Linkages Between Agricultural Extension Policies and Nutrition Outcomes

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Bringing Rigour and Evidence to Economic Policy Making in Africa

Linkages Between Agricultural Extension Policies and Nutrition Outcomes

By

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1. Introduction and background

The important role agriculture plays in African economies and livelihoods, and the strong linkages that agriculture forges with other sectors, cannot be overemphasized. Promoting agricultural growth spurs economic development in upstream and downstream subsectors (NEPAD, 2013). Agricultural performance, through its direct impact on job creation and increasing opportunities, especially for women and the youth, food security and improved nutrition, and strengthening resilience, is key to growth and poverty reduction in Africa.

Since 2016, the African Economic Research Consortium (AERC) has implemented several activities under the "Analysis of the Impact of Agricultural, Food and Nutrition Policies on Nutrition Outcomes in Africa" (AFPON) project by exploring the link between agricultural policies and nutrition outcomes in Africa.

The AFPON project, on one part, sought to analyse how agricultural productivity, agricultural extension and advisory services affect nutrition outcomes in order to establish policies and practices that would improve food security and nutritional status. Several papers on agricultural extension policies were produced in the course of the project's implementation. In this paper, a review and synthesis of AFPON research papers on the linkages between agricultural extension policies and nutritional outcomes are provided in order to understand the linkages between, and the impact of, agricultural extension policies on nutrition outcomes.

In this paper, we examine the available literature on agriculture, nutrition and health linkages, delineate the agricultural extension policy and nutrition outcome nexus, and provide empirical evidence informed by the AFPON research outputs. We undertake a synthesis of the AFPON research outputs by examining whether the agricultural extension-(policy)-nutrition outcomes nexus has been empirically deduced. The paper finally presents agricultural policy implications for addressing the challenges associated with malnutrition in sub-Saharan Africa (SSA).

2. Agriculture, nutrition and health

The World Bank (2007) provides different pathways that link agriculture to nutrition: (a) production for own consumption that could enhance nutritional status, especially for children, through better dietary intake; (b) increased market orientation towards increased surplus sales for income, influencing household health; (c) women's empowerment towards augmenting better child nutrition; (d) terms of trade that favour agriculture; and (e) growth acceleration in agriculture (Balaji et al., 2017).

Hoddinott (2011) conceptualizes the complex linkage that may exist between agriculture, nutrition and health through three components: settings (physical, social, legal and governance); resources (time and capital); and the processes (links between health status and agriculture are bidirectional as choices made in agricultural production affect health and vice versa) associated with such linkages that strengthen the links, which require a means of understanding their non-linear complexities.

The linkages between agriculture, nutrition and health have been explored in an attempt to explain the mutual dependence among these factors. As a result, several direct and indirect frameworks/pathways have been developed. First, the direct link between improved nutrition and agriculture (crop and livestock ownership) could be through own consumption (crop, meat, milk and egg consumption). Second, the indirect effect is crop and livestock ownership through improved income on nutrition. Policies that drive agricultural productivity and growth are therefore linked to nutrition and health through agricultural product consumption in much more complex ways, with women as the central mediators of the pathway from agriculture to nutritional outcomes (Ruel & Alderman, 2013).

However, agricultural policy plays a critical role in guiding structural transformation that helps realize multiple goals, including: (a) affordability and availability of a diverse, low-priced food supply through better food provision, which is ensured by increasing the productivity of agriculture and expanding the diversity in crop/livestock through innovative technologies and knowledge (Pawlak & Kolodziejczak, 2016); (b) a safe diet of high quality where agriculture ensures food and nutrition security (United Nations, 2010); (c) rural income growth, by increasing households' purchasing power through integration with markets that offload farm household surpluses as a means to eliminate poverty and improve food security (Hoddinott, 2011); and (d) time savings of a highly constrained population, especially vulnerable groups like women and children (Kadiyala et al., 2014) through increasing their human capital, which can be achieved by improving the wellbeing and nutrition of rural women and their families and freeing up time for women of all ages. The saved time gives women more opportunities to participate in development and decision making (IFAD, 2016).

3. Agricultural extension policies and nutrition outcome linkages

Hoddinott (2011) posits that the levers affecting agricultural production and markets affect health and nutrition through six pathways: (a) changes to incomes, as changes in agricultural production lead to increases in household income used to purchase goods that affect health status; (b) changes in crops, farm practices and markets that result in the introduction of new foods into diets at the farm level as a result of introducing innovations; (c) changes in the types of crops that are grown or changes in production processes/methods; (d) changes to the use of time that increases the returns to time spent in agriculture by households' use of labour; (e) changes in agricultural production resulting in higher incomes, and individuals and households saving some of these higher incomes in the form of assets that improve health; and (f) changes in intra-household resource allocation, where women earning greater incomes may affect how households spend money, how food is allocated and what types of assets are accumulated.

The changes stated by Hoddinott (2011) call for agricultural transformation to impact on household technology adoption in new crop and livestock varieties and production practices, and empowering women in agricultural households to provide an opportunity to improve the productivity and diversity of agricultural production as well as the income of households, and through the availability and consumption of nutritious food and addressing the issue of malnutrition. At the smallholder farmer level, agricultural extension provides the application of scientific knowledge of agronomic techniques and skills to change farm productivity, food security and livelihoods for the better. It is about sharing scientific findings and know-how with farmers and helping them capture a greater share of the value chain (CTA, 2011).

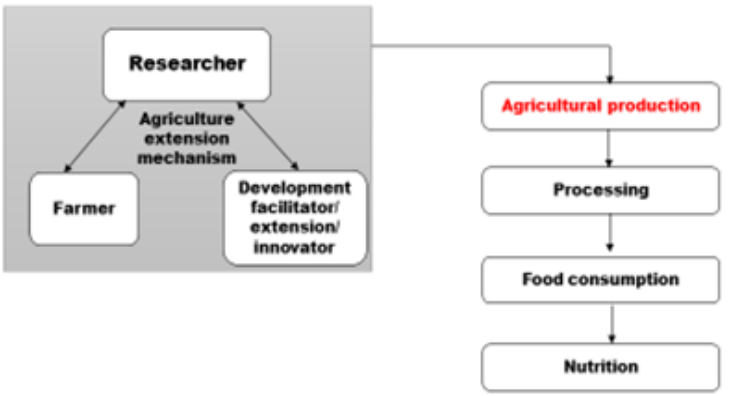
Agricultural extension policies in Africa are an integral part of agricultural and rural development policy, in particular, and with agriculture driving most African economies, have been a driver of national development and poverty reduction policies in general. Agricultural extension is a critical input to promoting agricultural production and plays a critical role in boosting agricultural productivity, thereby increasing food security and improving rural livelihoods. Agricultural extension is the main vehicle through which governments stimulate agricultural and rural development. Broadly, agricultural extension is the promotion of the entire sustainable farming system in agricultural and rural development. This narrow focus has mainly been on promoting food, cash crops and animal production. The scope of agricultural extension policies

in Africa, therefore, is to coordinate the interactions between research, farmers and agricultural advisory service agents in the dissemination of new and appropriate farm technologies in inputs, facilitating access to credit and marketing effectiveness, and ensuring livelihood diversity.

In Figure 1 we delineate a stylized linkage between agricultural extension mechanisms and agricultural productivity and nutrition outcomes. Through farming systems research and/or farmer participation research, different participatory approaches and processes have been developed in the internalization of farm technology or in the transfer of technologies to farmers, all aimed at improving agricultural production/productivity. In particular, research institutions, non-governmental organizations (NGOs) and a number of corporate social investment entities have participated in the generation of new and appropriate farm information and, either directly or through government extension workers, disseminated this information to farm households. Therefore, agricultural extension provides a critical input support service for agricultural producers, mainly in rural areas, in meeting new challenges confronting agriculture: climate change and its burden in mitigation and adaptation; the growing importance of food standards, labels, and food safety and mitigating food losses through basic processing; and growth in non-farm rural employment and agribusiness.

Whilst most extension systems in Africa primarily focus on technology transfers that emphasize increasing food production and achieving national food security, Africa's nutritional strategy (2015–2025) is derived from the non-effective utilization (the burdens of multidimensional malnutrition) of food in meeting dietary requirements, and constraints imposed by health challenges (including the recent COVID-19 pandemic) that affect children under five in particular, and rural livelihoods (African Union, 2022). Tasks undertaken under agricultural extension usually lack specific nutritional information.

Figure 1: Agricultural extension mechanisms, agricultural production and nutritional outcomes



Household nutritional status is the result of a combination of time, physical assets and knowledge of good nutritional practices, and together with health status and the consumption of food in terms of quantity, quality and diversity, plays a major role in determining nutritional status, hence providing the most direct link between agriculture and nutrition. However, it is not the only factor as good nutrition goes beyond ensuring an adequate quantity of food (African Union, 2022; IPU & FAO, 2021).

Dangour's (2012) exposition of the throughput from increasing agricultural production (manifested in an enhanced and effective agricultural extension mechanism) to nutrition and health outcomes is revealing. In Figure 2, the most striking exposition is the non-linear relationship that could exist between increasing agricultural productivity and nutrition outcomes. Between the availability of food and nutrition outcomes is the processing of food and access to food for consumption. Food production alone is not sufficient to determine the health and nutrition of all – the type and quality of food produced, access to the right types and quantities of food, and the distribution of food within the household also matter (IFPRI, 2021). An effective extension service delivery that translates increased agricultural production into effective nutritional outcomes must have a broad, but targeted, mission beyond emphasizing increased food production/productivity, to information delivery that leverages the intervening mechanism (food processing and food consumption).

Figure 2: Exposition of linkages from agriculture to nutrition and health outcomes

Source: Adapted from Dangour (2012)

Empowering women improves child health, and linkages between increasing resources controlled by women in farm households and (child) nutrition are well established although they may involve trade-offs between different objectives, and may differ across cultural contexts. This suggests that the usually narrow focus of Africa's agricultural extension policy on food security must more specifically encompass nutrition security pathways. This focus has implications for agricultural extension message generation and targeting in delivery.

4. Agricultural extension and nutrition outcomes: Empirical evidence

In this section, we review some papers generated through the AFPON for a number of countries in East Africa.[1] The main aim of the review is to delineate the pathway(s) identified in linking agricultural production to nutritional outcomes (either broadly or narrowly defined) from agricultural extension (policy) deliveries. Webb and Kennedy (2014) argue that the impacts of agricultural interventions on nutrition outcomes have focused on determining the size and direction of the impacts rather than the channels through which impacts occur. We also focus on the correlates that exist: how strong the linkage is (through statistical tests), and whether strong attribution exists for the analyses provided that agricultural extension (policy) impacts nutrition outcomes.

In ***Uganda***, Serunkuuma and Omiat (2018) focus on the key question of women's empowerment in agriculture and how this might help the fight against poverty and malnutrition in Uganda, through targeted interventions giving women a unique role as the primary food producers and custodians of household food security. Chumo and Ngeno (2019) investigate whether empowered mothers are less likely to have malnourished children, and shed light on the potential impact of the National Agricultural Advisory Services (NAADS) policy on nutritional outcomes.

Serunkuuma and Omiat (2018) focus on the government of Uganda (GoU) who, since the late 1990s, pursued agricultural commercialization as the linchpin of its strategy to alleviate poverty and ensure sustainable and rapid economic growth. The GoU's support for market-oriented production was based on the prospect of enabling households to obtain higher incomes (thereby reducing poverty) and to have better access to food through the market rather than through self-sufficiency. They examined the impact of maize and bean sales on household income and food intake, with a particular focus on women. Their study examines the determinants of women's participation in markets that sell pro-women commodities on household income and food intake, to determine the effectiveness of market-oriented production rather than self-sufficiency as a means of ensuring food and nutrition security in Uganda.

The authors raise the logic of Uganda's market-oriented production policy and the common perception about markets: markets raise incomes and purchasing power which, in turn, create demand for consumer goods. The increase in demand for consumer goods enhances welfare, which, in turn, creates demand for production inputs and investment goods. Markets also promote economic growth by facilitating the accumulation of assets and provide opportunities for improving nutrition. The

study provides two main pathways through which the income-mediated effect of commercialization on nutrition and health operates (Von Braun and Kennedy (1994). The first is where increased incomes are used to purchase either a different mix of goods and services or more of the current market basket, such as more access to healthcare or better housing, which leads to improved health. The second is through income-food consumption linkages, where increased income leads to improved energy or other nutrient intake by individual household members, which leads to improved nutritional status and, thus, improved health. They also provide a different view on the effect of market-oriented production on household food consumption: that market-oriented production negatively affects household food consumption due to reduced food availability when resources are diverted away from staples to the production of non-edible cash crops or when a big portion of the produce is sold.

Serunkuuma and Omiat (2018) use household survey data from the Living Standards Measurement Survey (LSMS) for Uganda for two waves (2009/10 and 2013/14) to allow for a sufficiently large gap (5 years) to capture changes in household welfare, consisting of a sample of about 3,200 households, whose selection follows the 2005/2006 Uganda National Household Survey (UNHS). They find that the proportion of female-headed households selling beans averaged 34%–38% over the two seasons compared to male-headed households at 38%–41%. Similar proportions are reported for maize (35%–38% for female-headed and 44%–50% for male-headed households). There was growth in total household income between the two surveys, but the magnitude of income growth was higher among female-headed households than male-headed households. However, male-headed households had significantly higher total household income than their female-headed cohorts in both surveys. They report that having a female household head is associated with a higher Household Dietary Diversity Score (HDDS), and income from maize and beans sales is significantly and positively associated with HDDS.

Conversely, Chumo and Ngeno (2019) posit that empowered mothers in Uganda have a lower likelihood of having malnourished children and they shed light on the potential impact of the National Agricultural Advisory Services (NAADS) policy on nutritional outcomes. They do so through an empirical investigation of the determinant factors influencing household participation in NAADS, and evaluate the impacts of NAADS participation on nutritional outcomes in Uganda. They argue that agricultural extension, for example, training and visits, is a vehicle for modernizing agriculture and solving agriculture-related or created problems and that agricultural extension has played a major role in transforming agriculture in many parts of sub-Saharan Africa.

Using Demographic Health Survey (DHS) data for 2003, 2008/2009 and 2014, this paper assesses: (i) whether empowerment indicators for women have shown trends in the period under study; (ii) whether household dietary diversity and children's anthropometric indicators have changed in the same period; and (iii) which dimensions of women's empowerment have had an impact on the nutritional status of children. Methodologically, a probit model is used to assess the trends in empowerment, with

empowerment on the left-hand side and a number of explanatory variables on the right-hand side, under the assumption that the residuals of the model are normally distributed, while the full vector of indicators of empowerment is used, along other household characteristics, to explain household nutrition diversity. To account for possible endogeneity (factors impacting on empowerment also affecting nutritional indicators), an additional test was carried out, leading to a modified model used in the analysis.

The main conclusions on the relation between empowerment and nutritional outcomes are: (i) agency, the ability to co-decide on the use of household income, has a positive impact; (ii) having control over large purchases has a negative impact, presumably because food purchases do not fall into this category and large purchases may actually crowd out food; (iii) access to news and communication channels has a positive impact; (iv) a reduction in time spent fetching water and firewood has a positive impact; (v) land ownership has a positive impact; (vi) access to cold storage has a positive impact; (vii) education has a positive impact; (viii) having health insurance has a positive impact; (ix) a higher social status has a positive impact; (x) being younger at first sex, and age difference with partner has a positive impact, which runs counter to the other results, as a bigger age difference is usually associated with more inequality between the partners. In general, the study confirms the idea that there is a positive relation between women's empowerment and child nutritional status and, through detailed analysis, offers a good indication of where the focus should be.

Three papers from AFPON for ***Malawi*** are reviewed: Edriss and Mehare's (2018), who focus on microenterprising as crucial for improving rural households' nutrition status in a subsistence agrarian economy; the paper by Tione et al. (2020), who assess the linkage between the Malawi Farm Input Subsidy Programme (FISP) and the nutrition status of under-five children in Malawi, and Katengeza et al.'s (2019) study on the impact of integrating a farm input subsidy policy and soil fertility management technologies on household nutrition security.

Edriss and Mehare (2018) posit that microenterprising is crucial for improving rural households' nutrition status in a subsistence agrarian economy through monthly income receipts from businesses that mostly lead to high food expenditure in households, and by relying on various own-farm products, increasing farm production diversity increases household dietary diversity on nutritional food diversity in the rural household. They analysed the effects of farm and non-farm microenterprise diversity, as well as farm production diversity on household dietary diversity (or household nutritional outcomes including children).

Their data were collected from 1,827 households, with 779 households engaged in some kind of farm and non-farm microenterprises in six districts that have a high concentration of microbusinesses and high population densities. Both parametric and non-parametric descriptive statistics, and Poisson and negative binomial regressions were used for estimations. Edriss and Mehare (2018) find several factors that are associated with household nutritional outcomes: farm and non-farm enterprise diversity, farm production diversity, and expenditure on food items all play a major role

in influencing the nutritional status of the household including children. Increasing farm and non-farm microenterprise diversity through any of the microbusinesses is associated with the possibility that the household could consume all 12 food groups. Similarly, increasing farm production diversity increases household dietary diversity by 33% (i.e., 4 food groups out of 12 could be consumed or added to daily consumption, given the consumption of 5 food groups, on average). Venturing into microbusinesses related to tubers and roots, legumes and pulses and horticulture positively and significantly affect household nutritional outcomes in the districts. The authors recommend the need to promote nutrition education, farm production diversity and microenterprise diversification as complementary and supplementary interventions for improving household members' nutrition.

Tione et al. (2020) focus on the Farm Input Subsidy Programme (FISP) and hypothesize that FISP increases food availability and accessibility at the household level, thereby reducing children's wasting. They argue that, through the FISP, subsidized input acquisition at the household level improves the nutrition status of children under five, especially with the consumption of cereals and legumes. In Malawi, the FISP is a social protection policy that was implemented in 2005/06 with the aim of targeting not only an increase in the production volumes of cereal and legumes, but also providing farmers with incentives to diversify their production, which corresponds to the attainment of Sustainable Development Goal (SDG) 2. Building on the previous literature, they assert that the link between agricultural input subsidies and nutrition and health-related outcomes occurs through impacts on production and changes in the health environment. FISP is seen to relate to the child malnutrition outcomes of wasting as FISP promotes an increase in food production, more specifically maize and legumes, which later provides nutritious and diversified food to children under five in beneficiary households.

They used panel data from Malawi's Integrated Household Panel Survey (IHPS) for 2013 and 2016, which was conducted by the Malawi National Statistical Office in collaboration with the World Bank to monitor and evaluate changing conditions of Malawian households. The 2013 survey sampled 3,219 households, while in 2016 there were 2,508 households. The merged sample size for the two periods was 2,321 households.

On the malnutrition outcome for under-five children, they concentrated on wasting (calculated using the anthropometric measurement weight-for-height [WHZ]) as it is a life-threatening result of poor nutrition intake that can be reversed with urgent feeding, treatment and care). Changes in wasting levels could also be observed in a short time: between the two panel data periods (2013–2016).

Their sample size was 1,995 households that either received an input subsidy voucher in one period or both, or did not receive an input subsidy voucher at all. To examine the impact of an input subsidy in reducing children's wasting, they used a two-stage least-squares regression, and applied a production function for maize and legumes, incorporating whether the household had received a voucher in either the 2012/2013 season or 2015/2016 season, or both.

A key variable of interest in the study was the interaction between access to subsidized inputs and food crop production. If positive and significant, it would suggest that an increase in food production due to access to subsidized inputs has a positive and significant correlation with nutrition security and, therefore, access to subsidized inputs would enhance nutrition security through improved food crop production.

Their findings suggest that households that received FISP had significantly higher maize and legume yields. However, FISP beneficiary households were associated with higher outcomes of wasting among under-five children, poor households that received input vouchers (FISP) and produced maize had better outcomes for wasting among under-five children, male children were more likely to be wasted compared to their female counterparts and households in rural areas were more likely to have under-five children that are wasted.

Katengeza et al. (2019), also focus on FISP, but in addition integrate soil fertility management (ISFM) technologies and their combined impact on household nutrition security, focusing on child anthropometry. They indicate that the core objective of the FISP has been to increase access to improved agricultural inputs by resource poor smallholder farmers in order to increase food and cash crop production and achieve food self-sufficiency and high incomes, and that the programme would contribute to food security and nutrition security in Malawi by increasing the availability of food and access to nutritious and high-quality food through the integration of maize and legumes for increased incomes.

In examining the impact of integrating farm input subsidy policies and ISFM technologies on nutrition security, the paper focused on the anthropometric indicators of height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) and related stunting, underweight and wasting as nutrition outcome variables for children under the age of five. They used two sets of data: the NMBU-LUANAR household panel survey data covering six districts in Central and Southern Malawi that covered four rounds, for the years 2006, 2009, 2012, 2015. The surveys have detailed farm plot information (measured by GPS) and geo-referenced farm plots to enable the measurement of productivity and the production impact of ISFM and FISP at plot level. The first round in 2006 drew a random sample of 450 households, ending with 350 in 2012 and 2015, resulting in four rounds of unbalanced panel data. This report uses plot-level information from 449 households in 2006, 362 in 2009 and 345 in 2012 and 2015. The second data set is the Living Standards Measurement Study-Integrated Household Survey (LSMS-I) for 2010, 2013 and 2016. This dataset is nationally representative, longitudinal and has detailed information for all key variables. The paper focused on children between six and 59 months of age and the total number for all three regions was 5,419.

Katengeza et al. (2019) are of the opinion that integrating farm input subsidy policies and ISFM technologies are complementary: FISP increases access to farm inputs such as inorganic fertilizer and improved maize and legume seed whilst adopting ISFM increases the uptake of soil nutrients by the crops for increased

yields. An increase in the production of maize and legumes, as well as high incomes from maize and legume sales, are intermediate impacts of farm input subsidies. The expectation is that such households will have improved nutrition security through the production effect – own consumption and income effect -- as households will be able to buy high quality and nutritious food from the markets.

The authors found robust evidence of the positive impact of a fertilizer subsidy on nutrition security when integrated with ISFM technologies. They found a positive correlation between input subsidies and maize productivity, and also that ISFM technologies reported a positive correlation with maize yield when integrated input subsidies and ISFM technologies have positive and significant impacts on maize productivity. On child anthropometric indicators, they found that an integration of FISP and ISFM technologies were associated with a reduction in child underweight, stunting and wasting. The results suggest that the integration of farm input subsidy policies and integrated soil fertility management technologies has the potential to improve household nutrition security.

In Zambia, the government has embarked on several policy initiatives to promote agricultural diversification, which can contribute towards improving food security. Marinda et al. (nd) examine the impact of select Zambian agricultural policy strategic directions on nutritional status and dietary diversity of children under the age of five years, whilst Rodha Mofya-Mukuka et al. (2019) study the impact of input subsidies on household food availability in rural Zambia from a gendered perspective.

Marinda et al. (nd) discuss the second National Agricultural Policy of Zambia (Government of Zambia, 2016) that covers agricultural diversification, agricultural research and extension services (e.g., bio-fortification), food and nutritional security, and agricultural production and productivity. One key objective of this policy is "to improve food and nutrition security". The measures of this objective include: (i) the promotion of agricultural production diversification; (ii) production and utilization of indigenous crop varieties; and (iii) the promotion of bio-fortified seed access to produce nutrient-enhanced crop varieties. The focus is on agricultural diversification in high value crops, fisheries, livestock and forestry products based on the comparative and competitive advantage of each product and agro-ecological zones. It is believed that agricultural diversification can help ensure food security by improving farmer adaptability and reducing vulnerability so that they are able to avert risk and increase income streams by adopting diversification practices, which can be achieved by increasing access to extension services and improving farming technologies.

Marinda et al. (nd) determine the impact of agricultural diversification on the nutritional status and dietary diversity of children under the age of five in rural Zambia by providing insights into pathways through which chronic malnutrition and micronutrient deficiencies have been reduced in this cohort of children. Using data from the Zambia Demographic Health Survey (ZDHS) dataset for the period 2006–2007 and 2013–2014 (3,854 and 7,810 rural households, respectively) the authors assessed the association between dietary diversity and the nutritional status of children under five, and established the determinants of stunting in children under five from rural

households. Multiple linear regression was used to relate dietary diversity to HAZ scores (that measure linear growth in in children) and also to determine the predictors of linear growth in children aged 6–59 months.

Their findings include: the mean HAZ for children under five was -1.83 (±2.21) and -1.64 (±1.83) in 2007 and 2013–2014, respectively, which showed a statistically significant difference for both time periods (t=-4.99, p= 0.00); and a high proportion of children under five consumed staples (grains, roots and tubers) and vitamin A-rich fruits and vegetables. A high proportion of children in 2013 (87.3%) did not meeting the minimum dietary diversity requirement. The mean dietary diversity scores in 2007 and 2013 were 2.3 (± 1.6) and 1.9 (±1.5), respectively. Bivariate analysis showed a weak negative, but statistically significant, association between HAZ and the dietary diversity of children (-0.047) (p=0.00). Dietary diversity is positively associated with HAZ in younger children (aged 6–23 months). A significant association is observed between tropical livestock units and HAZ.

Marinda et al. (nd) conclude that dietary diversity can be attributed to agricultural diversification in rural contexts and seems to have a significant contribution to child nutritional status, although the contribution is not consistent across both age groups of children considered in their study. Low dietary diversity is observed among children in rural households and is associated with high levels of stunting. Agricultural-related characteristics such as tropical livestock units, land and chicken ownership are not consistently significant in both age groups and across both time periods in the 2006/2007 and 2013/2014 DHS surveys. Direct points for intervention to prevent future stunting in children aged 6–59 months include poverty reduction in rural areas, a continuation of programmes that promote agricultural diversity with a focus on livestock and poultry keeping, focusing on child and infant feeding using local foods, and ensuring access to safe, clean drinking water and toilet facilities.

Rodha Mofya-Mukuka et al.'s (2019) paper focuses on the impact of input subsidies (FISP) on household food availability in rural Zambia from a gendered perspective, measured by months of adequate household food provisioning. In Zambia, large-scale input subsidies were re-introduced in the 2002/2003 farming season through the establishment of the Fertilizer Support Programme (FSP). As part of the government's push for crop diversification, there was an expansion in the range of crops included in the programme such as rice, sorghum, cotton and groundnuts. Changes were made to the FISP with the introduction of the electronic voucher system to allow increased private sector participation, timely access to inputs by farmers, improved beneficiary targeting and promotion of agricultural diversification.

Rhoda Mofya-Mukuka et al. (2019) argue that increased support for women through women's empowerment and support programmes can result in the improved welfare of women through increased resource ownership that can also enable them to acquire FISP and, hence, lead to an increase in crop production. In addition, increased women's empowerment can result in increased knowledge and, subsequently, better management of resources, all which could contribute positively to food availability for households.

This study used data from the nationally representative Rural Agricultural Livelihoods Survey (RALS) of small and medium-scale farming households in Zambia, collected in 2012 and 2015. The RALS is a longitudinal survey conducted by the Indaba Agricultural Policy Research Institute in conjunction with the Central Statistical Office of Zambia and the Ministry of Agriculture. A total of 8,839 and 7,934 households were interviewed during the 2012 and 2015 surveys, respectively. The study employed a correlated random effects for linear regression model. The findings reveal that participation in FISP is not determined by gender, instead it is determined by factors such as education level of household head, number of fields cultivated, tropical livestock units, agro-ecological zones and distance to markets. The results show that food availability increases when households participate in FISP, however, it could increase more if households participate in FISP and have a female as the primary decision maker in crop production. Hence, it is beneficial to target households with female primary decision makers in female-headed households to enhance household food security in rural Zambia.

The focus of Mujeyi and Mutambara's (2018) analysis of ***Zimbabwe*** is the impact of redistributive land reform policy on women's nutritional status, with particular focus on the minimum dietary diversity for women (MDD-W) in rural smallholder farming households, premised on the hypothesis that improving access to adequate and better-quality agricultural land enhances the diversity and increases the availability of food which, in turn, ensure better nutritional outcomes for the household. They suggest that land redistributive policies aim at achieving equitable access to resources for agricultural production, and where off-farm employment is low, agriculture plays a leading role as a source for food and employment.

While several important determinants of household nutritional status exist, they posit that agricultural land is the single most important factor in determining the nutritional status of households where access to agricultural land at the household level has both a direct and an indirect influence on nutritional status, implying that not only the availability of food is affected, but also the diversity of food consumed.

Under the Fast Track Land Reform Programme (FTLRP) over 10 million hectares of prime agricultural land was acquired, subdivided and transferred to over 145,000 smallholder farm families. It created over 20,000 medium-sized farms occupying about 2.7 million hectares under a resettlement scheme, an unprecedented shift in terms of the country's agrarian structure and land tenure system, and interestingly, a paradigm shift away from the dualistic system to a multi-modal tenure system dominated by state control of land resources.

The study used data from the 2018 Zimbabwe Vulnerability Assessment Committee (ZimVAC) Rural Livelihoods Assessment, but the sample size was restricted to smallholder farming households in the land reform resettlement and communal area subsectors. It employed an endogenous switching regression (ESR) approach. They find no statistically significant difference between the beneficiaries and non-beneficiaries of the land reform in terms of the MDD-W. They advocate the need for empowerment of female members of the household with relevant nutritional

education to equip them with adequate knowledge and information on the importance of diversified diets at the household level, and to enhance the delivery of critical support services such as agricultural extension, credit and social protection to women of reproductive age in land reform areas.

Conversely, Pindiriri (2018) finds that land reform improves child nutrition in rural areas. By buttressing the importance of the link between agricultural policies on nutrition, the study examines the impact of the land reform policy-induced access to land on nutritional outcomes of children, a crucial consumptive service of the household in Zimbabwe. The author provides a theory of change that land reform policy improves access to agricultural land and directly influences agricultural production which, in turn, affects nutritional outcomes via increased incomes and consumption.

The study utilized Multiple Indicator Cluster Survey (MICS) 2014 data, which sampled 17,047 households. The study applied agricultural household modelling in demonstrating the theoretical relationship between land access and nutritional outcomes. The results reveal that increasing land holding for households owning agricultural land, and increasing the production of domesticated birds, goats and pigs improve nutritional outcomes, in particular, reducing underweight children in rural areas. Resource access policies, such as land reform, improve child nutrition in agricultural or rural areas and the study recommends this.

In ***Ethiopia***, Haji (2018) studied the impact of agricultural commercialization on child malnutrition. Ethiopia has adopted smallholder agriculture commercialization as a key policy tool for agricultural development and has formulated a series of policies, strategies and programmes to promote agricultural development in order to achieve food and nutrition security and build resilience. The government developed a second Growth and Transformation Plan (GTP II) for the period 2016–2020, with the overarching objective of realizing Ethiopia's vision of becoming a middle-income country by 2025. Under GTP II, the agriculture sector is considered one of the major sectors driving growth, where the plan is to focus on improving agricultural production and productivity and commercialization and rural transformation, thereby improving rural welfare. Agricultural commercialization is believed to reduce malnutrition by increasing income and a household's ability to purchase a diverse range of food items.

Haji (2018) sets out to measure the commercialization level of smallholder farmers and child nutritional outcomes in Ethiopia, and evaluates the impact of commercialization on children's malnutrition using rigorous econometric techniques and large panel datasets.

Haji (2018) used a panel dataset comprising socioeconomic, agricultural and anthropometric data collected by the Ethiopian Socio-Economic Survey (ESS), a collaborative project between the Central Statistics Agency of Ethiopia and the World Bank Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA). Data were collected in two rounds from all regions of the country in 2011/12 and 2015/16.

Focusing on the anthropometric measurements in the literature, the study employed HAZ (stunting), HWZ (wasting) and WAZ (underweight) to analyze the nutritional status of children under five in Ethiopia using the panel data. The study finds that there is a significant causal effect of farmers' commercialization activities on two child malnutrition indicators, namely underweight and wasting, but has no significant causal effect on child stunting. Lower commercialization levels have a significant positive effect on stunting, but a significant negative effect for medium and higher commercialization levels, with the overall effect remaining insignificant. However, lower and higher levels of commercialization have a positive causal effect on underweight and wasting, but a negative causal effect on medium commercialization, with the overall significant causal effects on reducing underweight of children under the age of five. In general, the study concluded that commercialization could contribute significantly to improved child nutrition in smallholder farm households.

5. Agricultural extension and nutrition outcomes: A synthesis

In this section we provide a synthesis of the papers reviewed using three criteria.

A. *Which pathway is identified as linking agricultural production to nutritional outcomes (either broadly or narrowly defined) from agricultural extension policy deliveries?*

   The papers on the impacts of the FISP, distributive land reform, market commercialization, women's empowerment and women's response to market-oriented production in children's nutritional outcomes; farm production diversity; and microenterprise diversification, all provide various pathways that impact nutritional outcomes in rural households in Africa, which originate from increased food production, informed by an existing agricultural extension (policy) implemented over several years. The predominant agriculture to nutrition linkage in all the papers has been either direct (through household consumption, mainly increased food production) or indirect (increased income through participation in the market to generate income from the increased agricultural productivity).

B. *What correlates exist and how strong is the linkage (through statistical tests) provided?*

   Almost all data used in the AFPON papers reviewed are based on panel data utilizing nation-wide multiple indicator cluster survey data with large sample households. The studies applied agricultural household modelling in demonstrating the theoretical and empirical relationship between the variables of interest (such as agricultural productivity and crop outputs) and nutritional outcomes (anthropometric measures of children under five: wasting, stunting and underweight). The studies infer associations between agricultural and other variables and food security, and nutritional indicators using mainly regression-based analyses where hypotheses are formulated and statistical tests performed. Almost all reviewed studies provide significant and statistically inferred associations between the agricultural extension policy variables and the nutrition outcomes.

C. *Can strong attribution be identified for the analyses provided (that agricultural extension policy causes nutrition outcomes)?*

The challenge for strong attribution derives from the observations of Webb and Kennedy (2014) regarding the channels through which impacts occur. While we recognize the various pathways identified by the AFPON papers in this direction, and the complex interactions that are required in achieving the desired pathway, the channels by which impacts occur have mainly remained embedded in the "data" used in the analyses. At the household level, we fail to see any description of behavioural and communication change (BCC) activities at the community level. We do not find evidence for agricultural extension agent interactions with the households, particularly, in the delivery of timely information that could enhance BCC in nutritional outcomes. This is where, perhaps, an integrative and focused agricultural policy with nutrition messaging may be required. Several researchers who wrote these papers acknowledge the difficulty in attribution as most of the policies are not standalone predictors of nutritional outcomes.

6. Conclusion: Policy implications for addressing challenges associated with malnutrition in SSA

Malnutrition addresses four broad groups of conditions: (a) undernutrition, which is indicated by wasting (low weight for height), stunting (low height for age) and underweight (low weight for age); (b) micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; (c) overweight and obesity; and (d) diet-related non-communicable diseases (IPU & FAO, 2021, p.8). The multidimensional malnutrition burden and the associated challenges in SSA have had several researchers advocating for agricultural policies that address the use of modern agricultural techniques to increase food production (Bain et al., 2013), public health (Steyn & Mchiza, 2014) and other strategic interventions (Akombi et al., 2017).

Addressing malnutrition in SSA requires a food systems approach that promotes healthy diets. The United Nations Decade of Action on Nutrition calls for policy actions in key areas based on the Framework for Action of the Second International Conference on Nutrition, one of which is to create sustainable, resilient food systems for healthy diets that places nutrition and sustainable food systems that support healthy diets for all at the top of national and local agendas (IPU & FAO, 2021, p.13–14).

There is empirical evidence in the reviewed studies that agricultural policies provide a pathway for improved nutritional outcomes among women and children through women's empowerment, crop diversification and agricultural commercialization to food security, dietary diversity and nutrition. That is not exhaustive, as good nutrition goes beyond ensuring an adequate quantity of food.

What is required for addressing malnutrition is the strengthening of agricultural policy and enhancing the mechanisms for the impacts of these policies more closely with the nutritional outcomes in a food systems approach. Results from the reviewed papers base the correlates of agriculture to nutrition outcomes on women as the central mediators of the pathway; empowered mothers have a lower likelihood of having malnourished children. Hence gender-and nutrition-sensitive agricultural programmes in the food system must address women's dis-empowerment, resource acquisition and asset mobilization for enhancing participation in agricultural transformation.

The challenge for agricultural policy is to deliver improvements in the sustainability of making agriculture more nutrition-and health-sensitive so that the agriculture sector can provide quality, safe and nutritious food. Agricultural policies must work

in tandem with other sectors to develop technologies that can be profitable on farmlands for smallholders, so that they can adopt technologies that are gender sensitive and climate smart. A sustainable food production system would not only satisfy the principle of environmental, economic and social sustainability, including ethical labour, but also improve nutrition, and provide health benefits and reduce health risks for the poor.

In terms of specific agricultural policies, several of the authors recommend that further improvements to the FISP programme are required. First, it is recommended that the use of an input subsidy is not a standalone predictor that has a direct linkage with child malnutrition. Nevertheless, where beneficiary households can increase the output of crops, important reductions in malnutrition outcomes are attained, such as wasting. Therefore, an appropriately designed and implemented FISP programme would offer pathways for improving malnutrition outcomes in resource-poor countries. Second, to attribute the impacts of input subsidy programmes on nutrition outcomes, the targeting of farm household beneficiaries needs to be based on the productivity levels of households. In both the improvements proposed, farmers need timely and user-friendly farm information to make important management decisions, therefore, the agricultural extension services designed to address these needs must be strengthened. More accessible information that is customized to individual farmer circumstances can be important for behavioural change, leading to the adoption of innovative technologies to improve farm productivity and nutrition outcomes.

Notes

1. We review ten (10) papers generated through the AFPON for five (5) countries of Uganda (2), Malawi (3), Zambia (2), Zimbabwe (2) and Ethiopia (1).

References

African Union. 2022. *Africa Regional Nutrition Strategy, 2015–2025*. African Union, Addis Ababa, Ethiopia.

Akombi, B.J., K.E. Agho, D. Merom, A.M. Renzaho and J.J. Hall. 2017. "Child malnutrition in sub-Saharan Africa: A meta-analysis of demographic and health surveys (2006–2016)". *PLoS ONE* 12(5): e0177338. At https://doi.org/10.1371/journal. pone.0177338

Balaji, S.J., A. Jhajhria, S. Kumar and I Kingsly. 2017. "Agriculture–nutrition linkages: A preliminary investigation for rural India". *Outlook on Agriculture*, 46(4): 302–8.

Bain, L.E. Luchuo, P.K. & Awah, Paschal &, N. Geraldine, N.P.gia & Kindong, Njem &Y. Sigal, Yelena & N. Bernard, Nsah & and A.T. Tanjeko, Ajime.. (2013). "Malnutrition in Sub - Saharan Africa: Burden, causes and prospects". *The Pan African Medical Journal*. At 15. 120. 10.11604/pamj.2013.15.120.2535.

Chumo, C. and V. Ngeno. 2019. "The impact of agricultural extension policies on nutritional outcomes: The case of NAADs in Uganda." Report. African Economic Research Consortium, Nairobi, Kenya.

Dangour, A. 2012. Targeting Nutritional Security. In, Agricultural Research for Food and NButritional Security. Sirkka Immonen. Helsinki. 16 June.

Edriss, A-K. and A. Mehare. 2018. "Impact of farm production diversity and microenterprise diversifications on household nutrition security in Malawi." African Economic Research Consortium, Nairobi, Kenya.

Government of Zambia. 2016. Ministry of Agriculture, & Ministry of Livestock and Fisheries. (2016). Second National Agricultural Policy. Government Printers. Retrieved from http://cbz.org.zm/public/downloads/SECOND NATIONAL-AGRICULTURAL-POLICY-2016.pdf

Haji, J. 2018. "Impact of agricultural commercialization on child malnutrition in Ethiopia". Report. African Economic Research Consortium, Nairobi, Kenya, July.

Hoddinott, J. 2011. "Agriculture, health, and nutrition: Toward conceptualizing the linkages. In: *Conference Brief 2020*. Presented at: Leveraging Agriculture for Improving Nutrition and Health Conference, New Delhi, India, 10–12 February 2010.

IFAD. 2016. "Reducing rural women's domestic workload through labour-saving technologies and practices: Gender, targeting and social inclusion". How to Do Series. International Fund for Agricultural Development, Rome, Italy, April.

IFPRI. 2021. "Agriculture for nutrition and health: Gender strategy". A CGIAR Research Program on Agriculture for Nutrition and Health, International Food Policy Research Institute, Washington, D.C., USA, 16 November.

IPU and FAO. 2021. *Food systems and nutrition–Handbook for parliamentarians* No. 32. Inter-parliamentary Union and Food and Agriculture Organization of the United Nations, Rome, Italy. At https://doi.org/10.4060/cb2005en

Kadiyala, S. J. Harris, D. Headey, S. Yosef and S. Gillspie. 2014. "Agriculture and nutrition in India: Mapping evidence to pathways". *Ann. N.Y. Acad. Sci.*, 1331: 43–56.

Katengeza, S.P., S.E. Tione and K. Machira. 2019. "Integrating farm input subsidy policy and soil fertility management technologies in Malawi: Impact on household nutrition security." Report. African Economic Research Consortium, Nairobi, Kenya, May.

Marinda, P., K. Audain, R. Kiwanuka and C. Nkonde. Nd. "Nutritional impact of agricultural policy in Zambia: Exploring the relationship between dietary diversity and child nutritional status." Report. African Economic Research Consortium, Nairobi, Kenya.

Mujeyi, K. and J. Mutambara. 2018. "Impact of redistributive land reform policy on women nutritional status in Zimbabwe: Evidence from the rural livelihoods assessment survey." Report. African Economic Research Consortium, Nairobi, Kenya.

NEPAD. 2013. *African agriculture, transformation and outlook*. November. 72 p.

Pawlak, K. and M. Kolodziejczak. 2020. "The role of agriculture in ensuring food security in developing countries: Considerations in the context of the problem of sustainable food production". *Sustainability*, 12(13): 5488. At DOI:10.3390/su12135488

Pindiriri, C. 2018. "Land reform policy-induced access to agricultural land and nutritional outcomes in Zimbabwe." Report. African Economic Research Consortium, Nairobi, Kenya.

Rodha Mofya-Mukuka, R., N. Kiwanuka-Lubinda, B. Syakobbola, C. Nkonde and P. Marinda. 2019. "Impact of input subsidies on household food availability in rural Zambia: A gendered perspective". Report. African Economic Research Consortium, Nairobi, Kenya, February.

Ruel, M. and T. Alderman. 2013. "Nutrition-sensitive interventions and programmes: How can they help to accelerate progress in improving maternal and child nutrition?" *The Lancet,* 382: 536–51.

Serunkuuma, D. and G. Omiat. 2018. "Women's response to market-oriented production policy: Impact on income and nutrition outcomes in Uganda." Report. African Economic Research Consortium, Nairobi, Kenya.

CTA. 2011. "Agricultural extension: A time for change. Linking knowledge to policy and action for food and livelihoods". Policy Pointers. Technical Centre for Agricultural and Rural Cooperation, November.

Tione, G., E. Gondwe and B.B. Maonga. 2020. "Assessing the linkage between farm input subsidy program and nutrition status of under-five children in Malawi". African Economic Research Consortium. June.

United Nations. 2010. "Progress in nutrition". In *6th Report of the World Nutrition Situation.* The United Nations Systems Standing Committee on Nutrition, Geneva, Switzerland.

Von Braun, J. and E.T. Kennedy. 1994. *Agricultural Commercialization, Economic Development and Nutrition.* Johns Hopkins University Press: Baltimore, MD, US.

Webb, P., & Kennedy, E. 2014. Impacts of agriculture on nutrition: nature of the evidence and research gaps. *Food and Nutrition Bulletin,* 35(1), 126–132.

World Bank. 2007. From Agriculture to Nutrition: Pathways, Synergies and Outcomes. https://openknowledge.worldbank.org/handle/10986/28183

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