IFPRI Discussion Paper 01657

June 2017

Integrating Environmental Considerations into the Agricultural Policy Process

Evidence from Nigeria

Suresh Chandra Babu

George Mavrotas

Nilam Prasai

Director General's Office

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
The International Food Policy Research Institute (IFPRI), established in 1975, provides evidence-based policy solutions to sustainably end hunger and malnutrition, and reduce poverty. The institute conducts research, communicates results, optimizes partnerships, and builds capacity to ensure sustainable food production, promote healthy food systems, improve markets and trade, transform agriculture, build resilience, and strengthen institutions and governance. Gender is considered in all of the institute's work. IFPRI collaborates with partners around the world, including development implementers, public institutions, the private sector, and farmers' organizations, to ensure that local, national, regional, and global food policies are based on evidence.

AUTHORS

Suresh Chandra Babu (s.babu@cgiar.org) is a senior research fellow and head of the Capacity Strengthening Unit in the Director General's Office of the International Food Policy Research Institute (IFPRI), Washington, DC.

George Mavrotas is a senior research fellow in the Development Strategy and Governance Division of IFPRI and program leader of the Nigeria Strategy Support Program, Abuja.

Nilam Prasai is a data curator in the Communications and Knowledge Management Division of IFPRI, Washington, DC.

Contents

Tables

ABSTRACT

Policy processes that design, develop, and implement sectoral policies often leave environmental considerations to a central environmental authority. As a result, the environmental implications and consequences of policies and programs, even when they are explicitly recognized as a part of the policies' mandate, are often ignored at the time of implementation. This paper shows how individual, organizational, and systemic factors that enhance the abilities of policy actors are crucial for better integration of environmental considerations in policy processes. Using data collected in Nigeria, we develop empirical evidence on such factors so that the sectoral policy process can be improved for better environmental outcomes. The results indicate that explicit identification of environmental challenges, better collaboration and communication between researchers and policy makers, and a combination of the expertise of young analysts with the experience of senior policy makers can improve explicit consideration and follow-up of environmental issues in sectoral policy processes. The lessons from this paper are also applicable to the environmental considerations of the Agriculture Promotion Policy, the current policy road map for promotion of the agriculture sector in Nigeria, and to other developing countries' attempts to implement such sectoral policies.

Keywords: policy process, environmental policy integration, environmental considerations, environmental analysis, sectoral policies, developing countries, Nigeria

ACKNOWLEDGMENTS

1. INTRODUCTION

Over the past 30 years, scholars, policy researchers, and development activists have placed a strong emphasis on the consideration of environmental issues in policy making (Visseren-Hamakers 2015; Berkhout et. al. 2015; Pollack and Hafner-Burton 2010; Nilsson, Pallemaerts, and Homeyer 2009). Environmental policy integration (EPI) is critical at all levels of the policy process (Hogl, Kleinschmit, and Rayner 2016; Persson, Eckerberg, and Nilsson 2016; Bührs 2009; World Bank 2005; Weersink et al. 1998). The concept of EPI broadly implies an integration of environmental considerations into all stages of policy making in nonenvironmental policy sectors (Knudsen and Lafferty 2016; Homeyer et al. 2009; Sutton et al. 2008; Lafferty 2001). After the publication of the Brundtland Commission's report *Our Common Future* in 1987 (WCED 1987), EPI was identified as an approach to sustainable development (Aguilar-Støen et al. 2016; Persson 2009; Jordan and Lenschow 2008; Nilsson 2005); it became widely recognized in the policy arena shortly thereafter.

In 1992, the United Nations Conference on Human Environment (UNCHE) placed a strong emphasis on environmental protection through integrating environmental policy into development policy planning. At present, more than 178 countries around the world have made political commitments to include environmental issues in their national development policies, such as national Poverty Reduction Strategy Papers (UNEP 2002). As a result, several declarations, statutes, and national policies require that an environmental dimension be integrated into all government plans and policies (Howes et al. 2017; Connor and Dovers 2004; UN 2002; UN 1997). Further, international development goals such as the Millennium Development Goals (MDGs) and, more recently, the Sustainable Development Goals (SDGs) established by the United Nations (UN) set the global agenda for environmental issues.

More recently, the environmental focus has shifted to climate change issues. In fact, even in the SGDs, despite other goals related to the environment, SDG 13 focuses on combating climate change by 2020. In response to the increasing emphasis on environmental concerns and accountability, several methodologies and procedures have been developed to analyze the potential environmental consequences

of development programs. These include environmental risk and impact assessments, inter-service consultations, and green budgeting, among others. However, efforts to include environmental considerations rarely go beyond the project plans and into actual implementation (Howes et al. 2017; Chaker et al. 2006; Connor and Dovers 2004; Munasinghe and Cruz 1996).

Sectoral policies continue to disregard or marginalize environmental concerns in favor of other priorities (Hogl, Kleinschmit, and Rayner 2016; Nilsson and Eckerberg 2007; Biermann 2005; Mäler and Munasinghe 1996). As a result, environmental considerations are not fully integrated into sectoral policies, creating a large disconnect between the design and the implementation of policies and programs. This situation is partly due to a lack of understanding of the role that environmental analysis plays in the public policy process.[1] It is not clear how an emphasis on environmental considerations at the project and program implementation levels translates into policy making and vice versa, pointing to the need for further research in this area.

Empirical evaluations of EPI in sectoral policies are needed, particularly in developing countries. Empirical evaluations will help analysts assess the legitimacy of efforts to integrate environmental concerns and the level of policy makers' awareness of environmental issues. Such evaluations are also important to identify the constraints to incorporating environmental concerns into sectoral policies as well as to develop EPI practices. Further, a clear understanding of the phases of the policy cycle is useful to investigate the commitment to and constraints on EPI at each level of sectoral policy processes (Persson, Eckerberg, and Nilsson 2016; Jordan and Lenschow 2008). An understanding of the policy process is important for knowing the drivers of policy change and the roles of various policy actors (Babu 2013). Such disaggregated analysis will enable an understanding of how environmental considerations at each level are translated to other levels of policy making. The literature evaluating EPI is lacking, and studies investigating EPI in the non-European context, more specifically in developing countries, are rare (Hogl, Kleinschmit, and Rayner 2016; Nilsson, Pallemaerts, and Homeyer 2009; Jordan and Lenschow 2008).

---

[1] The public policy process can be seen as steps or a course of action taken by the government to address a particular issue or problem. These steps include identifying a problem, formulating a policy to solve the problem, implementing that policy, and evaluating whether the solution is working as expected.

Agriculture is among the sectors most affected by environmental changes, and in addition, the sector itself influences the environment in several ways. First, the sector is under tremendous pressure to support the growing population with an adequate supply of food. This pressure has led to the overintensification of agricultural production systems, resulting in several negative environmental consequences such as soil degradation and erosion, water pollution, biodiversity loss, and deforestation (Irani and Sharif 2016; Ellis and Pontius 2010; Goodfray et al. 2010; Moss 2008; Tilman et al. 2001). Poorly designed agricultural policies and programs that fail to consider environmental impacts are largely responsible for the environmental consequences emerging from agricultural activities (Runhaar 2016; Kivimaa and Mickwitz 2006; Mäler and Munasinghe 1996; Clapham 1980). Consequently, the agriculture sector is now facing the challenge of increasing food production on one hand and reducing its environmental impacts on the other (Runhaar 2016; Hertel and Rosch 2010). Understanding the factors and challenges involved in incorporating environmental analysis into the agricultural policy process is critical for enhancing the policy outcomes of both the environment and agriculture sectors. In addition, building resilient food systems in developing countries also requires such considerations (Pandya-Lorch and Yusef 2014).

In this context, this article aims to examine how and to what extent environmental concerns are integrated into the policy process of the agricultural and rural development sector of Nigeria, and whether the EPI principle is reflected at different levels of decision making in the country. It analyzes different factors influencing the incorporation of environmental considerations into the policy process to derive implications for program and policy design. The paper is organized as follows. The next section elaborates on EPI development and its relevance in the policy process. Section 3 gives contextual background on Nigeria, with an overview of the environmental challenges its agriculture sector faces and the role of various environmental considerations in the agriculture and rural development policies of the country. Section 4 presents the conceptual framework used as the basis for the analysis. Section 5 describes the methodology and econometric model of the study. Section 6 discusses the findings of the analysis. Section 7 lays out some policy implications of the study. Concluding remarks make up the last section.

2. ENVIRONMENTAL POLICY INTEGRATION: DEVELOPMENT AND RELEVANCE

In spite of a growing recognition of and demand for integrating environmental concerns into development agendas and policies, the term *environmental integration* is relatively uncommon in development documents and scholarly articles (Runhaar 2016; Bührs 2009). Instead, the concept is generally expressed in terms such as *integrated environmental management*, *ecosystem management*, *ecosystem governance*, and *environment mainstreaming*, among others (Persson, Eckerberg, and Nilsson 2016; Bührs 2009). Traditionally, managing environmental issues and concerns was considered to be entirely the responsibility of the environmental ministry, rather than a common responsibility across all sectors (Runhaar 2016; Hertin and Berkhout 2003; Lenschow 2002b). This thinking resulted in environmental policies' offering end-of-pipe solutions (Hogl, Kleinschmit, and Rayner 2016; Berger and Steurer 2009; Lenschow 2002a). However, many social, economic, and environmental issues are intricately linked to one another (WCED 1987) and cut across sectors, particularly the agriculture sector.

It is well recognized that specific issue-oriented solutions and single-sector policies contribute to environmental problems, both directly and indirectly, and that well-coordinated, multidimensional, and multisectoral policies are needed in order to achieve the goal of sustainable development (Wilson et al. 2017; Briassoulis 2005). To address this challenge, an environmental policy concept that incorporates environmental perspectives into all levels and sectors of policy making originated in early 1970s (Runhaar 2016; Persson 2009; Herodes, Adelle, and Pallemaerts 2007; Kivimaa and Mickwitz 2006). The establishment of the UN Environment Programme (UNEP) in 1972, followed by the UNCHE, sparked a movement for environmental policy integration. Principle 13 of the Stockholm Declaration, an outcome of the UNCHE, states, "In order to achieve a more rational management of resources and thus *to improve the environment, states should adopt an integrated and coordinated approach to their development planning* so as to ensure that development is compatible with the need to protect and improve [the] environment for the benefit of their population" (UNCHE 1972, 4, emphasis added).

The Brundtland Commission report, *Our Common Future* (WCED 1987), further strengthened this conviction. One of its the key messages was that a long-term, sustainable solution to environmental problems would not be found in the end-of-pipe approach (for example, addressing water pollution through wastewater treatment) but instead through a consolidated approach of addressing environmental issues and concerns alongside socioeconomic development issues (WCED 1987). The 1992 UN Conference on Environment and Development (UNCED) further supported the views expressed in the Brundtland report with its Rio Declaration, which attributed legal status to the concept of integrating environmental protection into the development process by considering it one of the principles of international law (Biermann, Davies, and Grijp 2009; UN 1993). Additionally, *Agenda 21*, an outcome of UNCED 1992, dedicated an entire chapter to the integration of the environment and development in decision making (UN 1993, Chapter 8), identifying the integration of environmental considerations into the policy, planning, and management levels as one of four thematic program areas.

The nexus between the environment and socioeconomic development outcomes has been widely discussed across multiple disciplines (Roberts, Sykes, and Granger 2016; Barbier 2010; Sarkar 2010; Dasgupta 2008; World Bank 2008; Lufumpa 2005). In the context of developing countries, this relationship is often framed in terms of environment, agriculture, and poverty (Shapiro 2006; Hertel and Rosch 2010; The Africa Society 2008). The livelihoods of rural populations in developing countries depend almost entirely on agricultural and natural resources, both directly and indirectly (Skoufias et al. 2011; Barbier 2010). Rapid land use change, including forest clearing and the establishment of plantations in marginal lands, has led to multiple natural habitat loss and environmental problems such as soil erosion and water pollution (Croitoru and Sarraf 2010; World Bank 2008). The combination of the decline in the natural environment and the reliance of rural populations in developing countries on natural resources points to a causal link between environmental degradation and rural poverty (Sarkar 2010; Dasgupta 2008). It is well recognized that these rural populations are more focused on short-term goals, such as yield, than on long-term goals, such as the sustainability of their production practices. Thus, considering

environmental issues along with sectoral development policies is even more critical in the context of developing countries.

In response to wider acceptance and advocacy of environmental policy integration toward sustainable development, both developing and developed countries have expressed a high level of political commitment. However, current government commitments are mostly in the form of documents and are practiced only to a limited extent (EC 2004). Therefore, the current situation is still far from effective environmental policy integration (Nilsson and Eckerberg 2007). Sectoral policies, although addressing their specific development priorities, either continue to ignore or address very few of the environmental problems they identify (Biermann 2005; Knill and Lenschow 2000). Different actors in the same or different sectors add to environmental problems, enhancing the need for multidisciplinary and coordinated programs and policies with environmental considerations. To understand EPI at all levels of decision making, it is beneficial to know the potential environmental impacts emerging from sectoral policies and programs (Nilsson and Eckerberg 2007). The following section will highlight the key environmental considerations resulting from recent agriculture-sector policies in Nigeria, such as the country's Agriculture Transformation Agenda and its Agriculture Promotion Policy.

3. CONTEXTUAL BACKGROUND

This section provides a contextual background to set the stage for our analysis. We first describe the environmental issues facing the agriculture sector of Nigeria. Next, we take stock of environmental considerations in the country's agriculture and rural development policies.

Environmental Issues in the Nigerian Agriculture Sector

Nigeria is the most populous country in Africa, with a population of roughly 182 million, growing at 3 percent annually (World Bank 2015). Nigeria recently became the largest economy in Africa after rebasing its gross domestic product (GDP) in 2014, using 2010 as the base year. As the largest country in Africa (by both population and size of the economy), Nigeria has abundant and rich agricultural resources, human capital, and a very diversified and rich natural resource base. At the same time, however, because the country depends on oil and gas exports for nearly 70 percent of its revenue, its economy has been influenced by recent developments in the global economy. Global oil prices fell by about 70 percent between 2014 and 2016 alone, adding further pressure on the revenue side for countries like Nigeria. Economic growth in 2015 was 2.97 percent, down from 6.22 percent in 2014; it is projected to increase to 5.61 percent in 2019, with an average growth rate of 5.41 percent annually (Nigeria, NBS 2015). In recent years, growth has been driven primarily by the service and agriculture sectors, with almost 70 percent of the overall growth attributable to these sectors. The growth rate of the industrial sector increased slightly in 2014 and then dropped in 2015.[2]

Turning to the agriculture sector, the country's agricultural statistics show the potential of the sector in achieving the country's development agenda, especially in the areas of the UN SDGs. According to the most recent general household survey report from the country's National Bureau of Statistics and the World Bank (Nigeria, NBS and World Bank 2016), agriculture is the most prevalent income-generating activity in the majority of Nigerian households. Furthermore, the sector continues to make important contributions to the country's overall GDP and has been a key source of economic growth in

---

[2] Adesugba and Mavrotas (2016a, 2016b) provide further discussion.

recent years. It contributed the most to the nation's overall GDP among the non-oil sectors. In the third quarter of 2016, it contributed 28.65 percent of overall real GDP, about 2 percent higher than its corresponding share in the same quarter in 2015 (Nigeria, NBS 2016). Such statistics show that the most important source of growth in Nigeria in recent times has been the agriculture sector. The revitalization and sustenance of this sector are therefore key to the achievement of the SDGs, particularly those that are focused on poverty eradication and zero hunger.

Agriculture is the mainstay of the rural Nigerian economy. Value-added agriculture accounts for an average of 41.70 percent of GDP (Nigeria, NBS 2010), and nearly 70 percent of the labor force is engaged in agricultural or resource-based activities (Nigeria, FMARD 2007). More than 80 percent of the Nigerian poor live in rural areas (Udofia and Essang 2015; Kolawole and Torimiro 2006; Ekong 1999), and their livelihoods critically depend on natural resources and the environment for agriculture, livestock, and other basic requirements (Barbier 2010; Nigeria, FMEH&UD 2008; Lufumpa 2005).

In recent years, the government of Nigeria has renewed its efforts to refocus the agriculture sector in order to ensure sustained improvement in poverty reduction and the food and nutrition security of its citizenry, and thereby achieve the MDGs of poverty eradication and zero hunger (MDGs 1 and 2). To this end, the government vigorously pursued an agricultural strategy known as the Agricultural Transformation Agenda between 2011 and 2015. At the heart of the agenda were the strategies of promoting agriculture as a business, enhancing private-sector investment in agriculture, reducing postharvest losses, and encouraging value addition. It also sought to enhance access to financial services and markets, especially among the most vulnerable (women and youth), and to develop rural infrastructure and institutions (Nigeria, FMARD 2011). Proponents of the strategy strongly argued that its successful implementation would help transform Nigeria from a country dependent on food imports to one that can feed its people as well as export both raw and processed agricultural products.

Land use in agriculture in Nigeria can be broadly classified into four categories: crop production, animal husbandry, fisheries, and forestry/agroforestry (USAID 2002). Environmental challenges emerging from the sector include deforestation, soil erosion, desertification, and land and water pollution

(UN 2005; USAID 2002). The Nigerian agriculture sector is struggling to meet growing food demand, especially in the expanding urban centers. In response, the sector has intensified production on existing land and brought more land under production (Fasinmirin and Braga 2009). New land under production comes from areas of less intensive use or previously unexploited land such as savanna, forest, or swamp (USAID 2002). The rapid population growth in the country is forcing producers to abandon previous resource management techniques that allowed them to produce enough food for themselves with minimal impact on the environment (Omofonmwan and Osa-Edoh 2008).

Agricultural practices such as shifting cultivation and rotating crops are rarely used in Nigeria; instead, monoculture farming with extensive dependence on chemical fertilizers, pesticides, and water to increase production is widely practiced (Ehimore 2009). Intensive farming practices coupled with unsustainable water management have made agricultural lands more susceptible to desertification and erosion (Environmental Resources Management 2009; Olawumi 2009). The leaching of fertilizer from agricultural lands into water sources is causing both soil and water pollution (UN 2001; Osemeobe 1992). Massive deforestation for fuelwood gathering, logging, and agricultural activities is also creating unfavorable environmental conditions, including soil erosion, desertification, flooding, and reduced capacity for forest carbon sequestration (DFID 2009; Omofonmwan and Osa-Edoh 2008). Okoye (2009) documented that among these environmental problems, soil erosion causes the greatest loss of gross national product. Since 1995, the area impacted by gully erosion has increased by 18,395 km^2 (USAID 2002).

The agricultural mechanization policy in Nigeria has significantly altered the soil structure and quality. Mechanization through large irrigation programs, boreholes, and deep artesian wells, and the injudicious management of these structures, has led to waterlogging and increased soil salinity in some areas.[3] Such impacts reduce not only agricultural yields but also the capacity of the ecosystem to support a

---

[3] Despite the scarcity of tractors in Nigeria, their average horsepower and prices appear high. These patterns are different from the experiences in other parts of the world, such as Asia, where initially tractor horsepower was often smaller, or Latin America, where farmers were better endowed with land and wealth. In Nigeria, joint ownership of tractors is rare, and formal loans are often unavailable due to high transactions costs—see Takeshima (2016) and Takeshima and others (2015) for further discussion. See also Takeshima, Adeoti, and Popoola (2016) for a recent assessment of irrigation issues in the Nigerian

diversity of flora and fauna (Environmental Resources Management 2009; UN 2001; Titilola 2000). Thus, biodiversity loss is one of the most serious environmental problems brought about by agricultural mismanagement in Nigeria. This is an important illustration of how policies from many sectors can have unintended environmental consequences.

Another practice with environmental consequences is the pastoral livestock system used by farmers in several states of Nigeria (Titilola 2000). This practice involves moving a large number of animals from one corridor to another, exerting significant pressure on soil, rangeland, and woody vegetation, which in turn causes soil erosion and desertification, especially during drought periods.

The challenges faced by the agriculture sector in Nigeria are typical of the environmental situation in many developing countries, particularly those in Africa south of the Sahara. Table 3.1 summarizes the environmental problems emerging from the country's agricultural system.

Table 3.1 Environmental problems generated by agriculture

Agricultural practice	On-site effects	Off-site effects (externalities)	Global effects (externalities)
Intensive agriculture	• Soil degradation (salinization, loss of organic matter) • Waterlogging • Leaching • Desertification	• Ground water depletion • Agrochemical pollution • Loss of local biodiversity (natural and agricultural)	• Greenhouse gas emissions • Animal diseases • Loss of in situ crop diversity and biodiversity
Extensive agriculture	• Nutrient depletion • Soil erosion on site • Soil desertification	• Downstream effects of soil erosion (reservoir siltation) • Hydrological change (loss of water retention in upstream areas) • Pasture degradation in common property areas	• Reduced carbon sequestration (storage) due to deforestation and carbon dioxide emissions from forest fires • Loss of biodiversity

Source: Adapted from Andersson and D'Souza (2014).

Environmental problems arising from the agriculture sector require proper attention and consideration in both national environmental policies and agricultural and rural development policies for sustained development. The next section provides an overview of how environmental considerations are addressed in Nigerian agriculture and rural development polices.

---

agriculture sector.

4. ENVIRONMENTAL CONSIDERATIONS IN AGRICULTURE AND RURAL DEVELOPMENT POLICIES

Broadly, the goals of the current agricultural and rural development policies in Nigeria include self-sufficiency in food production, modernization of the agricultural production system, generation of employment opportunities for rural people, development of physical infrastructure in rural areas, and promotion of exports (ARCN 2008; Babu et al. 2017). All agricultural and rural development policies since 1988 have incorporated similar objectives. The Nigerian government has adopted various strategies to achieve its targets for agricultural and rural development, many of which have environmental implications. A host of strategies have been adopted to increase agricultural output, including, among others, modernizing agricultural production through improved technologies and management techniques, adopting improved seeds, increasing the productivity of cultivated land, enhancing the use of fertilizers, establishing irrigation systems to bring more land under cultivation, and increasing the aggregate area under cultivation (Titilola 2000).

Earlier agricultural policy documents, from 1960 to 1989, did not discuss or thoroughly analyze the environmental consequences of agricultural policy, guidelines, and strategies (Osomeobe 1992). Further, environmental considerations were not taken into account in prioritizing the country's agricultural and rural development goals. However, the agriculture policies implemented since 2001 have explicitly mentioned the environmental objectives of protecting and improving agricultural land resources, and preserving the environment for sustainable agricultural production (Nigeria, FMARD 2002). Similarly, the National Economic Empowerment and Development Strategy II (NEEDS II), implemented in 2007 (Nigeria, NPC 2007), aims to address its agricultural development objectives through diversifying the economy, enhancing food security, generating employment, establishing economic linkages, encouraging exports, and reducing poverty (Nigeria, FMAWR 2009).

One of the major policy thrusts of NEEDS II is to establish a safe and healthy environment that sustainably secures the economic and social well-being of Nigerians. NEEDS II also includes the Environmental Renewal and Development Initiative, which embraces the larger goals of taking inventory

of Nigeria's natural resources, evaluating environmental damage, designing and implementing restoration and rejuvenation measures, and reducing further deterioration of the environment (for details, see Nigeria, NPC 2007). In addition, NEEDS II also identifies the role of the private sector in protecting environmental resources (air, water, land, and so on) and maintaining the environmental balance. Thus, environmental concerns are a part of broader national goals and agricultural policies in Nigeria in recent years, including the Agricultural Transformation Agenda and the Agriculture Promotion Policy. Yet these policies seem to fall short of defining specific strategies to reduce the environmental consequences of growth-oriented agriculture and rural development.

The National Policy on Integrated Rural Development, implemented since 2001, emphasizes promoting rural production activities, developing human resources, enhancing rural infrastructure, designing special programs for targeted groups, and promoting rural community organizations and mobilization. However, there are no explicit provisions relating to the sustainable management of the environment or the natural resources on which agriculture and rural development depend. In a similar vein, the agriculture section of the Vision 2020 policy does not identify environmental problems pertaining to agriculture in its list of agriculture-related issues and challenges (Nigeria, NPC 2010, 54). Among the 16 objectives identified in the Vision 2020 policy document, only 1 relates to addressing the problems of soil fertility, water pollution, and environmental degradation by 2011. The term *environmental degradation* is not defined precisely in this document, targets and goals for reducing environmental degradation are not specified, and promotion of sustainable agricultural practices is not discussed in the entire policy.

In 2003, leaders of the African Union made the first Comprehensive Africa Agriculture Development Programme (CAADP) declaration as part of the New Partnership for Africa's Development (NEPAD) in Maputo, Mozambique. The declaration was a major step toward developing a common policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth, and prosperity in Africa. The environment is a key issue across the CAADP's four pillars of focus. Building on this commitment, each participating country developed a National Agriculture

12

Investment Plan to deliver on each commitment. CAADP has been a major continentwide sectoral program, but countries have also developed their own programs. Nigeria is no exception, and its Agricultural Transformation Agenda, initiated in 2011, is a good example of such programs.

The agenda focused on transforming the agriculture sector, with environmental considerations given important consideration. In fact, at the time of the project's conception, its environmental and social impacts and benefits were analyzed through a detailed strategic environmental and social assessment in line with the requirements of Nigerian environmental regulations. The African Development Bank also assessed the potential negative environmental impacts of the agenda. Similarly, with enactment of the new government's Agriculture Promotion Policy 2016–2020, environmental considerations have not been downplayed; however, similar to those of previous sectoral polices, its targets on the environment remain unclear.

All agricultural policies in Nigeria are growth oriented; they promote intensification of agriculture, high-yielding varieties and breeds, mechanization, and other modern inputs such as fertilizers and pesticides. Recent policies, particularly after 2000, have made efforts to include environmental concerns in their objectives. However, they lack specific targets for programs and projects to address environmental issues and challenges. Further, environmental concerns documented in agriculture and rural development policies are frequently ignored when it comes to implementation. One key issue for the agriculture and rural development sector in Nigeria is to find the best approach to reach environmental goals while also achieving agricultural growth and rural development. For sustained agricultural and rural development, Nigeria must account for the environmental impacts of its development policies (Titilola 2000). Yet the country's Federal Ministry of Environment remains primarily responsible for addressing all the environmental challenges while other ministries focus on their own sectoral goals, ignoring the cross-cutting environmental issues (Olawumi 2009). Furthermore, coordination among the different agencies appears to be a problem when more than one sector is involved in addressing the same environmental issue (Olawumi 2009).

Environmental analysis or environmental impact assessment is required on paper in Nigeria; however, its execution in practice—before and after the completion of programs and projects—is very limited (Ogunba 2004). This disconnect between identifying environmental challenges as a part of policy documents and addressing them in practice largely depends on how such issues are considered during the policy process. Understanding the factors that enable policy professionals to include environmental considerations in their analysis and program implementation can help identify the challenges in the policy process.

The next section describes the conceptual framework used to understand the factors that influence the inclusion of environmental issues in policies. Through this framework, we consider individual, organizational, and system-level characteristics of the agriculture sector at key stages of the policy process.

Conceptual Framework

This section presents the conceptual framework used to examine how and to what extent environmental concerns are integrated into the policy process of the agriculture sector of Nigeria and whether the EPI principle is reflected at different levels of decision making in the country. Using the framework, we identify various factors that influence the incorporation of environmental considerations into the policy process, and we derive implications for program and policy design. To achieve desired development outcomes, it is important to understand how policy processes bring about change in societies. In the context of EPI, we need a better understanding of how policy systems develop and operate to address challenges to the environment along with food and nutrition insecurity. How do some policy systems fail, whereas others reach desired outcomes more smoothly? These questions inform the conceptual framework.

Studying the policy process is increasingly recognized as an approach to improve the effectiveness and efficiency of policy development and program implementation (Sabatier 2007; Watson 2013; Meier 1991). There are several reasons for understanding how policies are made, implemented, and revised (Rausser and Swinnen 2010; Bates and Block 2010). First, it helps us to understand the capacity

gaps in the policy system, highlighting areas in which government can divert its limited resources to increase the impact of its policies. This understanding is important because the nature and speed of policy reforms depends on the capacity of the individuals and organizations involved in the policy process. Second, policy process analysis allows us to understand the issues from various perspectives, thereby improving outcomes. Third, it allows us to identify areas in which evidence can be used to improve policy outcomes. Finally, increased evidence can help in reducing politicization of the policy process, making it more evidence based. The aim of studying the policy process of Nigeria is to identify inefficiencies, capacity gaps, and overlaps that prevent a country from reaching optimal outcomes, particularly in the context of environmental degradation.

The simplest model for analyzing the policy process is the linear model, which involves six sequential stages that move in a cycle that repeats itself: agenda setting, policy formulation, stakeholder discussions, implementation, impact monitoring, and policy revision. This top-down way of looking at the policy process is often criticized for being too simplistic (Babu 2013; Sabatier 2007). Subsequently, models such as the interactive policy process model, the multiple stream approach, the rational choice model, and the learning and diffusion model were developed to give more nuanced perspectives on policy processes (Sabatier 2007; Kingdon 1984; Court and Young 2006; Ostrom 2011). Babu (2013) argued that these models may not be suitable for developing-country contexts and went on to show how a combination of elements from each of the existing models can be used to develop a stylized framework. This paper adapts the kaleidoscope model developed by Resnick and colleagues (2015) and the stylized framework of Babu (2013) to fit the case of Nigeria's agricultural transformation.

To develop a framework to analyze Nigeria's efforts in integrating environmental considerations into the policy process, we use the kaleidoscope model as the starting point because it helps in identifying the different stages of the policy process and the stakeholders involved at each point. Table 4.1 shows the different stages of the policy process, contextual factors, and the key determinants of policy change in the context of the Agricultural Transformation Agenda and the Agriculture Promotion Policy initiated in Nigeria in recent years.

15

Table 4.1 Applying the kaleidoscope model to the integration of environmental considerations into the policy process of Nigeria

Policy stage	Determinants of policy change	Hypothesis testing in the context of environmental considerations in the agricultural policy process	Application to Nigeria
Agenda setting	1. Recognized, relevant problem	A relevant problem is identified by a concerned constituency based on credible evidence or popular perception.	Nigeria is signatory to various international commitments on environmental conservation and has taken a number of steps to incorporate these commitments into its agricultural policy process. *Relevant indicator: envinnap (whether environmental issues that affect agricultural development are treated as part of the National Agricultural Policy)*
	2. Focusing event	A well-defined event focuses public attention on a problem or creates a window of opportunity for policy change.	Activities at the global level, such as the meetings and conferences leading to the Paris Declaration, were focusing events during development of the ATA and the APP. But they had little influence beyond those who were part of the events. *Relevant indicator: envinnap*
	3. Powerful advocates	Strong individuals, organizations, or companies support a new or changed policy to key decision makers.	The government, particularly FMARD, and international organizations have been advocates for conservation of the environment and biodiversity since 2001. *Relevant indicators: envinnap, policyinv (individual's policy involvement)*
Design	4. Knowledge and research	Evidence-based knowledge shapes feasible design.	Although the importance of evidence-based policy is well understood, Nigeria has limited capacity for knowledge and research in the agriculture sector. *Relevant indicators: learnresource (individual has adequate learning resources on the job), educ (individual's education), res_univ_dummy (individual works at a research institute or university)*
	5. Norms, biases, ideology, and beliefs	Beliefs and biases shape the range of design features that are acceptable.	Though Nigeria is facing a number of environmental problems, it also has a rapidly increasing population, for which agricultural production needs to increase. This dilemma makes it difficult to get all stakeholders on the same page. *Relevant indicators: res_univ_dummy, parastat_dummy (individual works at a parastatal), min_dummy (individual works at the ministry)*
	6. Cost-benefit calculations	Expected costs and expected benefits (political, economic, social, environmental) determine preferred design.	All policies in Nigeria are assessed on the environmental costs and benefits they may cause. The African Development Bank conducted a strategic environmental and social assessment of the ATA in 2013. *Relevant indicators: educ, yearonjob (years of experience in the job), res_univ_dummy, learnresource*

Table 4.1 Continued

Policy stage	Determinants of policy change	Hypothesis testing in the context of environmental considerations in the agricultural policy process	Application to Nigeria
Adoption	7. Powerful opponents versus proponents	For a policy to be adopted, supporters must be relatively more powerful than opponents. For it to *not* be adopted, opponents must be relatively more powerful than supporters.	The government and international organizations were committed to adoption of the ATA and the APP. Both groups were supportive of environmental issues in general. Yet the inclusion of relevant stakeholders, such as CSOs, who had more commitment to the environment was limited. *Relevant indicators: educ, yearonjob*
	8. Government veto players	For a policy to be adopted, government agents with ultimate decision-making power must be supportive or neutral. For it to be vetoed, government agents with ultimate decision-making power must be opponents.	Former president Goodluck Jonathan initiated the ATA, and current president Muhammadu Buhari has built on those efforts through the APP. However, over time the emphasis on environmental considerations has not increased. *Relevant indicators: min_dummy, policyinv, yearonjob*
	9. Propitious timing	Supporters wait for opportune moments (political, economic, social) to push policy change.	In this case, with the change in government there was very little change in the environmental considerations within Nigeria's transformation agenda. *Relevant indicator: envinnap*
Implementation	10. Requisite budget	Government or donors provide funds sufficient to carry out the new policy or program as intended.	Although several agricultural programmatic issues were identified for special funding under the ATA, no specific requirements were identified under either the ATA or the APP. *Relevant indicator: learnresource*
	11. Institutional capacity	Government, organizations, or companies are available and able to practice and manage the new policy or program as it was intended.	The institutional capacity of the policy system to deal with environmental issues was initially weak under both the ATA and the APP. However, new capacity that was mobilized under the ATA, such as the leaders of the value chains, had considerable understanding of the effects of their commodity development plans on the environment and sustainability. *Relevant indicators: univ_dummy, parastat_dummy, min_dummy, learnresource*
	12. Implementation-stage veto players	Designated implementers—from the private sector, NGOs, or local agencies—have both incentives and willingness to implement the policy program.	There were no veto players for environmental issues due to a general recognition of the issues that were important; this was more to do with capacity, both human and financial (see determinants 10 and 11). *Relevant indicators: educ, gender (individual's gender), agintervention (individual is aware of agriculture / rural development program), yearonjob*
	13. Commitment of policy champions	Strong individuals, organizations, or companies continue to publicly support the program.	Environmental issues entered the agricultural development process though land, soil, water, and energy considerations. Although land degradation had some champions in the research community, its support was limited in the policy community. *Relevant indicators: educ, gender, agintervention, yearonjob*

Table 4.1 Continued

Policy stage	Determinants of policy change	Hypothesis testing in the context of environmental considerations in the agricultural policy process	Application to Nigeria
Evaluation and reform	14. Changing information and beliefs	New learning emerges that impacts how decision makers believe the policy/program should be structured.	Due to the commodity orientation of the ATA and APP, there were very limited opportunities for learning and information-based change in the belief systems of those involved in the policy process. *Relevant indicator: educ*
	15. Changing material conditions	Available resources, technology, or policy relevance has changed since the policy was originally implemented.	Although the allocation of general resources to the agriculture sector has increased, there has not been any special effort to reallocate some of these resources to environmental issues facing the sector. *Relevant indicator: policyinv*
	16. Institutional shifts	New actors enter the policy arena as a result of elections, cabinet reshuffling, or new staffing.	More recently, CSOs and farmer organizations have entered into environmental debates involving the agriculture sector. But their presence was limited during development of both the ATA and the APP. *Relevant indicator: polcyinv*

Source: Based on Resnick and others (2017); Babu and others (2014).
Note: APP = Agriculture Promotion Policy; ATA = Agricultural Transformation Agenda; CSO = civil society organization; FMARD = Federal Ministry of Agriculture and Rural Development; NGO = nongovernmental organization.

Using this framework and a selected set of parameters of the kaleidoscope model, we aim to develop an understanding of the policy process of Nigeria's food and agriculture sector, and analyze the extent to which environmental considerations are taken into account. We use extant data to examine the level of policy involvement and the capacity of professionals employed in key institutions participating in the policy process. Further, we also aim to understand how environmental issues translate from policy development to implementation. This analysis will help us identify capacity and institutional gaps in the policy process, and inform possible ways to fill them. Building on this framework, the next section presents our data collection methodology and the model specification used to develop our results.

5. METHODOLOGY

Data

The paper uses an extant dataset collected through a survey of professionals in the Nigerian public sector, conducted in collaboration with the Federal Ministry of Agriculture and Rural Development (Sanyal and Babu 2010). The data were collected in 2010 and are still valid because the political situation in the policy-making environment in Nigeria has not changed since 2010 and factors considered for this analysis remain relatively stable. These data were collected to assess improvement in the knowledge base on food security policies as well as how enabling the environment is in agriculture and rural development.

Several consultative meetings and workshops with stakeholders helped to identify the government institutions, public financial institutions, research institutes, and universities that are involved in the agricultural policy-making process. Three stakeholder meetings took place between February 2008 and May 2009. The first stakeholder meeting was for participants from the Federal Ministry of Agriculture and Water Resources, the Federal Ministry of Women's Affairs and Social Development, the National Planning Commission, farmer organizations, development partners, and academic and research institutions.

The selected institutions are located in the Abuja (federal capital), Oyo, Kaduna, Enugu, Ogun, Benue, and Abia states of Nigeria. Data were collected from a random sample of professionals working in these purposefully selected institutions. A total of 320 individual questionnaires were administered, yielding 183 individual responses. The questionnaire included information on respondents' professional background and level of involvement in the agricultural and rural development policy process, as well as other relevant information such as individual experiences and satisfaction with the agriculture and rural development policy process, institutional incentives available to the respondents, and whether the individual's work included environmental issues and analysis. The qualitative information collected was used to validate empirical evidence.

The present study considers three groups of explanatory variables. The first group includes variables representing individual attributes such as gender, education level, job experience, involvement in environmental analysis or issues at work, and level of involvement in the agriculture and rural development policy process. The second group concerns the individual's perception of organization culture and includes the person's perceptions about income security, job security, resource availability, the performance appraisal system, and so forth. The final group includes variables on the enabling environment, such as whether the environmental issues affecting agricultural development are treated as part of the agricultural policy, whether the government reviews and amends existing policies in agriculture and rural development to include environmental sustainability, and the government's efforts to include environmental sustainability in the policy process.

Table 5.1 provides an overview of the descriptive characteristics of the respondents. Most (79 percent) are male, indicating a gender imbalance within the agricultural policy process in a nation in which the population is split nearly evenly between the genders (Nigeria, National Population Commission 2006). Approximately 14 percent of the professionals surveyed were engaged in designing and developing a policy, and 60 percent reported being involved in the implementation or the monitoring and evaluation of agricultural policies. The remaining 26 percent were involved in the policy process via activities other than design, development, implementation, and monitoring and evaluation. The majority of the professionals in the policy process had an advanced degree, with nearly 46 percent holding a master's degree, about 26 percent a PhD, and around 26 percent a bachelor's degree. Only 1.47 percent had only a diploma. Around 55 percent of the professionals were affiliated with research institutes and universities, 31 percent with parastatal organizations, and the remaining 14 percent worked directly in the Ministry of Agriculture. The professionals interviewed had an average job experience of 13.26 years.

Table 5.1 Descriptive characteristics of the sample

Variable	N	Environmental issues/analysis at work	
		Yes	No
Gender	*141*	*111 (78.72♀)*	*30 (21.28)*
Male	112 (79.43)	88 (78.57)	24 (21.43)
Female	29 (20.57)	23 (79.31)	6 (20.69)
Policy involvement	*129*	*104 (80.62)*	*25 (19.38)*
Designing	14 (10.85)	13 (92.85)	1 (7.14)
Developing	4 (3.10)	4 (100.00)	0 (0.00)
Implementation	53 (41.08)	42 (79.24)	11 (20.75)
Monitoring	24 (18.60)	20 (83.33)	4 (16.66)
Others	34 (26.36)	25 (73.52)	9 (26.47)
Type of institution	*140*	*110 (78.57)*	*30 (21.43)*
Research and university	77 (55.00)	64 (83.12)	13 (16.88)
Parastatal	43 (30.71)	34 (79.07)	9 (20.93)
Ministry	20 (14.29)	12 (60.00)	8 (40.00)
Awareness of agriculture and rural development intervention programs	*133*	*105 (78.95)*	*28 (21.05)*
Yes	125 (93.98)	101 (80.80)	24 (19.2)
No	8 (6.01)	4 (50.00)	4 (50.00)
Education	*136*	*108 (79.41)*	*28 (20.59)*
Diploma	2 (1.47)	2 (100.00)	0 (0.00)
Bachelor's or HND	36 (26.47)	29 (80.55)	7 (24.13)
Master's level	63 (46.32)	48 (76.19)	15 (23.80)
PhD level	35 (25.73)	29 (82.85)	6 (17.14)
Average job experience	141	13.26*	

Source: Authors.
Note: * indicates mean. ♀ Numbers inside parentheses are percentages. HND = higher national diploma.

Although the magnitude of difference between the percentages of male and female professionals undertaking environmental analysis in their work is small, in this sample female professionals tend to consider environmental analysis more than male professionals do. The tabular analysis presented in Table 5.1 also shows that professionals involved in implementation are relatively less involved in environmental analysis than are the professionals involved in designing and developing policies. Similarly, professionals involved in monitoring and evaluation undertake less environmental analysis than do those involved in the design and development of policies. It should be noted that in this sample, the professionals in research institutions and universities consider environmental analysis more in their work than those in parastatal organizations and the ministry.

In summary, the sample is made up of well-educated professionals with a good amount of job experience in research, institutions, universities, parastatal organizations, and the government ministry, who are engaged in one or more phases of the policy process.

Model Specification

In this paper, we use a logit regression model to explain the extent to which professionals involved in the agricultural policy process consider environmental factors in their work. A large body of literature recognizes that linear regression is inappropriate when the dependent variable is binomial (Agresti 2010; Wooldridge 2009; Kleinbaum et al. 2007). The assumption of a linear relationship between the dependent variable and the explanatory variable, and the homoscedastic error term in ordinary least squares (OLS) regression, may not hold when there are only two categories for the dependent variable. Furthermore, OLS with a binomial or dichotomous dependent variable will predict values outside the actual range of the dependent variable. Because the dependent variable of this study is dichotomous (yes/no), this paper uses the logit model for data analysis. The dependent variable will be a yes/no question, in which yes is coded as 1, meaning the individual incorporates environmental issues/analysis in his or her work, and no is coded as 0.

Let Y_i denote an unobserved, continuous dependent variable, X_i an observed independent variable, ε_i a logistically distributed error term that is uncorrelated with X, and β a slope parameter to be estimated for an observation, i. Further, let Y_i^* be the observed binary variable, where

$$Y_i^* = \begin{cases} 1 & if\ the\ i\text{th}\ individual\ could\ include\ environmental\ issues/analysis\ in\ work, \\ 0 & otherwise. \end{cases}$$

Then a regression model will be

$$Y_i^* = \beta X_i + \epsilon_i, \tag{1}$$

where X_i is the vector of independent variables describing the enabling environment, individual characteristics, and the organizational or institutional culture. Thus, we will estimate the slope parameters, β, in this model. They denote the effect on the dependent variable of a unit change in independent variable X. The probability associated with the binomial dependent variable in a logit model is

$$p(Y^* = 1|X_i) == \left[\frac{e^{\beta X}}{\left(1 + (e^{\beta X})\right)} \right]. \tag{2}$$

The parameters, β, are estimated by maximum likelihood (Agresti 2010; Wooldridge 2009; Kleinbaum et al. 2007).

6. RESULTS AND DISCUSSION

Table 6.1 presents the definitions and descriptive statistics of only those variables that are included in the final models. Given the binomial and ordinal nature of the data for a majority of the variables, median and mode (not mean) are the appropriate measures of central tendency. It is clear from Table 6.1 that the distributions of *envanalysis* (the dependent variable) and other variables including *learnresource, envinnap, parastat_dummy, min_dummy*, and *gender* are skewed. The median level of education is a master's degree and the average length of job experience is 13.61 years in the final sample defined for running the models.

Table 6.1 Definitions and descriptive statistics of variables

Variable	Variable type	Description	Med.	Mode	Mean	St. dev.	Range
envanalysis (dependent variable)	dummy	= 1 if individual can incorporate environmental issues in work; otherwise 0	1	1	0.82	0.38	0–1
Individual characteristics indicators							
educ	categorical	Highest education level: 1. Diploma, 2. BSc or HND, 3. Master's or equivalent, 4. PhD	3	3	2.95	0.76	1–4
gender	dummy	= 1 if female; otherwise 0	0	0	0.20	0.40	0–1
policyinv	categorical	Individual's involvement in the policy process: 5. Design, 4. Development, 3. Implementation, 2. Monitoring and Evaluation, 1. Other	3	3	2.52	1.18	1–5
agintervention	dummy	= 1 if individual is aware of agriculture / rural development program; otherwise 0.	1	1	0.97	0.17	0–1
yearonjob	continuous	Years of experience in job	14	15	13.61	8.49	1–32
Enabling environment indicators							
envinnap	dummy	= 1 if environmental issues that affect agricultural development are treated as part of the National Agricultural Policy; otherwise 0	1	1	0.64	0.48	0–1
Organizational culture indicators							
res_univ_dummy	dummy	= 1 if individual works at a research institute or university; otherwise 0	1	1	0.51	0.50	0–1
parastat_dummy	dummy	= 1 if individual works at a parastatal organization; otherwise 0	0	0	0.33	0.47	0–1
min_dummy	dummy	= 1 if individual works at ministry; otherwise 0	0	0	0.16	0.37	0–1
learnresource	categorical	Individual is given adequate learning resources to carry out duties: 1. Strongly disagree, 2. Disagree, 3. Not sure, 4. Agree, 5. Strongly agree	2	2	2.53	1.33	1–5

Source: Authors' calculations.
Note: HND = higher national diploma.

Dummy variables are included in the models for three types of organizations to which the respondents belong: research and university, parastatal, and ministry. The purpose of the institutional dummy variable is to explain variations in the organizational culture of these different institutions. Controlling for gender allows us to examine the respective behavior of male and female professionals in integrating environmental concerns in their work. Relevant information on agricultural and rural development programs, and knowledge of the possible environmental consequences emerging from these programs, may be a triggering factor to incorporate environmental analysis. This effect is captured by a dummy variable, *agintervention,* which measures respondents' awareness of agriculture and rural development intervention programs. Further, individuals' roles and responsibilities in the policy process can be a crucial factor in their ability to integrate environmental analysis as part of their job responsibilities. Respondents' roles and responsibilities are categorized in the variable *policyinv*. Table 6.1 provides descriptions of these dummy variables and their corresponding codes.

Professionals associated with the design and development of agricultural policies may have a better opportunity to include environmental analysis in their work than those involved in implementation. Similarly, professionals involved in monitoring policies and programs, because these activities are undertaken after the policies are implemented, may also have a better opportunity to include environmental analysis. This effect is controlled in the models through a categorical variable, *policyinv*, that indicates whether the respondent is involved in policy design, development, implementation, monitoring and evaluation, or other activities (that are related to the policy process but do not fall under one of the other four categories). It should be noted that resource availability and accessibility are crucial factors for undertaking any job responsibilities. Among the several indicators concerning job resources, availability of learning resources is one. We use this indicator to investigate the effect of learning resources on incorporating environmental analysis in the work of the policy professionals. The other two explanatory variables, *educ* and *yearonjob*, could also influence professionals to include environmental analysis in their work. We controlled for several other variables representing the organizational culture of the institution and the overall enabling environment, including the performance evaluation system and

political interference in undertaking job responsibilities. These variables were not found to influence the

model significantly and are not discussed here. Table 6.2 presents the results from the logit model.

Table 6.2 Econometric results

Variable	Model 1	Model 2
envinnap	1.678 (0.785♀)**	1.993 (0.942)**
res_univ_dummy	3.539 (1.113)***	3.185 (1.192)***
parastat_dummy	1.548 (0.951)*	1.342 (0.994)
agintervention	3.517 (1.488)**	3.020 (1.478)**
policyinv	2.333 (1.194)**	0.932 (0.436)**
learnresource	0.549 (0.302)*	0.507 (0.313)*
gender	2.333 (1.194)**	1.765 (1.177)
yearonjob	n.a.	-0.079 (0.048)*
educ	n.a.	0.015 (0.555)
constant	-8.245 (2.441)	-6.794 (2.794)
N	100	100
LR chi^2	29.85	33.01
Prob chi^2	0.0001	0.0001
Log likelihood	-32.216	-30.636
Pseudo R^2	0.317	0.350
AIC	80.430	81.272
BIC	101.272	107.324

Source: Authors' calculations.
Note: ***, **, and * denote significance at 1, 5, and 10 percent, respectively. ♀ Standard errors are in parentheses. gender in the second model is significant at 13 percent. AIC = Akaike information criterion; BIC = Bayesian information criterion; LR = likelihood ratio; n.a. = not applicable.

First, in both models, we find *envinnap* significant at 5 percent, indicating that when

environmental issues affecting agricultural development are treated as a part of the broad national

agricultural policy, the probability of incorporating environmental analysis into one's job responsibilities

and work assignments increases. Thus, to trigger environmental analysis and discussions at each level,

environmental concerns and issues need to be first embraced by the broader policies relating to

agricultural development. Second, we find *res_univ_dummy* significant at the 1 percent level in both

models. The probability of undertaking environmental analysis increases when the professional belongs to

a research or university system rather than a federal ministry. The variable *parastat_dummy* is significant

in the first model at 10 percent, showing that professionals belonging to parastatal organizations are more

likely to incorporate environmental analysis in their work than professionals working for the ministry. In

both models, we find the variable *agintervention* significant at the 5 percent level, indicating that when professionals are well informed about agricultural and rural interventions, the probability of undertaking environmental analysis increases. In the first model, the *gender* variable is significant at 5 percent, showing that female professionals are more likely to undertake environmental analysis than male professionals.

We control for the effects of two additional variables in the second model: *educ* and *yearonjob*. The variable *educ* is not significant, a result that was not expected; still, the association between *educ* and the dependent variable is positive, indicating that having advanced education helps employees to undertake environmental analysis. The *yearonjob* variable is negatively significant at 10 percent, a result that we did expect. Younger people are generally more aware of environmental issues than older people and hence more likely to undertake environmental analysis. Further, environmental education and policy integration became a hot topic in the global arena only after 1992. Therefore, more experienced professionals may not have been sufficiently exposed to environmental education and the methodologies of environmental assessments, particularly in the context of developing countries. In addition, younger professionals may have greater methodological know-how and therefore be more inclined to undertake environmental analysis. Two variables, *parastat_dummy* and *gender*, lose their significance when *educ* and *yearonjob* are added to Model 2. Based on the Akaike information criterion, the first model statistically best fits the data.

7. POLICY IMPLICATIONS

Although most studies on EPI pertain to developed countries, this paper adds value to the literature on EPI by providing a contextual result related to the sectoral policies of a developing country. In doing so, the paper seeks to understand the factors influencing the incorporation of environmental analysis in the agriculture and rural development policy process in Nigeria. We apply the kaleidoscope model for policy process analysis and use survey data on agricultural and rural development professionals from selected institutions to arrive at our results (Resnick et al. 2015). The results show that a number of factors significantly influence the incorporation of environmental analysis in the work of professionals involved in the policy process. Based on the kaleidoscope model and our data analysis, we derive several policy implications. The model provides a framework for policy analysis that can be used to ensure better integration of environmental considerations into agricultural policies.

In Nigeria, environmental issues are often considered at the agenda-setting stage of the kaleidoscope model. Such issues are well recognized and have some powerful advocates, but there are few focusing events at the national level to drive the agenda. Thus, there is little motivation to follow through on environmental considerations of policies.

In order for environmental issues and concerns to be taken seriously throughout the policy process, it is necessary that broader policy documents recognize these issues explicitly. Therefore, environmental issues should be considered at the design stage. The Environmental Impact Assessment Decree (no. 86 of 1992) mandates that all major policies undergo an environmental impact assessment; however, there is little follow-up after the first assessment is completed.

When agricultural policy leaders make commitments to develop or facilitate EPI in broad development strategies and policy documents, the probability of incorporating environmental analysis increases. Empirically, very little evidence is available to support this argument, but several authors have alluded to the interconnection between the broad policy statements and incorporation of environmental issues and analysis in planning and program development (Nilsson and Eckerberg 2007; Persson 2004; Keeley and Scoones 2000). Therefore, policy champions can play a major role in pushing and following through the environmental agenda.

Another major factor that influences incorporation of environmental analysis in the agriculture and rural development policy discussion relates to the organizational culture of key institutional actors in the policy process. It is expected that professionals from academic and research institutions are more likely to incorporate environmental analysis than those in public-sector organizations. In our study, both models show that professionals affiliated with research institutes and universities are more inclined to undertake environmental analysis as a part of their policy analysis work than those who work for the government ministry. In most developing countries, the practice of evidence-based policy making is rare (Hansohm 2002, 2007). The lack of evidence-based policy making indicates a lack of consultation and coordination between, on the one hand, academic and research institutions, and on the other hand, the policy decision-making organizations. The distinct organizational cultures of academic and research institutions versus public-sector organizations indeed play a significant role in determining whether environmental analysis is taken into consideration in their professionals' work. This finding points to the need for regular consultative efforts between public-sector policy makers and professionals in academic and research institutions. Further, it also speaks to the need for organizational transformation in the public sector toward incorporating environmental considerations into procedural work, a step necessary for the effective integration of environmental issues into sectoral policy discussions. These efforts would help in the adoption stage as well, by developing powerful opponents and proponents of environmental considerations, initiating healthy debate in the policy process. Moreover, this transformation would also help in building institutional capacity at the implementation stage of the policy process.

Broad understanding of agricultural interventions and their possible environmental consequences will enable integration of environmental analysis into the policy process. Both of the models in this study show that a knowledge of agricultural and rural development programs significantly influences the undertaking of environmental analysis. Our results suggest that information sharing about different agricultural and rural development interventions, and discussions about their possible environmental consequences, should be facilitated and encouraged in the broad policy framework and among stakeholders. Here too, key focusing events involving various stakeholders at the agenda-setting stage are important in order to inspire greater commitment on environmental issues.

Although integration of environmental perspectives and concerns is important at all levels, a professional's ability to conduct environmental analysis effectively in the policy process also depends on his or her role in the process. People who are involved in implementation and in monitoring and evaluation are less likely to have the opportunity to incorporate environmental analysis compared with those who are involved in designing and developing policies, plans, and programs. In our study, both of the models show that professionals who are involved in the higher levels of the policy-making process are more likely to undertake environmental analysis, indicating that a conducive environment is needed, particularly from the point of view of EPI in sectoral policies.

Environmental consideration and analysis undertaken during the design and development phase may not trickle down to the implementation phase when people at lower levels of the policy process are not likely to undertake environmental analysis. This finding calls for a special intervention to sensitize people involved in lower-level policy processes, mainly at the implementation and the monitoring and evaluation stages, about environmental issues that may emerge from policy interventions, the importance of mainstreaming the environment in the policy process, and methodologies for implementing environmental analysis.

Young and environmentally sensitized professionals are more likely to include environmental analysis as a part of their work. Integration of environmental perspectives at all levels and in all processes reached a height after the Rio Declaration in 1992. At the same time, environmental education programs were also prioritized as part of the development agenda. Further, younger people are more likely to be equipped with environmental analysis skills than older people because of their exposure to recent curricula and course contents. The implication of this finding is that a team of junior and senior professionals should be formed in order to facilitate environmental analysis in an organizational setting. The experience of senior professionals needs to be backed up with the expertise of young and innovative professionals in the policy process. Similarly, the results also suggest that women professionals are more likely to undertake environmental analysis than their male counterparts. However, this finding should be generalized with caution and needs further research.

8. CONCLUDING REMARKS

Incorporating environmental considerations into sectoral policy processes continues to be a challenge for several developing countries. A major challenge to agricultural development in Africa south of the Sahara is the lack of understanding of the roles of actors in the policy process and the drivers of policy change. Understanding the factors that facilitate integrating environmental issues and analysis at the individual, organizational, and system levels is a first step in addressing this challenge. This paper attempts to identify the role of these factors using the kaleidoscope model and survey data collected from professionals in the Nigerian agriculture sector. We use the kaleidoscope model because it provides a framework for understanding the policy processes of countries. In this paper, the model helps in analyzing the key gaps that cause environmental considerations, despite their inclusion in policy documents, to have no real effect on the ground.

Results seem to indicate that explicit mention of environmental issues and the potential environmental consequences of policies and programs as a part of the policy and strategy document is a necessary step. However, this step may not be sufficient to integrate environmental considerations into other stages of the policy process, particularly the implementation stage. Though researchers are likely to analyze environmental challenges as a part of their work, integrating their research results into the policy process will require strategic collaboration with their counterparts in policy-making organizations such as parastatals and government ministries. Such collaboration needs nurturing and should be a part of enhancing the policy process through evidence-based debate and dialogue. Young professionals are likely to be environmentally conscious and more skilled in integration of environmental issues in their work, yet they may lack the needed experience to bring the results of their work into the policy debate. Their collaboration with senior policy makers who could mentor them would increase the chances of addressing environmental considerations at the sectoral level. Further research is needed in order to explore other institutional and organizational factors that could facilitate greater integration of environmental considerations into the policy process.

REFERENCES

Adesugba, M., and G. Mavrotas. 2016a. *Delving Deeper into the Agricultural Transformation and Youth Employment Nexus: The Nigerian Case*. Nigeria Strategy Support Program Working Paper 31. Washington, DC: International Food Policy Research Institute.

———. 2016b. *Youth Employment, Agricultural Transformation, and Rural Labor Dynamics in Nigeria.* Discussion Paper 01579. Washington, DC: International Food Policy Research Institute.

The Africa Society. 2008. *Addressing Environmental Problems in Africa.* Washington, DC.

Agresti, A. 2010. *Analysis of Ordinal Categorical Data*, 2nd ed. Hoboken, NJ, US: Wiley.

Aguilar-Støen, M., A. Hansen, D. McNeill, and K. A. Stølen. 2016. "Introduction to the Special Issue: Frontiers of Research on Development and the Environment." *Forum for Development Studies* 43 (1): 1–4.

Andersson, J. A., and S. D'Souza. 2014. "From Adoption Claims to Understanding Farmers and Contexts: A Literature Review of Conservation Agriculture (CA) Adoption among Smallholder Farmers in Southern Africa." *Agriculture, Ecosystems, and Environment* 187: 116–132.

ARCN (Agricultural Research Council of Nigeria) 2008. *Agricultural Policies in Nigeria*. Abuja.

Babu, S. C. 2013. *Policy Process and Food Price Crisis: A Framework for Analysis and Lessons from Country Studies*. Working Paper 2013/070. Helsinki: United Nations University–World Institute for Development Economics Research.

Babu, S. C., E. O. Oyedipe, O. Ajakaiye, and K. Ajoni. 2017. *Strategies for Restructuring Agricultural Research Council of Nigeria: Process, Opportunities, and Lessons*. NSSP Working Paper. Washington, DC: International Food Policy Research Institute, forthcoming.

Babu, S. C., K. Gyimah-Brempong, M. Nwafor, and H. Edeh. 2014. *Capacity Assessment for Achieving the Agricultural Transformation Agenda in Nigeria*. NSSP Working Paper 26. Washington, DC. and Abuja, Nigeria: International Food Policy Research Institute. http://ebrary.ifpri.org/cdm/ref/collection/ p15738coll2/id/128472.

Barbier, E. B. 2010. "Poverty, Development, and Environment." *Environment and Development Economics* 15: 635–660.

Bates, R, and S. Block. 2010. "Agricultural Trade Interventions in Africa." *The Political Economy of Agricultural Price Distortions* (2010): 304–331.

Berger, G., and R. Steurer. 2009. "Horizontal Policy Integration and Sustainable Development: Conceptual Remarks and Governance Examples." *ESDN Quarterly Reports*. June. www.sd-network.eu/?k=quarterly% 20reports&report_id=13.

Berkhout, F., L. M. Bouwer, J. Bayer, M. Bouzid, M. Cabeza, S. Hanger, A. Hof, et al. 2015. "European Policy Responses to Climate Change: Progress on Mainstreaming Emissions Reduction and Adaptation." *Regional Environmental Change* 15 (6): 949–959.

Biermann, F. 2005. "The Rationale for a World Environment Organization." In *A World Environment Organization: Solution or Threat for Effective International Environmental Governance?,* edited by F. Biermann and S. Bauer, 117–144. Aldershot, UK: Ashgate.

Biermann, F., O. Davies, and N. V. Grijp. 2009. "Environmental Policy Integration and the Architecture of Global Environmental Governance." *International Environmental Agreements: Politics, Law and Economics* 9 (4): 351–369.

Briassoulis, H. 2005. "Complex Environmental Problems and the Quest for Policy Integration." In *Policy Integration for Complex Environmental Problems: The Example of Mediterranean Desertification*, edited by H. Briassoulis, 1–49. Burlington, VT, US: Ashgate.

Bührs, T. 2009. *Environmental Integration: Our Common Challenge.* Albany, NY, US: State University of New York Press.

Chaker, A., K. El-Fadl, L. Chamas, and B. Hatjian. 2006. "A Review of Strategic Environmental Assessment in 12 Selected Countries." *Environmental Impact Assessment Review* 26 (1): 15–56.

Clapham, W. B. 1980. "Environmental Problems, Development, and Agricultural Production Systems." *Environmental Conservation* 7 (2): 145–152.

Connor, R., and S. Dovers. 2004. "Strategic Environmental Assessment: Policy Integration as Practice or Possibility?" In *Institutional Change for Sustainable Development*, 153–173. Cheltenham, UK: Edward Elgar.

Court, J., and J. Young. 2006. "Bridging Research and Policy in International Development: An Analytical and Practical Framework." *Development in Practice* 16 (1): 85–90.

Croitoru, L., and M. Sarraf. 2010. The Cost of Environmental Degradation: Case Studies from the Middle East and North Africa. Directions in Development; Environment. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/2499 License: CC BY 3.0 IGO.

Dasgupta, P. 2008. "Nature in Economics." *Environmental and Resource Economics* 39 (1): 1–7.

DFID (UK Department for International Development). 2009. *Impact of Climate Change on Nigeria's Economy*. Abuja, Nigeria.

Ehimore, O. M. 2009. "Pre-colonial Nigerian Economy: Dynamic or Stagnant." Accessed November 25, 2010. http://www.policyri.com/pre-colonial-nigerian-economy-dynamic-or-stagnant/.

Ekong, E. E. 1999. *Rural Development and the Persistence of Poverty: First Inaugural Lecture of the University of Cross River State, Uyo*. Uyo, Nigeria: University of Cross River State.

Ellis, E., and R. Pontius. 2010. "Land-Use and Land-Cover Change." *The Encyclopedia of Earth,* edited by J. C. Cleveland. Washington, DC: National Council for Science and the Environment. Last updated March 20, 2013. http://editors.eol.org/eoearth/wiki/Land-use_and_land-cover_change.

Environmental Resources Management. 2009. *Impact of Climate Change on Nigeria's Economy*. London: Department for International Development. www.scribd.com/document/47086875/27-Impact-of-Climate-Change-on-Nigerias-Economy.

EC (European Commission). 2004. Integrating Environmental Considerations into Other Policy Areas—A Stocktaking of the Cardiff Process. Commission Working Document, COM(2004)394 Final. Brussels.

Fasinmirin, J. T., and F. Braga. 2009. "Agriculture for Sustainable Food, Energy and Industrial Development in the Sub-Saharan Africa: The Case of Nigeria." *African Journal of Food Science* 3 (13): 429–433.

Goodfray, H. C. J., R. B. John, I. R. Crute, L. Haddad, D. Lawrence, J. F. Muir, J. Pretty, et al. 2010. "Food Security: The Challenge of Feeding 9 Billion People." *Science* 327 (812): 812–818.

Hansohm, D. 2002. "Economic Policy Research, Governance, and Economic Development: The Case of Namibia." In *Better Governance and Public Policy: Capacity Building and Democratic Renewal in Africa*, edited by O. Dele and S. Soumana, 195–213. Bloomfield, CT, US: Kumarian Press.

———. 2007. "Research and Policy-Making: The Unique Experience of NEPRU in Nambia." In *The Policy Paradox in Africa: Strengthening Links between Economic Research and Policymaking,* edited by E. T. Ayuk and M. A. Marouani, 219–238. Trenton, NJ, US: African World Press.

Herodes, M., C. Adelle, and M. Pallemaerts. 2007. *Environmental Policy Integration at the EU Level: A Literature Review*. Environmental Policy Integration and Multi-level Governance (EPIGOV) Paper 5. Berlin: Ecologic—Institute for International and European Environmental Policy.

Hertel, T. W., and S. D. Rosch. 2010. "Climate Change, Agriculture, and Poverty." *Applied Economic Perspectives and Policy* 32 (3): 355–385.

Hertin, J., and F. Berkhout. 2003. "Analysing Institutional Strategies for Environmental Policy Integration: The Case of EU Enterprise Policy." *Journal of Environmental Policy and Planning* 5 (1): 39–56.

Hogl, K., D. Kleinschmit, and J. Rayner. 2016. "Achieving Policy Integration across Fragmented Policy Domains: Forests, Agriculture, Climate and Energy." *Environment and Planning C: Government and Policy* 34 (3): 399–414.

Homeyer, I. V., A. Goria, M. Nilsson, and M. Pallemaerts, eds. 2009. *The Prospects and Practice of Environmental Policy Integration: A Multi-level Governance Perspective*. Cheltenham, UK: Edward Elgar.

Howes, M., L. Wortley, R. Potts, A. Dedekorkut-Howes, S. Serrao-Neumann, J. Davidson, T. Smith, and P. Nunn. 2017. "Environmental Sustainability: A Case of Policy Implementation Failure?" *Sustainability* 9 (2): 165.

Irani, Z., and A. M. Sharif. 2016. "Sustainable Food Security Futures: Perspectives on Food Waste and Information across the Food Supply Chain." *Journal of Enterprise Information Management* 29 (2): 171–178.

Jordan, A. J., and A. Lenschow. 2008. "Integrating the Environment for Sustainable Development: An Introduction." In *Innovation in Environmental Policy? Integrating the Environment for Sustainability*, edited by A. J. Jordan and A. Lenschow, 3–23. Cheltenham, UK: Edward Elgar.

Keeley, J., and I. Scoones. 2000. "Knowledge, Power, and Politics: The Environmental Policy-Making Process in Ethiopia." *Journal of Modern African Studies* 38 (1): 89–120.

Kingdon, J. W. 1984. "*Agendas, Alternatives, and Public Policies* 45 165-169. Boston: Little, Brown.

Kivimaa, P., and P. Mickwitz. 2006. "The Challenge of Greening Technologies: Environmental Policy Integration in Finnish Technology Policies." *Research Policy* 35: 729–744.

Kleinbaum, D. G., L. L. Kupper, K. E. Muller, and A. Nizam. 2007. *Applied Regression Analysis and Other Multivariable Methods*. Belmont, CA, US: Thomson Higher Education.

Knill, C., and A. Lenschow. 2000. *Implementing EU Environmental Policy: New Directions and Old Problems*. Manchester, UK: Manchester University Press.

Knudsen, J. K., and W. M. Lafferty. 2016. "Environmental Policy Integration: The Importance of Balance and Trade-Offs." *Research Handbook on Fundamental Concepts of Environmental Law*, edited by D. Fisher, 337. Cheltenham, UK: Edward Elgar.

Kolawole, O. D., and D. O. Torimiro. 2006. "Nigerian Poor Majority: Issues and Challenges in the 21st Century." *Research Journal of Social Sciences* 1 (1): 11–20.

Lafferty, W. M. 2001. "Adapting Government Practice to the Goals of Sustainable Development." Paper presented at OECD seminar Improving Governance for Sustainable Development, Paris, November 22–23. http://www.prosus.org/prosusFTP/prosusrep/publications/prosuswp2002_01.pdf.

Lenschow, A., ed. 2002a. *Environmental Policy Integration: Greening Sectoral Policies in Europe.* London, UK: Earthscan.

———. 2002b. "New Regulatory Approaches in Greening EU Policies." *European Law Journal* 8: 19–37.

Lufumpa, C. L. 2005. "The Poverty-Environment Nexus in Africa." *African Development Review* 26 (3): 366–381.

Mäler, K. G., and M. Munasinghe. 1996. "Macroeconomic Policies, Second-Best Theory and the Environment." *Environment and Development Economics* 1 (2): 149–163.

Meier, G. M. 1991. Politics and Policy Making in Developing Countries. San Francisco: ICS Press.

Moss, B. 2008. "Water Pollution by Agriculture." *Philosophical Transactions of the Royal Society B: Biological Sciences* 366: 659–666.

Munasinghe, M., and W. Cruz. 1996. "Economy-wide Policies and the Environment: Developing Countries." In *Macroeconomics and the Environment,* edited by V. P. Gandhi, 195–232. Washington DC: International Monetary Fund.

Nigeria, FMARD (Federal Ministry of Agriculture and Rural Development). 2002. *The New Policy Thrust on Agriculture*. Abuja.

———. 2007. "Nigeria's Agriculture Sector." Unpublished, Abuja.

———. 2011. *Agricultural Transformation Agenda: We Will Grow Nigeria's Agricultural Sector*. Abuja. www.unaab.edu.ng/attachments/Agricultural%20Transformation%20Blue%20Print.pdf.

Nigeria, FMAWR (Federal Ministry of Agriculture and Water Resources). 2009. *Review of Ongoing Agricultural Development Efforts*. Brochure. Abuja. www.inter-reseaux.org/IMG/pdf_Brochure_1.pdf.

Nigeria, FMEH&UD (Federal Ministry of Environment, Housing & Urban Development). 2008. *Managing Environment for Sustainable Development: Challenges and Opportunities*. Abuja.

Nigeria, National Population Commission. 2006. *2006 National Census*. Abuja.

Nigeria, NBS (National Bureau of Statistics). 2010. *Revised 2009 and Estimates for Q1–Q2, 2010 Gross Domestic Product for Nigeria*. Abuja.

———. 2015. *Nigerian Gross Domestic Product Report: Quarter Four 2015*. Abuja. www.nigerianstat.gov.ng/pdfuploads/GDP%20Q4%202015%20final.pdf.

———. 2016. *Nigerian Gross Domestic Product Report: Quarter Three 2016*. Abuja. www.nigerianstat.gov.ng/report/469.

Nigeria, NBS; and World Bank. 2016. *LSMS-Integrated Surveys on Agriculture: General Household Survey Report*. Abuja: National Bureau of Statistics.

Nigeria, NPC (National Planning Commission). 2007. *National Economic Empowerment and Development Strategy*. Abuja.

———. 2010. *Nigeria Vision 20: 2020—First National Implementation Plan (2010–2013)*. Abuja.

Nilsson, M. 2005. "Learning, Frames and Environmental Policy Integration: The Case of Swedish Energy Policy." *Environment and Planning C: Government and Policy* 23 (2): 207–226.

Nilsson, M., and K. Eckerberg, eds. 2007. *Environmental Policy Integration in Practice: Shaping Institutions for Learning*. London: Earthscan.

Nilsson, M., M. Pallemaerts, and I. G. Homeyer. 2009. "International Regimes and Environmental Policy Integration: Introducing the Special Issue." *International Environmental Agreements: Politics, Law and Economics* 9 (4): 337–350.

Ogunba, O. A. 2004. "EIA Systems in Nigeria: Evolution, Current Practice and Shortcomings." *Environmental Impact Assessment Review* 24 (6): 643–660.

Okoye, C. U. 2009. "Soil Erosion Control and Damage Costs in Nigerian Small Farms: Implications for Farm Growth and Sustainability." Paper Presented at 111th seminar of European Association of Agricultural Economists, Canterbury, UK, June 26–27.

Olawumi, A. 2009. *Environmental Considerations in Nigerian Agricultural Policies, Strategies, and Programs*. Nigeria Strategy Support Program Report NSSP004. Washington, DC: International Food Policy Research Institute.

Omofonmwan, S. I., and G. I. Osa-Edoh. 2008. "The Challenges of Environmental Problems in Nigeria." *Journal of Human Ecology* 23 (1): 53–57.

Osemeobe, G. J. 1992. "Impact of Nigerian Agricultural Policies on Crop Production and the Environment." *The Environmentalist* 12 (2): 101–108.

Ostrom, E. 2011. "Background on the Institutional Analysis and Development Framework." *Policy Studies Journal* 39 (1): 7–27.

Pandya-Lorch, R., and S. Yusef, eds. 2014. *Resilience for Food and Nutrition Security*. Washington, DC: International Food Policy Research Institute.

Persson, Å. 2004. *Environment Policy Integration: An Introduction*. Policy Integration for Sustainability Background Paper. Stockholm: Stockholm Environment Institute.

———. 2009. "Environment Policy Integration and Bilateral Development Assistance: Challenges and Opportunities with an Evolving Governance Framework." *International Environmental Agreements: Politics, Law and Economics* 9 (4): 409–429.

Persson, Å., K. Eckerberg, and M. Nilsson. 2016. "Institutionalization or Wither Away? Twenty-Five Years of Environmental Policy Integration under Shifting Governance Models in Sweden." *Environment and Planning C: Government and Policy* 34 (3): 478–495.

Pollack, M. A., and E. M. Hafner-Burton. 2010. "Mainstreaming International Governance: The Environment, Gender and IO Performance in the European Union." *Review of International Organizations* 5 (3): 285–213.

Rausser, G. C., and J. Swinnen. 2010. "Governance Structures, Political Economy, and Public Policy." *American Journal of Agricultural Economics* 93 (2): 310–316.

Resnick, D., S. C. Babu, S. Haggblade, S. Hendriks, and D. Mather. 2015. *Conceptualizing Drivers of Policy Change in Agriculture, Nutrition, and Food Security: The Kaleidoscope Model*. Discussion Paper 01414. Washington, DC: International Food Policy Research Institute.

———. 2017. *The Kaleidoscope Model of Policy Change: Applications to Food Security Policy in Zambia*. Feed the Future Innovation Lab for Food Security Policy Research Paper 40. East Lansing, MI, US: Michigan State University.

Roberts, P., H. Sykes, and R. Granger, eds. 2016. *Urban Regeneration: A Handbook*. Thousand Oaks, CA, US: Sage Publishers.

Runhaar, H. 2016. "Tools for Integrating Environmental Objectives into Policy and Practice: What Works Where?" *Environmental Impact Assessment Review* 59: 1–9.

Sabatier, P. A. 2007. *Theories of Policy Process*. Boulder, CO, US: Westview Press.

Sanyal, P., and S. Babu. 2010. *Policy Benchmarking and Tracking the Agricultural Policy Environment in Nigeria*. Abuja, Nigeria: International Food Policy Research Institute.

Sarkar, S. 2010. "Gender, Environment, and Poverty Linkages." *Journal of Development and Agricultural Economics* 2 (4): 145–156.

Shapiro, H. 2006. "The Story of Sustainable Cocoa: Reducing Poverty, Improving Lives, Protecting the Environment One Chocolate Bar at a Time." Presented at North Carolina A&T State University, Greensboro, March 20.

Skoufias, E., M. Rabassa, S. Olivieri, and M. Brahmbhatt. 2011. *The Poverty Impacts of Climate Change: A Review of the Evidence*. Economic Premise 51. Washington, DC: World Bank.

Sutton, W., S. P. Galinato, P. Whitford, E. M. Stephens, E. Karamete, B. Nevel, and B. Plonka. 2008. *Integrating Environment into Agriculture and Forestry: Progress and Prospects in Eastern Europe and Central Asia*. Washington, DC: World Bank.

Takeshima, H. 2016. *Market Imperfections for Tractor Service Provision in Nigeria: International Perspectives and Empirical Evidence*. Nigeria Strategy Support Program Working Paper 32. Washington, DC: International Food Policy Research Institute.

Takeshima, H., E. Edeh, A. Lawal, and M. Isiaka. 2015. "Characteristics of Private-Sector Tractor Service Provisions: Insights from Nigeria." *The Developing Economies* 53 (3): 188–217.

Takeshima, H., A. Adeoti, and O. A. Popoola. 2016. *The Impact on Farm Household Welfare of Large Irrigation Dams and Their Distribution across Hydrological Basins: Insights from Northern Nigeria*. NSSP Working Paper 35. Washington, DC: International Food Policy Research Institute.

Tilman, D., J. Fragione, B. Wolf, C. D. Antonio, A. Dobson, R. Howarth, and D. Schindler. 2001. "Forecasting Agriculturally Driven Global Environmental Change." *Science* 292 (5515): 281–284.

Titilola, S. T. 2000. "Environment and Sustainable Agricultural Development in Nigeria." *Journal of Sustainable Development in Africa* 2 (1): n.p. http://www.jsd-africa.com/Jsda/Spring%202000/articles/Environment%20and%20Sustainable.pdf.

Udofia, L., and N. Essang. 2015. "Agricultural Expenditure and Poverty Alleviation in Nigeria." *Development* 7 (21): 29–44.

UN (United Nations). 1993. *Agenda 21: Earth Summit—The United Nations Programme of Action from Rio.* New York: United Nations Department of Public Information.

———. 1997. *UN Conference on Environment and Development (1992)*. New York: United Nations Department of Public Information.

———. 2001. *Nigeria Common Country Assessment*. Abuja: United Nations System in Nigeria. www.preventionweb.net/english/professional/policies/v.php?id=10653.

———. 2002. *Report of the World Summit on Sustainable Development: Johannesburg, South Africa, 26 August–4 September 2002*. New York: United Nations Department of Public Information.

———. 2005. "Environmental Statistics: Situation in Federal Republic of Nigeria." Country report presented at workshop, Dakar, Senegal, February 28–March 4.

UNCHE (United Nations Conference on the Human Environment). 1972. *Report of the United Nations Conference on the Human Environment*. New York: United Nations. http://www.un-documents.net/aconf48-14r1.pdf.

UNEP (United Nations Environment Programme). 2002. "Integrating Environment and Development: 1972–2002." In *Global Environment Outlook 3,* 1–28. Sterling, VA, US: Earthscan. http://drustage.unep.org/geo/sites/unep.org.geo/files/documents/chapter1.pdf.

USAID (US Agency for International Development). 2002. *Nigeria Environmental Analysis Final Report*. Washington, DC.

Visseren-Hamakers, I. J. 2015. "Integrative Environmental Governance: Enhancing Governance in the Era of Synergies." *Current Opinion in Environmental Sustainability* 14: 136–143.

Watson II, D. D. 2013. *Political Economy Synthesis: The Food Policy Crisis.* WP/2013/050. Helsinki: UNU-WIDER.

WCED (World Commission on Environment and Development). 1987. *Our Common Future*. Oxford, UK: Oxford University Press.

Weersink, A., J. Livernois, F. Shogren, and J. A. Shortle. 1998. "Economic Instruments and Environmental Policy in Agriculture." *Canadian Public Policy* 24 (3): 309–327.

Wilson, G. A., C. L. Kelly, H. Briassoulis, A. Ferrara, G. Quaranta, R. Salvia, V. Detsis, et al. 2017. "Social Memory and the Resilience of Communities Affected by Land Degradation." *Land Degradation and Development* 28 (2): 383–400.

Wooldridge, J. M. 2009. *Introductory Econometrics: A Modern Approach.* Mason, OH, US: South-Western.

World Bank. 2005. *Integrating Environmental Considerations in Policy Formulation: Lessons from Policy-Based SEA Experience*. Report 32783. Washington, DC.

———. 2008. *Agriculture and the Environment*. Agriculture for Development Policy Brief 41384. Washington DC: World Bank.

———. 2015. World Development Indicators Database. Washington, DC. http://data.worldbank.org/indicator/SP.POP.GROW.

RECENT IFPRI DISCUSSION PAPERS

1656. *Understanding the measurement of women's autonomy: Illustrations from Bangladesh and Ghana.* Greg Seymour and Amber Peterman, 2017.

1655. *Addressing transboundary cooperation in the Eastern Nile through the water-energy-food nexus: Insights from an e-survey and key informant interviews.* Helen Berga, Claudia Ringler, Elizabeth Bryan, Hagar El Didi, and Sara Elnasikh, 2017.

1654. *Limited attention and information loss in the lab-to-farm knowledge chain: The case of Malawian agricultural extension programs.* Chiyu Niu and Catherine Ragasa, 2017.

1653. *Does providing agricultural and nutrition information to both men and women improve household food security?: Evidence from Malawi.* Catherine Ragasa, Noora-Lisa Aberman, and Cristina Alvarez Mingote, 2017.

1652. *Is the WTO dispute settlement procedure fair to developing countries?* Antoine Bouët and Jeanne Metivier, 2017.

1651. *Role of media in shaping the policy process: Comparative lessons from the food price crisis in Bangladesh, China, India, and Viet Nam.* Suresh Chandra Babu, Smita Aggarwal, and Junjie Chen, 2017.

1650. *Food and nutrition security in transforming Ghana: A descriptive analysis of national trends and regional patterns.* Olivier Ecker and Joanna van Asselt, 2017.

1649. *Pathways from agriculture to nutrition in India: Implications for sustainable development goals.* Mousumi Das, Ajay Sharma, and Suresh Chandra Babu, 2017.

1648. *Agribusiness competitiveness: Applying analytics, typology, and measurements to Africa.* Suresh Chandra Babu and Mahika Shishodia, 2017.

1647. *The Abbreviated Women's Empowerment in Agriculture Index (A-WEAI).* Hazel Malapit, Crossley Pinkstaff, Kathryn Sproule, Chiara Kovarik, Agnes Quisumbing, Ruth Meinzen-Dick, 2017.

1646. *Intertemporal choice and income regularity: Non-fungibility in a lab-in-the-field experiment.* Berber Kramer and David Kunst, 2017.

1645. *Climate change and variability: What are the risks for nutrition, diets, and food systems?* Jessica Fanzo, Rebecca McLaren, Claire Davis, and Jowel Choufani, 2017.

1644. *Building resilience for food systems in postwar communities: Case study and lessons from Northern Sri Lanka.* Hamsha Pathmanathan, Suresh Chandra Babu, and Chandrashri Pal, 2017.

1643. *Empowerment, adaptation, and agricultural production: Evidence from Niger.* Fleur Wouterse, 2017.

1642. *Insurance structure, risk sharing, and investment decisions: An empirical investigation of the implications of individual and group weather index insurance.* Laura Munro, 2017.

1641. *Economic accounts for agriculture and farm income in Senegal.* Ismaël Fofana, Mahamadou Tankari, and Fousseini Traore, 2017.

1640. *Food inflation and food price volatility in India: Trends and determinants.* C. S. C. Sekhar, Devesh Roy, and Yogesh Bhatt, 2017.

1639. *Revitalized agriculture for balanced growth and resilient livelihoods: Toward a rural development strategy for Mon State.* Mateusz Filipski, Ulrike Nischan, Joanna Van Asselt, Ben Belton, Adam Kennedy, Aung Hein, Duncan Boughton, and Paul Dorosh, 2017.

1638. *Rural livelihoods in Mon State: Evidence from a representative household survey.* Mateusz Filipski, Joanna Van Asselt, Ulrike Nischan, Ben Belton, Kyan Htoo, Myat Thida Win, Aung Hein, L. Seng Kham, Zaw Min Naing, Ellen Payongayong, and Duncan Boughton, 2017.

1637. *The great Chinese inequality turnaround.* Ravi Kanbur, Yue Wang, and Xiaobo Zhang, 2017.

1636. *Can agricultural aspirations influence preferences for new technologies?: Cropping systems and preferences for high-efficiency irrigation in Punjab, Pakistan.* Andrew R. Bell, Patrick S. Ward, Muhammad Ashfaq, and Stephen Davies, 2017.