collaborations. The methodology offers coordinated approaches and opportunities toward improving agricultural health and safety and cultivating strong research and policy programs by



bridging underlying gaps in research and policy. This could be better achieved through borrowing from other countries and implementing strategies highlighted in the East African Community regional strategy on pesticide products.

MESPT approaches on food safety

MESPT's strategic pillar on improving food safety and sustainable agricultural productivity by MSMEs entrenches efforts such as food safety compliance and policy dialogues. This is achieved through enabling food safety standards and requirements within the partnering counties as well as capacity development initiatives for smallholder farmer knowledge and adherence. This is achieved through various programmatic interventions, which so far have been pronounced in the 21 counties. These include Machakos, Makeni, Tana River, Laikipia, Muranga, Kilifi, Kwale, Taita Taveta, Meru, Embu, Kirinyaga, Kiambu, Uasin Gishu, Trans Nzoia, Bungoma, Kakamega, Siaya, Kisii, Migori, Nakuru and Nyandarua within the republic of Kenya. Donors and partners fund the initiatives, including DANIDA, The European Union, The Nature Conservancy, and the Netherlands Ministry of Foreign Affairs. The list of MESPT programs includes the Green Employment in Agriculture Program (GEAP), the Agriculture Finance Initiative (AgriFI), the Danida Market-led Development Program (DMDP), The Central Highlands Ecosystems Food Scapes (CHEF) and the Challenge Fund for Youth Employment (CFYE).

Impacts of MESPT interventions across counties

MESPT's food safety interventions across the counties have been phenomenal, driving sector-wide approaches that are intentional in addressing systemic challenges. Toward sustainability, MESPT's efforts in driving multi-stakeholder collaborations through key actors: SMEs, producer groups, County Governments and other service providers have fostered synergies toward an effective facilitative environment guiding pesticide governance and usage in the counties. These have been achieved through capacity development of National and County governments, championing a private sector-led approach in pesticide management across the counties, capacity building for increased compliance among the producer groups, collaborating with umbrella bodies and associations and working through academia and research Institutions. These have had tangible impacts on farmer's knowledge (impacting up to 150,000 farmers) (<https://mespt.org/>).

Capacity development of national and county governments

MESPT programmatic interventions employ a deliberate approach to work closely with the Ministry of Health (MoH) at the national level. This is done alongside the major central competent

authorities in charge of food safety. These include the Pest Control Products Board (PCPB), Horticultural Crops Directorate Authority (HCDA), Kenya Plant Health Inspectorate Services (KEPHIS), Kenya Dairy Board (KDB), Kenya Fisheries Services (KeFS), Kenya Bureau of Standards (KeBS), and Technical Vocational Education and Training Authority (TVETA) (<https://nation.africa/kenya/brand-book/mespt-agrifi-programme-and-food-safety-342995>).

Capacity-building initiatives have enabled county governments to establish food safety control systems with functional structures, such as County Food Safety Coordination Committees (CFSCC), where technical teams are strengthened on matters of surveillance and champion policy guidelines for informed decision-making. The technical teams have been instrumental in pushing the legislative agenda, which has yielded to the drafting of food safety policies and bills as foundation documents with the potential of addressing pesticide use concerns in the respective counties (<https://www.kenyanews.go.ke/county-unveils-a-food-safety-coordinating-committee/>).

The central competent authorities (CCAs) have been in charge of training and building the capacity of the CFSCC to increase their preparedness in handling food safety cases. These include developing terms of reference guiding the committees. This is to enable committees to address and coordinate food and feed safety concerns within their jurisdiction. Furthermore, the CCAs have consistently backed up the efforts of CFSCC and strengthened structures through training on the ten (10) principles of inspection. The 10 principles of inspections are a set of principles developed with assistance from DANIDA to help enhance inspection among and across multiple regulatory agencies and foster cooperation and coordination with the aim of enhancing the risk-based approach to inspection, thus increasing the efficiency and effectiveness of Kenya's inspection system.

Toward sustainability of CFSCCs, MESPT has been deliberate on linking county committees to the national level initiatives for learning and for coordination at both the county and national level, efforts which eased the drafting of legislations pushing for reforms on food safety through efforts such as The Food & Feed Safety Control Coordination Bill 2023 (GOK, 2023) (<http://www.parliament.go.ke/node/19892>).

Championing private sector-led approach in pesticide management across the counties

The private sector has been at forefront in promoting high-value export crops, mainly fruits and vegetables. MESPT's collaboration with the private sector has strengthened efforts toward sustainable pesticide use and safety (<https://nation.africa/kenya/brand-book/mespt-agrifi-programme-and-food-safety-3429954>). Capacity building through technical assistance on setting up measures such as quality management systems (QMS), Traceability, Standard Operating procedures (SOPs), Self-Assessment guides (SAGs), and compliance audits are among the measures MESPT has been deployed to support initiatives by the private sector. Through program support, MESPT has facilitated market access through the private sector's exposure to

attend global events taping on markets that promote food safety. These standards include but are not limited to GlobalGAP, Fair Trade, and organic labels, which promote the safe use of pesticides through defined certification systems (<https://nation.africa/kenya/brand-book/mespt-towards-self-reliant-agri-food-value-chains-kenya-3455254>).

Increasing compliance among the producer groups

Through market linkage interventions, MESPT has activated a facilitative environment enabling the private sector to link and collaborate with the niche of smallholder farmers producing for targeted markets (<https://nation.africa/kenya/brand-book/strengthening-food-safety-systems-across-kenya-598566>). Thus, the private sector has been a key agent championing market standards with which smallholder farmers must comply. MESPT often supports interventions such as good agricultural practices (GAP) training and certification to ensure farmers' compliance. Among the commonly pursued certification schemes are GlobalGAP, Fair Trade, and Rainforest Alliance, which target international markets. The programs also support local certification, such as Kenya Bureau of Standards (KeBS), Kenya Dairy Board (KDB), Kenya Plant Health Inspectorate Services (KEPHIS) and Kenya Standards, KS-1758, for purposes of internal compliance safeguarding consumers on safe food.

Training programs toward building the resilience of smallholder farmers

MESPT interventions at the farmer level are heavily informed by the non-compliance level on pesticide use, which remains a major risk to human health and the environment (Momanayi et al., 2019). This is alongside other socioeconomic challenges, as highlighted by Muriithi et al. (2018), where resources limit households in making informed decisions on approved pesticide purchases. Furthermore, limited knowledge of pesticide usage and safety among smallholder farmers calls for the need to break the gender barriers in pesticide management and governance (Kurui et al., 2014; Tsimbiri et al., 2015). MESPT interventions, therefore, aim to increase the pesticide knowledge base, thus building the resilience of smallholder farmers on sustainable pesticide usage. MESPT has supported capacity-building initiatives through training programs driving farmers toward sustainable production through safe farming practices, accountable use of pesticides and food safety through Good Agricultural Practices (GAP) while leveraging on nature-based solutions including integrated Pest Management (IPM) (<https://nation.africa/kenya/brand-book/strengthening-food-safety-systems-across-kenya-598566>). MESPT has trained 49,506 smallholder farmers across the 4 GAP and Food safety programs cumulatively from Jan 2021 to June 2024. The programs' models driving this objective include training on:

i. Improved productivity and food safety: On-farm training involving sizeable farmers groups who have been trained on good agricultural practices (GAP). This has been facilitated through

sustainable agriculture programs such as Climate Smart Agriculture (CSA) and Regenerative Agriculture (RA), which promote the judicious application of agrochemicals on farms to protect and regenerate nature.

ii. Agricultural technical vocational education and training (ATVET) model training: MESPT, through the AgriFI program, has partnered with 13 counties to promote skill-based training within the agriculture sector. ATVET model aims to build knowledge, skills and attitudes (worker behavior) within the agriculture sector. Through the competency-based curricula, trainees will be impacted with food safety knowledge while improving skills and attitudes to produce safe food for human consumption while conserving the environment through the safe use of pesticides.

iii. Food safety champions and Spray service provision training: Across the programs, MESPT intentionally builds sector-specific skills on food safety in “261 champions” who have been trained on the broad food safety curriculum specific to dairy, aquaculture, export vegetables, mangos, and avocado value chains. Furthermore, through a partnership with PCPB and AAK, MESPT has trained up to 400 spray service providers (SSPs) who have been attached to producer groups.

Leveraging food safety champions and spray service providers is a last-mile approach to strengthening pesticide safety within the producer groups. Through these cohorts, there has been reduced usage of toxic pesticides, increased knowledge on product toxicity, thus strengthened observance of the preharvest interval (PHI), proper use of personal protective equipment (PPEs), and increased pesticide handling procedures among farmers. Training has also increased farmers knowledge on proper disposal of unused products and pesticides containers safeguarding the environment and bio-diversity such as pollinators (<https://blog.plantwise.org/2023/10/12/empowering-smallholder-farmers-in-kenya-to-produce-sustainable-safe-food/>). Ensuring the sustainability of this model, the institution is further strengthening this cadre of leaders into business service providers (BSPs). This is to increase competencies in the provision of these services as a business, thus creating an avenue for job creation as well as translating into job creation.

Collaborating with umbrella bodies and associations

Targeted partnerships with umbrella bodies such as the Agrochemical Association of Kenya (AAK), Fresh Produce Consortium of Kenya (FPC Kenya), Fresh Produce Exporters Association of Kenya (FPEAK), Kenya Livestock Producers Association (KALPA), Kenya Poultry Farmers Association (KEPOFA), Kenya National Chamber of Commerce and Industry (KNCCI), Root and tubers technical working group, Mango technical working group, Hybrid Coconut Technical Committee, Agriculture Sector Network (ASNET) and Society of Crops Agribusiness Advisors of Kenya (SOCCA) has championed advocacy on food safety. This has been done through campaigns enlightening the general public on food safety concerns in relation to pesticides (<https://nation.africa/kenya/brand-book/strengthening-food-safety-systems-across-kenya-598566>). These efforts have increased food safety knowledge

among the producers' groups and the private sector. The public has been trained on how to access updated information on pesticides and detect counterfeit and generic pesticides. Through concerted efforts of platforms including the County Food Safety Coordination Committees (CFSCC), media conversation/talks on Food safety, and World Food Safety Day, the public is now becoming aware of pesticides associated risks to human health, biodiversity, contamination/pollution of natural ecosystem as well as the economic connotation. These avenues have increased campaigns pushing national authorities to heighten measures on pesticide safety traceability systems to safeguard consumers. Furthermore, food business operators (FBOs) and consumers are now making informed decisions by taking responsibility for table-safe food, safeguarding safe procurement, and abiding by safe food preparation guidelines.

Working through academia and research institutions

MESPT has collaborated with academia and research institutions such as Egerton University, Pwani University Kenya Agricultural and Livestock Research Organization (KALRO), Nairobi University, Center for Agriculture and Bioscience International (CABI), African Center for Technology Studies (ACTS), among others. Demand-driven research, adoption and upscaling solutions and innovations around organic farming, integrated pest management (IPM), and organic pesticides (Njenga et al., 2023), as well as making data available, have been critical to the efforts toward safe use of pesticides. Through these collaborations, MESPT has influenced value chain development, including pineapples (Muti et al., 2024), poultry (Mutua, 2018), and mango (Muthini, 2015), among others.

Conclusions and recommendations

Despite their economic importance in food production, pesticides have irreversible adverse health effects on humans, biodiversity and the environment. The need for safe and responsible use of pesticides and adhering to proper disposal guidelines stipulated by regulatory authorities must be balanced. Pesticide governance is, therefore, critical in controlling the importation/entry of pesticide products. It also promotes judicious management, driving inclusive regulations while promoting sufficient knowledge dissemination to actors and stakeholders on practices such as good agricultural practices (GAP) and various food safety initiatives to promote safe food production.

In Kenya, authorities at national and county levels need to ensure legal compliance at all stages of food production. This will be achieved through a pesticide registry system and robust monitoring of generic, counterfeit and illegal pesticide ingredients guided by PCPB. This encompasses compliance on maximum residue limits (MRLs) adopted from Codex limits or that of the importing country, controlled imports and observance of substances banned within the European Union (EU) and strengthening research and extension in disciplines of Organic farming, agroecology and integrated pest management (IPM).

Strengthening pesticide governance and management efforts in Kenya means leveraging partnerships and multi-stakeholder collaboration at national and county levels. Strengthened collaborations among government, stakeholders, researchers, smallholder farmers, consumer organizations, and other like-minded partners have enhanced expertise, increased commitment, and increased investments in research and development. They have mobilized resources, activated strong forces for sharing data and information, and strengthened the pesticides-policy-practice nexus.

Author contributions

AA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. GN: Conceptualization, Funding acquisition, Investigation, Resources, Supervision, Validation, Writing – review & editing. DK: Conceptualization, Formal analysis, Funding acquisition, Resources, Supervision, Validation, Writing – review & editing. RA: Conceptualization, Funding acquisition, Resources, Supervision, Validation, Visualization, Writing – review & editing.

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Conflict of interest

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