Feed the Future Innovation Lab for Food Security Policy

Policy Research Brief 41 July 2017

Nigeria Agricultural Policy Project

Climate Change and the Poultry Value Chain in Nigeria: Issues, Emerging Evidence, and Hypotheses

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Introduction

The Nigerian poultry value chain is growing fast and transforming. This is linked to Nigerian diets including more eggs and poultry meat as incomes rise and urbanization occurs. Poultry are important for nutrition as well as incomes in Nigeria. But the poultry value chain is complex – varying over parts of the country in how modern or traditional it is. Really very little has been known about that value chain, as its rapid emergence as an important domestic commercial supply chain is recent. Climate change is also a recently emerging problem and little is known about how it will affect Nigeria's food economy. These two gaps make it especially unknown what is occurring from the combination of climate change and poultry value chain growth and transformation. How will climate change affect feed supply chains? Poultry farming and supply chains? How will poultry farming itself perhaps affect climate change? We explore these questions in a preliminary way in this brief.

Potential and emerging impacts of climate on Nigeria maize farming

Weather shocks will affect differently the North vs the South of Nigeria (as being very different agroecological zones) and crops. Both crop model simulations and econometric estimations predict that higher temperatures and rainfall variability will affect yields and historical patterns of rainy and dry seasons. Losses for rainfed maize are predicted to be small compared to those for sorghum (a substitute for maize in feed) (Hassan et al. 2013). Hotter wetter climates will also promote maize disease, such as of aflatoxin, a fungus dangerous to human health.

Key Findings

- In general, climate change affects the whole poultry supply chain, from bird and egg farming to wholesale to processing to retail. Climate change will probably affect maize farming differently over zones.
- Also in general, climate change affects the feed supply chain (mills and wholesale) indirectly by its effects upstream on maize and poultry farming and midstream by affecting the integrity of supply chain infrastructure and the humidity conditions of storage.
- Climate change can also affect the geography of production and supply chains over time. We posit that more production risk and extreme weather may move part of maize farming south in Nigeria from its traditional center in middle and Northern Nigeria. This shift may need innovation in technology and institutions to occur well.
- Climate change can be linked to animal disease diffusion. It makes it hotter and that hurts poultry farming by provoking stress and disease.
- Climate change is itself affected by poultry farming via farming's generation of GHG. Poultry farming involves various practices each of which can be done in such a way as to produce more greenhouse gas than done in more sustainable ways.

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Box 1. Conceptualizing climate shocks and change on the supply chain

Reardon and Zilberman (2017) lay out two categories of effects of climate shocks and change on supply chains. We use maize and poultry value chain examples to illustrate their points.

The first category of effects on the value chains are short-term climate shocks. Examples of these are big rain years, heat waves, droughts, flash floods washing out roads, big fires caused by dry and hot conditions, and so on. These shocks can disrupt every segment of the supply chain both directly and in a cascade of linkages:

(a) inputs such as fertilizer and feed may not reach maize and chicken/egg farms or be expensive;

(b) farming of maize can be hurt by heat waves and floods and droughts;

(c) farming of chickens may then be affected by shortage of feed from (a) and (b), and heat may hurt chickens and increase disease;

(d) (b) might affect feed mills;

(e) floods and other shocks along supply chain routes of inputs and of outputs of chicken and eggs may disrupt transport and wholesale.

(f) (e) might affect chicken processors with costs and disruptions and diseases;

g) a-f then affect chicken retail and consumption and/or competitiveness with imports.

g) feedback from any downstream back up on upstream segments too; if floods or heat cause chicken disease that hurts feed mill industry etc.

The second category of effects is medium-long term where climate change (and or repeated short term shocks) force supply chains to reconfigure. This can happen in several ways:

a) geographic shifts (e.g., if the area feed mills were getting maize from goes dry or wet so maize becomes harder to grow then buyers may have to redirect procurement routes of maize to other zones or imports to keep feeding mills; the same goes for chickens and egg buyers);

b) temporal shifts (e.g., if there is a change in how long the season runs or what the seasonality of the product or input is; buyers might have to shift from two to one season).

Note that climate shocks and changes have parallel manifestations to sociopolitical risks and shocks, energy cost shocks and long term changes, disease introduction, and so on.

In turn, shocks or long term changes in climate can affect the structure, conduct, and performance of the overall value chain. Reardon and Zilberman (2017) discuss the value chain actors as strategizing actors who address their vulnerabilities by adjusting their sourcing and marketing activities, as well as technologies and institutions. For example, the greater risk or requirements of threshold investments to mitigate or cope with the shocks can lead to concentration of the structure of the supply chain either spatially for the overall chain or in terms of the "industrial organization" of the chain's segments. Or, shocks can lead to conduct changes such as alteration of technologies (such as addition of binders in stored maize by feed mills to mitigate aflatoxins spawned by hot and wet conditions of maize production and transport). These conduct changes can in turn affect the structure of the chain. Finally, the changes can affect the performance, such as increasing costs to mills of maize, or of chicken to consumers.

Potential and emerging impacts of climate onfeed mill and maize wholesalers

Climate on maize wholesalers

Maize wholesalers are likely to develop innovative responses to increased variability in growing conditions

Climate change will initially disrupt and eventually force to adaptation food supply chains (Stathers et al. 2013; Reardon and Zilberman 2017). Maize wholesale is the first point of entry in the post-harvest value chain of maize. Wholesalers buy where the maize and chickens are – and that will be conditioned by weather. They will set up warehouses and seek transport links to where they think the likeliest sourcing points are and will be. The more cash and trucks and information a trader has, the easier it is for him to work around weather shocks and still source his needed product. That means smaller traders will be at a relative disadvantage in coping with weather change. We also think that climate getting worse or more variable in the North will mean that traders will need to work out ways to source more from the South to spread their risks. That might mean they will set up contracting with farmers in the South, and set up transport hubs and warehouses to handle these new flows.

Climate on feed mills

Actors engaged in feed milling and feed wholesale are likely to adopt institutional arrangements that guarantee consistency in quality and delivery of maize

With climate variability translating into price fluctuations and supply shorts, feed mills might try to reduce uncertainty by moving from buying from the spot market to increasingly trying to tie down their maize supply via contracting with farmers. Maybe they will even grow some of their own maize to make sure of a minimum supply, as low capacity utilization kills a mill. Mills might pay more for dried maize especially to minimize fungus problems. Mills might even shift somewhat beyond maize to some sustitutes (such as High Quality Cassava Grits or sorghum. . Again, as with the traders, mills might shift from sourcing only or mainly in the North to also sourcing from the South. Mills might also have to manage wider sales networks as bird producers in some areas might reduce demand as climate shocks cause disease in their stocks so they buy less feed.

Potential and emerging impacts of climate directly on poultry farming and vice versa

Climate impacts on poultry farming

Although the existing literature highlights the indirect effects of climate change on the poultry sector, the direct effects of climate on poultry farming can be important

Heat spells slow bird growth, reduce the quality of their meat, and increase their likelihood of disease (Gous 2010; Gregory 2010). Poultry farmers might have to vaccinate the birds more to control disease. That can be costly for small farmers. Bird farming in Nigeria is already stressed by heat, and even more heat from climate change will make it necessary for farmers to invest in cooling practices to keep the birds alive.

Poultry farming impacts on climate

The structure and trajectory of growth in the poultry subsector could have significant effects on the environment at home and abroad

Bird farming practices might even feed climate change through generating more greenhouse gas. Osuntade (2014) found that the average gas in the poultry area in Southwest Nigeria fall between 2.4 and 3.2ppm for methane and ammonia, respectively. The gas density declines with distance from the farms (Osuntade, 2014). Although this is well below the IPCC threshold, it could change if the appropriate measures are not put in place. The daily production of wastes is essentially equal to the amount of feed used as the quantity of feed brought into a poultry house amounts to the quantity of wastes generated on the same farm (Bell, 1990). There is room for bird farmers ot reduce GHG emissions by sustainable practices (Osuntade 2014; Foster et al 2006).

Climate on wholesale, chicken and egg processing, retail of poultry

The potential effects of climate shocks and change on maize wholesale and feed mills are transmitted to subsequent segments

Climate shock "upstream" affects the midstream. For example, shocks to climate can affect egg delivery from South to North Nigeria (as that is an important flow at present) and from Southwest to the East delivery of "spent layers" (old hens) to freezing facilities there who sell to the oil sector. Moreover, the flow of birds and eggs within these segments will be affected by the throughput from the chicken and egg production areas. Reardon and Zilberman (2017) emphasize that companies in the wholesale, processing, and retail sector are not passive to these changes, but take active strategic steps and make investments to mitigate the effects of climate induced upstream and downstream changes on them. In the Nigeria case these could take a wide variety of directions. One could be that there will be a concentration in poultry operations with advantage going to larger firms who can set up geographically broader and more flexible sourcing systems, refrigerated warehouses, and freezing facilities.

Next steps from a research agenda perspective

For a sustainable growth of the poultry sector in Nigeria, it is crucial to gain a better understanding of the interaction of climate change and shocks, and the different segments of the value chain. This would ultimately guide policy makers in their work to stimulate the subsector for inclusive participation.

a) Higher temperatures, and the increased incidence of disease are likely to alter the investment and technology requirements of poultry farmers. Thus, it is important to understand why and how some operations remain viable overtime, and how that is potentially related to the ability of different demographic groups to invest in adaptation strategies.

b) Cognizant of the disparities in high moisture in maize between the South and the North, it is worthy to understand how the structure, conduct and performance of the value chain will likely be altered.

c) There is a need to understand the link between different poultry management practices and key meteorological variables, including GHG, to promote those which are less harmful to the environment

d) The intensity and extent of transmission of shocks across different segments of the poultry value chain is also a worthy empirical undertaking

This brief is adapted from: Awa Sanou, Bukola Osuntade, Saweda Liverpool-Tasie, Thomas Reardon. 2017. Climate Change and the Poultry Value Chain In Nigeria: Issues, Emerging Evidence, and Hypotheses. Feed the Future Innovation Lab for Food Security Policy Research Paper 45. East Lansing: Michigan State University.

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This research is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the Feed the Future initiative. The contents are the responsibility study authors and do not necessarily reflect the views of USAID or the United States Government

Published by the Department of Agricultural, Food, and Resource Economics, Michigan State University, Justin S. Morrill Hall of Agriculture, 446 West Circle Dr., Room 202, East Lansing, Michigan 48824