Evaluating the role of public agricultural extension and advisory services in promoting agro-ecology transition in Southeast Nigeria

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Abstract

Agro-ecological farming approaches sustain food production with zero or reduced dependence on agro-chemicals. This study investigated the impact of public agricultural extension activities in enhancing the transition to agro-ecological approaches, in particular organic farming, in south-eastern Nigeria. Data were collected from thirty farmers and twenty extension personnel using in-depth interviews. The respondents were selected using a purposeful random sampling technique. The results show that extension and advisory activities are influenced by current agricultural policy. Extension personnel currently focus almost exclusively on intensive agricultural practices because of the agricultural transformation agenda which surprisingly ignores the principles of organic farming. Factors such as policy, social, environmental, research and extension management were observed to impede organic farming transition. It is concluded that there is need for a clearly enunciated organic agricultural policy that supports farmers, organic agricultural research and information dissemination. A participatory approach in policy formulation and information dissemination that incorporates farmers' traditional knowledge with capacity to strengthen the agricultural information dissemination structure is recommended to improve agro-ecological transition.

Keywords: Agro-ecology transition, Organic agriculture development, Extension and advisory services, Smallholder farmers, Nigeria.

Introduction

Agriculture globally faces enormous challenges because of the increasing world population, climate change, water shortages and environmental degradation. According to the United Nations (2017), the world population is estimated to grow by 83 million people per annum,

increasing to 9.8 billion by 2050. This will result in the need for increased food production as well as rising hunger levels in some of the poorer countries. Also rising with the increasing population is the demand for fuel and animal feed (Food and Agriculture Organisation of the United Nations (FAO) 2017a). The push for more food production because of the increasing demand for food and land for agricultural purposes has led to the application of unsustainable agricultural practices, also known as conventional or industrial farming systems in various parts of the world. Such practices include but are not limited to mono-cropping, intensive use of agro-chemical inputs, genetic modification of organisms, and unsustainable water consumption in irrigated cropping systems. These agricultural practices have exacerbated climate change, distorted natural ecosystems, polluted the water systems and rendered many soils infertile (Aziz et al. 2015; Bhandari 2014; Kalia and Gosal 2011). Hence, the need for improved agricultural production in more sustainable ways, without further harm to humans and the environment requires urgent attention (Altieri et al. 2015; De Schutter 2010; De Schutter, 2014).

Agro-ecological farming approaches aim to achieve healthy food security without negative impacts on the environment following ecological concepts to develop ecological structures that limit the use of external inputs and allow ecosystem interaction (Altieri and Nicholls, 2012; Altieri, Nicholls, and Montalba, 2017). The farming practice involves the application or use of various techniques such as crop rotations, green manuring, composting and bush fallow systems or shifting cultivation to improve soil nutrients and organic matter. Also, integration of livestock into cropping systems, use of native seeds and local breeds of livestock, natural farm water harvesting, biological pest and disease management, and polycultures are some of the widely accepted practices applied in small-scale family farms across the world as organic techniques (Altieri and Toledo 2011; Wezel et al. 2014). Organic agriculture developed as a response to what appeared as pollution of the food supply by modern farming techniques, and the ensuing degradation of the ecosystem and climate change with agro-chemicals and

50 greenhouse gas emissions (Morgera, Caro and Durán, 2012). Hence, promoting the adoption
51 of organic agriculture and other agro-ecological approaches is becoming increasingly
52 important in most developed and developing countries due to recorded successes (De Schutter,
53 2010; The Alliance for Food Sovereignty in Africa (AFSA) 2017; Oakland Institute 2017).

54 This study focuses on Nigeria as an example of a developing country facing several of the
55 challenges from climate change and increasing human population as outlined above.
56 Agricultural activities in Nigeria are changing as the country has embarked on various
57 agricultural development projects that are focused on agri-business in the quest for more food
58 production. Such projects include the agricultural transformation agenda and the growth
59 enhancement scheme (Federal Ministry of Agriculture and Rural Development (FMARD)
60 Agricultural Policy and Strategy Document 2013; 2016). The projects have been reported as
61 very successful in restructuring the fertilizer procurement system and deregulation of seeds
62 (Akinwumi 2013; Igudia 2017). This shift has enhanced farmers' access to genetically
63 modified seeds and excessive use of agro-chemicals, most importantly the use of nitrogen
64 fertilizers (Akinwumi 2013; FAO 2017b; FMARD 2016). Furthermore, the projects support a
65 reduction in fallow systems, intensive irrigation, mono-cropping and use of growth hormones
66 and antibiotics for livestock production (Oguamanam 2015). This contrasts with the Nigerian
67 environmental protection policy, 1999, aiming to preserve the country's biodiversity and
68 improving the livelihood of the population (Kankara et al. 2013). Nevertheless, in some areas
69 of the country existing traditional methods of farming which have elements of organic farming
70 (i.e. organic by default) are still practiced, while in others, they have been abandoned (Adebayo
71 and Oladele 2014; Nwachukwu 2010; Oguamanam 2015). However, the area of certified
72 organic land, including land in conversion, is extremely low, with an estimated 5,021 hectares
73 in 2015 (Willer and Lernoud 2017), and no increase has been observed over the last years.
74 Despite numerous activities such as organised programmes, seminars, national organic

agriculture movements and associations geared towards enhancing organic agriculture awareness and practice (Olaito 2014). These activities are yet to transform into significant structured organic farm holding as certified organic products are still poorly marked, with most of these activities taking place in the western part of Nigeria (Olaito 2014; Willer and Lernoud 2017). The few certified organic products include honey and lemongrass tea. There are other non-certified products from agro-ecological farming which include turmeric, a local rice cultivar known as ofada, black soap produced from wood ash and herbs, red hibiscus for local soft drinks, tropical fruits, mushrooms and cashew nuts (AdeOluwa 2010; Kazeem 2010; Mgbenka, Onwubuya and Ezeano 2015). For livestock production, a certification system was reported to be in the developing stage (Kazeem 2010). These products are sold to the local market and there are no organised sales outlets where consumers can access organic products, a situation regarded as under-maximisation of the premium benefits in organic farming (AdeOluwa 2010).

The underdevelopment of organic agriculture and slow transitioning to the practice by farmers in Nigeria has been linked to limited access to organic agriculture information (AdeOluwa 2010). On the other hand, an effective agricultural extension delivery system is invaluable in motivating farmers to adopt new or existing innovation (Aphunu and Otoikhian 2008; Rivera and Qamar 2003; Zwane 2012). The National Agricultural Extension and Research Liaison Services (NAERLS) is a public institute under the Federal Ministry of Agriculture and Rural Development responsible for agricultural information dissemination in Nigeria. NAERLS coordinates national agricultural training activities; planning and development of extension liaison services throughout Nigeria; conducts research on agricultural technique transfer and adoption; and collaborates with Research Institutes and Agricultural Development Programme (ADP) in transferring existing knowledge and innovations (NAERLS 2017a). NAERLS established the Research Extension Farmer Input Linkage System (REFILS) and adopted

village scheme to improve the agricultural information dissemination and utilisation (NARLS 2017b). In ensuring access to information and an effective delivery system, NAERLS selected 120 communities on the mandate of "adopted village scheme" within 20 kilometre distance from the headquarter and respective zonal offices (NAERLS 2017b). The institute further adopted a targeted information delivery method by setting up Information Resource Centres (IRCs) in each of the selected communities to care for their agricultural information needs (NAERLS 2017b; Sani et al. 2015). NAERLS has been reported to encounter various challenges such as inadequate funding to support field extension activities, unsteady policies, poor staffing, poor access roads, and negligence by the government, despite contributions to the national economy (Anaeto et al. 2014; Chikerenma 2015). However, Sani et al. (2015) observed that farmers' access to agricultural information improved through IRCs in the various adopted villages.

Given these structures, NAERLS seems ideally placed to facilitate the adoption of agricultural practices in these selected communities. In this study, we therefore evaluate the potential role of the public agricultural extension and advisory services in enhancing the transition to agro-ecology approaches and organic certified farming in southeast Nigeria. The study uses a qualitative approach to explore this potential role by addressing the following research questions;

- What are the agricultural activities in the study area?
- What are the extension personnel activities?
- What are the factors that influence the extension activities?
- How do the extension activities influence farming activities?
- What are the key constraints to wider adoption of agro-ecological and/or organic farming methods?

Methodology

This study uses a qualitative research methodology in keeping with the methodological tradition of political ecology that requires sensitivity to context, multiple views and social relations, and in identifying the major stakeholders involved in the implementation and receipt of the programme under study (Palys 2008; Patton 2014; Watts 2000).

The study location is the south-eastern zone of Nigeria, where the NAERLS' southeast zonal office is located. The zonal office has the mandate of supervising the agricultural extension activities in the five south-eastern states namely; Abia, Anambra, Ebonyi, Enugu and Imo (see Figure 1 for the map of Nigeria highlighting the south-eastern zone).

Data Collection and Analysis

Data was collected through in-depth interviews with fifty respondents comprising extension personnel at the Imo state agricultural development programme (ADP) office and NAERLS' south-east zonal office, and farmers from Umuakaobia an adopted community in Imo State under the NAERLS' southeast zonal office. The 50 respondents included 30 farmers from Umuakaobia, eight field extension personnel and six extension coordinators from the state ADP and six extension subject specialists from NAERLS. The respondents were selected using purposeful random sampling technique. The randomised sampling strategy was adopted because the researcher believes that the population has varied agricultural and extension experience, respectively. This strategy was adopted to increase credibility not to foster representativeness.

The study was approved through Coventry University's ethical approval procedure and written informed consent was obtained from each participant prior to the data collection. Ensuring a suitable environment for the interviewees, the interviewing researcher visited the participants in their public offices and own farms, accompanied by two facilitators who also assisted in the

148 validity and review of the interview questions. Telephone calls were made to inform the
149 respondents of the study aim and expected questions prior to visiting. The researcher adopted
150 a systematic questioning technique to gain in-depth responses. During the interviews, agro-
151 ecology and organic farming terminology were used interchangeably and this approach was
152 therefore also used in the results section. Questions were worded to suit the individual
153 participant's English proficiency. The questions included the demographic characteristics of
154 the respondents, type of crops and farming practices, level of experience, and their knowledge
155 about organic farming. Questions to assess whether the information needs of the farmers are
156 met by the extension personnel and whether the extension service influenced their (farmers)
157 farming practices were included. Also included were questions to assess the factors that
158 influenced the extension activities which may have impacted on organic agriculture
159 development. All data were collected between March 2016 and August 2017.

160 Interviews were audio-recorded, notes were taken simultaneously and transcribed verbatim to
161 prevent bias. The study adopted Miles, Huberman and Saldaña (2014) strategy by manually
162 conducting the analysis using hand-coding, instead of relying on computer analytical software.
163 This was achieved by reviewing the raw data, codes were inductively derived, organised, and
164 emergent codes summarised in themes. The results were organised and presented in categories
165 based on the interview questions. The first category is an account of the farming activities and
166 knowledge of organic farming. The next detailed the evidence of how the extension activities
167 have influenced farmers' farming decisions and their information needs with focus on the type
168 of information they receive from the extension personnel. The last session described the factors
169 that affect the transition to agro-ecology approaches. The responses were grouped into two
170 categories namely; farmers' perspective and extension personnel perspective. Accordingly, the
171 study adopted Miles, Huberman and Saldaña (2014) result presentation strategy by presenting
172 the results in two formats, namely; verbatim quotations from the respondents which serve as

low-inference descriptors; and summary of recurrent themes clarifying the most articulated themes. The verbatim quotations which are the core study results indicates how participants attached meaning to each theme. The emerging themes are summarised, and number of participants who articulated each theme recorded and presented in tables. Although the use of numerical data in qualitative research has been contested (Maxwell 2010), this study uses the summary tables to show the number of participants that articulated each emergent theme. Furthermore, the identified factors that hinder transitioning to agro-ecology approaches principally organic farming were summarised in sub-themes.

Results

The results are presented in sections according to the interview checklists. Table 1 summarises the demographic characteristics of the respondents, highlighting the participants' age, gender, level of experience in agriculture and knowledge about organic farming. The farmers' and extension personnel age were between 30 and 69 and 30 and 59 years, respectively. While most of the respondents were male, levels of farming experience were very different. Most farmers know about organic farming, but do not understand the practices. Farmers with more years of experience tend to know more about organic farming, but rarely use most of the practices. Also, farmers that understand and use some of the practices explained they lack proper skill in the procedures and management. All the extension personnel know about organic farming, but the majority lack adequate skills for informed agro-ecology and/or organic farming extension services.

One of extension personnel explained:

'*I have read about organic agriculture, but have not received training on that*'

Table 2 highlights the diversity of the farming activities engaged in by the farmers. Most farmers in the study area grow staple food crops such as maize, cassava, yam, okra, and

vegetables. Very few farmers in this study complemented their food crops with nitrogen-fixing crops such as groundnuts. Improved or hybrid crop varieties are the most commonly used in the area and none of the farmers who use such crops practice seed recycling. There are still some traditional family farmers who grow a variety of plants grown from seeds passed down from generation to generation. These farmers expressed concerns that their local crop varieties are being practically lost to transgenic crops.

A farmer explained:

'*we used to have our own native seeds, like the maize and okra varieties, but now it's difficult to see one farmer who has such*'.

A few farmers practice some of the widely accepted organic practices such as shifting cultivation, crop rotation, manuring, and mixed cropping. However, they depend on synthetic fertilizer and other agro-chemicals for enhancing the yield (see Table 2).

The agricultural information delivery and/or advisory activities involved in by the extension personnel in the area include assisting the farmers with information about agro-chemicals and use, access to available markets for improved seed varieties and access to information about crop and livestock management.

One of the extension personnel explained:

'Farmers are guided on how to manage their farm crops and animals to maximise yield, we advise them to put the right fertilizer to the right crop and where to buy them'.

The Impact of Extension Activities on Farming Practices and the Potential for Agro-ecology Transitioning

The farmers were interviewed based on their activities, information needs and their experience with the extension agents. Whilst the extension personnel were questioned regarding the

policies to encourage research and extension support for agro-ecological farming systems (organic farming), and a general evaluation of the institutes' activity in improving organic farming extension.

Farmers' Perspectives

The farmers explained some of the extension personnel activities that influence their soil fertility management, choice of crops and methods of farming. Disregard of farmers' own traditional knowledge by the extension personnel emerged as a significant impact on their farming decisions. Such a situation is where the farmers are advised and/or encouraged to abandon their traditional methods in order to adopt the intensive use of agro-chemicals such as fertilizer and as well as a lack of opportunities to share information on the benefits of their own traditional methods with the extension personnel.

One of the farmers explained that:

'*here in my farm I plant various crops in the same piece of land, but I buy and apply fertilizers and pesticides because the extension agents will always advise we use chemicals, even when you tell them our own method is good, they do not listen, they want us to do away with our ancestral ways of farming and adopt their style*'.

The situation is a challenge because these group of farmers rely solely on the extension field agents for information regarding their day-to-day farming activities and tend to be influenced by the information they receive. The farmers tend to react positively to agricultural information that comes from the extension services, even when is contrary to their practice and/or local knowledge. Most of the farmers clearly narrated their concern that the extension field agents go as far as convincing them to buy external inputs even when is not cost effective.

This is a typical narrative of one of the farmers:

'this time one spends a lot in buying seeds which you cannot even replant, they tell you not to because it will not germinate, or it will multiply diseases, and the fertilizer application needs continuous efforts, sometimes these seeds do not even germinate that means you keep replacing them'.

The interview narratives further revealed that farmers who tend to practice some of the organic farming techniques have limited access to the information, thus affecting continuous practice in the area. Also, the application and use of agro-chemicals such as fertilizer is perceived by the farmers as requiring less labour.

This farmer explained that:

'*I use farm yard manure on my farm because I keep lots of goats, I even go as far as other neighbouring communities to source for other animal dung. But you see my problem is, is difficult to prepare especially when combining with other raw materials for composting. The agriculture people do not say how to do it or apply it, so I gave up with the large farm and do it only at my backyard farm which is small. The fertilizer application is easier, even if no one tells you; you can manage to do it yourself*'.

However, some farmers in the study were convinced of the efficiency and viability of organic practices in the improvement of yield and soil health in small-scale farm setting as this farmer explained: '*it [organic] is the best practice, the yield is more and better soil quality with high organic matter content*'.

Other farmers pointed out the benefits of integrating livestock with crop production, suggesting that keeping livestock improves the opportunities for the improvement of soil health by facilitating fallow system and sharing of nutrients. Furthermore, it emerged that farmers who engage in both crop and livestock farming tend to apply some of the agro-ecological approaches such as manuring and fallow systems.

Among the farmers who keep ruminant animals, one explained:

'*I prefer to leave some of my farm land fallow for three to four years that helps me in feeding my sheep and goats, and putting them out for grazing, which at the same time restores the soil fertility*'.

When asked to elucidate on their perspective on the current extension activities in enhancing organic farming, most farmers explained that the extension and research institutes' activities revolve around promoting the use of external inputs which include synthetic pesticides and fertilizers, hybrid and genetically modified seeds. In which the extension services term as '*progressive ways of farming*' (multiple narratives from farmers).

Extension Personnel Perspectives

During the interview, most of the extension personnel explained that the agricultural extension policy does not cover organic farming. They revealed that the government programme known as the '*agricultural transformation agenda with the focus on increased productivity*' has the mandate of ensuring provision and availability of improved seeds and agro-chemicals which heavily influences the available agricultural information that reaches the farmers.

One of the personnel explained that:

'*Organic farming is not part of the farming system yet, no structure put in place for organic farming extension, however, some farmers actually practice it unknowingly. The government implements policies on how extension services are run, so research is geared towards achieving the nation's mandate for food security'*.

The interview responses also suggest that the Nigerian government through the research institutes and extension services is keen on improving food production in the region. However, this is based on practices which are detrimental to both the environment and human health.

Most significantly, all the extension personnel in this study articulated that research and extension interventions widely promote conventional farming.

Another explained that:

'*The government is interested in providing and increasing food production for the populace so what matters is sufficient food, not how is produced or what is used. Although farmers find it hard to cope with the high priced external farm inputs, but we rely on policy, irrespective of any interest in organic farming as there is no structure in place for such information*'.

Factors Influencing Both the Extension Services and Agricultural Practices

Obviously, the public extension services are being driven by the government interest in increasing the quantity of food production. The research is focused on the hybrid seeds and animals, and their disease/pest infestation. The farmers explained that institutes' exhibitions mostly showcase breakthroughs made with genetically modified organisms. Furthermore, increasing number of household per family farmer affected the sole reliance on organic farming. Rights to land ownership emerged as constraints to maintaining or adopting agro-ecological approaches as an increase in household population affects the size of land inherited by the farmers. Most farmers noted being sceptical with the initial yield as they need immediate food available to take care of their increasing household. Majority of the farmers articulated that younger adults show reduced interest in farming generally. When probed on what could have triggered the reduced interest, it emerged that the youth migration to the urban areas in search for paid employments played a significant role in the older farmers abandoning the traditional methods due to required labour.

A farmer revealed:

'*We are eleven in my household and our land is very small, because that is the portion I inherited from my father and no money to acquire more, so if we rely entirely on traditional*

systems, although it's sustainable, the high yield is not immediate. Even the soil has poor quality, so I am forced to spend more on external inputs to ensure a decent yield'.

Another farmer explained:

'*I hire labour for digging the soils and making ridges even during weeding, gathering animal dung from my livestock and preparing the manure requires a lot of work and the required labour is expensive and the youths are no longer interested in farming. But fertilizer is easier to use, and I can do it on my own*.

The farmers noted that some of their local crop varieties such as maize and cassava are easily affected by heavy rains and storms, whilst reiterating that the improved varieties do not withstand the time for next planting season. Also, access to some organic farm resources such as the neem leaves for biological control of pests is limited in this area due to deforestation. This, therefore, made it less accessible for some farmers who wish to use such methods.

A farmer explained that:

'*some of our own crop varieties grow taller and rarely withstand storms, so the agriculture people insist we use improved varieties that mature quickly and dwarf in nature, but their own spoils quickly after harvest and tasteless*'.

Another farmer explained:

'*I do use neem plant leaves mixed with pepper which I learned from my father for controlling pests in my farm, before it was easier to see the trees, but now it's difficult to get the trees around here'.*

Significantly, there was increased interest in organic farming among the farmers, although limited access to useful information on the availability, preparation and application of organic farm input and practices emerged as one of the constraints.

On the other hand, the extension personnel highlighted some of the key constraints to enhancing organic farming that are in line with the farmers' observation. Majority explained that the extension agents are yet to be convinced about the effectiveness of farming organically and have inadequate knowledge and skills in the practice.

An extension personnel explained that:

'*I think what we need is better knowledge and skills of organic practice to be able to work with the farmers'*.

Also, drastic weather conditions such as heavy rains affect pre and post-harvest management resulting in farmers' inability to recycle and sustain their indigenous local crop varieties and reduced interest in seed preservation.

Another personnel stated that:

'*these farmers cannot feed themselves if left alone with their indigenous farming practices, so the government is playing a significant role in the distribution of fertilizers at subsidised rates, and we encourage them to buy improved seeds because their own seeds get infested easily and cannot withstand drastic weather*'.

Another extension personnel explained that:

'*Preserving the local seeds requires more care and knowledge, and sometimes the weather condition is not favourable for prolonged drying due to rains. So, the farmers find it hard to manage pre and post-harvest seasons*'.

The responses from the farmers and the extension personnel are summarised in Table 3, this illustrates how research and extension activities, social and environmental issues in the area have influenced farming decisions and practices. The factors that affect agro-ecology approaches identified by both farmers and extension personnel were combined, summarised

and incorporated in a wordle diagram (Figure 2). The size of the factor in this diagram illustrates the frequency.

Discussion

The main findings of this research show that the public agricultural extension and advisory services currently focus almost exclusively on intensive agricultural practices, with little concern for the incorporation of agro-ecological farming practices. This focus on conventional farming in Nigeria is based on current Nigerian agricultural policy, whose aims are based on '*agricultural transformation agenda*', the notion of '*food quantity for overpopulated nations*' and '*improving supply of specialised fertilizers and protection chemicals, as well as wider scale use of high improved yielding seeds'* (Federal Ministry of Agriculture and Rural Development 2016, The agricultural policy promotion 2016 – 2020, p. 4-6). Even though conversion of land into agricultural purposes contributes to ecosystem depletion and soil contamination, this study found that there were few practical activities by the national extension services to encourage farmers to sustain the environment. Thus, undermining the government policy which seeks to promote "*farmer's quality of life and use of environment-friendly practices*" (FMARD 2000). Furthermore, the findings revealed that there is no organic agriculture policy and no structure yet for organic farming extension to enhance organic farming awareness. The findings support the evidence that there is lack of appropriate agricultural policy for organic agriculture in Nigeria (Atoma and Atoma 2015).

There is an overwhelming practical and policy disconnection between the government's policies for preserving the ecosystem as outlined in the Environmental Protection Decree 1999 (Kankara et al. 2013), improving farmers' livelihoods as stated in the agricultural policy objectives (FMARD 2000) and the research and extension activities in Nigeria. The institute has made little or no effort in discouraging the increasing use of agro-chemical inputs amongst

smallholder farming communities. Their activities clearly promote commercial transgenic seeds, and the use of chemical fertilizers, insecticides and pesticides to increase yield. Not minding the detriment to the natural farming resources required for production. This finding corroborates DeSchutter (2014) by drawing attention to the need to protect smallholder farmers' welfare and the ecosystem in Nigeria using agro-ecological approaches such as organic farming. Furthermore, the findings revealed that the extension personnel actively discourage farmers' reliance on indigenous knowledge systems both in farming practices, local seed preservation and use. This poses threat to the traditional locally relevant methods that have been developed and replicated over decades and further jeopardising the call for an urgent shift to agro-ecological practices globally.

The local knowledge of the farmers should not be underestimated because it constitutes the capacity needed for conserving the local ecosystems. According to Tella (2007), local or indigenous knowledge is the systematic body of knowledge or skills acquired by a people through accumulated experiences and informal trails that helped them to understand their environment. Indeed, organic farming as an agro-ecological approach combines traditional farmers' knowledge with modern ecology, soil management and crop production in designing and managing the ecosystem. It improves and sustains on-farm production fertility which in turn reduces farmers' reliance on external inputs and government subsidies helping vulnerable smallholder farmers less dependent on loans (Altieri 2015). The findings confirm that organic farming approaches can improve yield within the small-holder farming context. Furthermore, the findings corroborate evidence from other parts of the world that the combination of livestock and crop production enhances organic farming practices. This is because the animals provide manure and other types of animal waste which can improve the nutrient cycle and organic matter important for the maintenance of soil structure and fertility (Reents, Küstermann and Kainz 2008). However, the situation still requires that the extension practices and policies

409 should be redirected to focus on supporting and empowering farmers in their decision-making
410 process that is within the context of their environment, health and socioeconomic conditions.

411 The findings corroborate Sani et al. (2015) that farmers' access to extension services improved
412 because of the Information Resource Centres (IRCs) implemented by NAERLS. This is
413 because most farmers in the study area often relied on the extension personnel for agricultural
414 information through the medium. However, farmers' reliance on external inputs significantly
415 increased, where some farmers rely on the private sources for agro-chemicals that are often
416 supplied to them at exorbitant costs. Most significantly, the farmers rely on purchasing new
417 seeds every planting season and are discouraged from seed saving and using traditional
418 varieties. These findings are important because they must have influenced the radical shift from
419 the traditional ways of farming classified as agro-ecology approaches to conventional
420 approaches that have drastic effects on the environment. It was observed that farmers in the
421 study area rarely practised solely organic. Gliessman (2014) opined that hybrid seeds are
422 undesirable for planting as they are susceptible to disease and pest infestations, encourages
423 mono-cropping and transgenic manipulation, thus requiring farmers to purchase seeds every
424 planting season. This study corroborates Gliessman (2014) notion in the case of the farmers in
425 the study area.

426 The findings revealed that the current extension services in most cases disregard farmers'
427 traditional knowledge which does not support the sharing of their own traditional knowledge
428 with the extension personnel such that traditional practices can be replicated. This approach
429 does not support the spread of existing traditional knowledge. Dialoguing with the farmers and
430 promoting farmer experimentation are approach that can improve the development and
431 spreading of innovation, hence efficacy of extension (Hagmann, Chuma and Murwira 2007).
432 The current research and extension management need to give farmers important, consistent,
433 and impartial advice and services on how to make significant use of their indigenous/local

knowledge for sustainable farming and food security to align with the government agenda to improve productivity. There should be the incorporation of platforms for improving farmers' knowledge sharing on ecosystem conservation to instigate collaborative action amongst farmers and extension personnel to engage in agro-ecological farming practices.

The findings revealed that farmers who have more years of experience in agriculture have deeper understanding of organic farming, but rarely applied most of the practices. This study contradicts Odoemelan and Ajuka (2015) that older farmers with higher level of experience are less likely to adopt new technologies, rather in the case of the farmers in the study area, the extension personnel had more influence on their decision-making in adopting the intensive use of agro-chemical inputs.

The farmers stated that the indigenous farming practice is almost disappearing due to some social issues such as high cost of labour, lack of awareness and access to basic information. Also, from the farmers' perspective, increasing household numbers which reduces the available size of land inherited by each family head reduced the sole practicing of organic farming. Also, pressure from the government through the extension personnel to adopt conventional methods has reduced their interest in organic farming. However, most farmers in the area are willing to rejuvenate their existing traditional systems and are open to adopting other widely accepted agro-ecology practices. The findings corroborate Iyagba and Ovai (2015) that majority of the farmers are desiring to practice organic farming.

Environmental factors such as poor soil quality, disease and pest infestation, unfavourable weather conditions and scarcity of local and biological farm resources such as the neem plant used for biological control of pests and diseases impact on farmers' engagement in organic farming which influences its improvement. This is because of the farmers' inability to tackle these issues in a more sustainable way, which could be attributed to their low technical know-

how and lack of information on agro-ecological practices and sources of resources that can ameliorate such farming issues. On the contrary, the extension personnel associated these factors to the reason why the farmers should embrace the conventional agricultural system and abandon organic by default or traditional systems of farming. Harvest management plays a significant role in food supply chain and maximum food losses have been attributed to poor pre and post-harvest management (Hodges, Buzby and Bennett 2011). Therefore minimising seed losses by equipping farmers with the right management skills could be a resource-efficient way of improving seed vahiability and strengthening food security. Accordingly, Atoma and Atoma (2015) noted that inadequate information, lack of expertise about organic practices and unavailability of organic inputs are some of the constraints to using organic practices. The only available management methods offered by the extension personnel is the use of synthetic agro-chemical inputs. For the farmers and extension personnel in the area, all farming issues are solved with chemicals. This study corroborates Mustapha, Bzungu and Sanusi (2012) that the extension agents still believe in the positive impact of conventional systems; thereby ignoring organic farming practices with the notion of the later cannot solve food insecurity. This study findings show that public extension and advisory services in Nigeria still ignore the increasing research that shows that the productivity of smallholder, ecologically-based, organic and traditional knowledge systems can measure with the conventional systems' productivity when measured by the number of people fed per unit of land (Ponisio et al. 2015).

There is an indication that most of the extension personnel lack the required knowledge and skills to support agro-ecological techniques that can replace or substitute the use of agro-chemical and genetically modified crops and are compatible with the environmental conditions and livelihood of the smallholder farmers. The findings revealed a clear bias from the training and research institutes in Nigeria towards high input agriculture that has inspired the use of transgenic crops and agro-chemicals. This study draws the attention of the agricultural

universities in training the extension professional to acquire the relevant skills, knowledge and attitudes towards the promotion of sustainable and environmental-friendly farming systems. Accordingly, Iyagba and Ekpete (2017) reported the need for elaborate knowledge and in-service training about organic farming amongst agricultural teachers. It is imperative that national extension services should acknowledge these factors to inform their decision-making and policy implementation in the services delivered to the farmers. This is significant because farmers rely on the result of demonstrations.

Conclusion and Recommendations

The Nigeria public extension and advisory service is influenced by current national government agricultural policies. These policies have focused solely on the maximisation of food production using intensive methods with the aim of improving food security for the population. They have failed though to acknowledge the impact of intensive agricultural practices on human health and environment. Although these policies state that improvements in food production should be achieved in a sustainable manner, policy guidelines mean that extension agents provide advice and information only on conventional methods. The farmers in the study area rely on the extension personnel for agricultural information and this in turn influences their farming decisions. Currently, most farmers in the area depend on agro-chemicals for yield improvement, although a few still combine the practice with indigenous practices such as mixed-cropping and crop rotation. These indigenous practices are often compatible with agro-ecological approaches. Many farmers are concerned by the impact of intensive farming methods and there is a general willingness amongst these farmers to engage in more sustainable practices. Although farmers in this study were interested in agro-ecological practices they will not engage in new practices without access to information and the opportunity to learn new skills. Farmers tend to be conservative, and unwilling to risk money and time on new

techniques without proof of their effectiveness. Their primary source of information is the extension service, but extension agents also lack adequate expertise in agro-ecology.

There are a number of reasons for this, including a lack of locally relevent research, lack of opportunities in education and training in agro-ecology for extension agents and academics and lack of support for agro-ecology in government. These various social, environmental, research and extension management factors hinder the transition.

This study recommends that research in agro-ecology approaches should be intensified and extension personnel must be encouraged by providing adequate funding for working resources and updated training on ecologically compatible practices. In this regard, agricultural extension services should be reinvigorated through policies and projects that are geared towards promoting sustainable agricultural practices such as agro-ecology approaches. Drawing evidence from other countries where agro-ecology farming systems are practised, this study also recommends a participatory approach that incorporates farmers' own traditional knowledge and methods.

References

Adebayo, S., and I. O. Oladele. 2014. Organic agricultural practices among small holder farmers in South Western Nigeria. In *Organic Agriculture Towards Sustainability*. InTech. https://cdn.intechopen.com/pdfs-wm/46549.pdf

AdeOluwa, O. O. 2010. Organic agriculture and fair trade in West Africa. *Food and Agriculture*. http://www.fao.org/docrep/014/i2230e/i2230e11.pdf

AFSA. 2017. The Alliance for Food Sovereignty in Africa 'AGROECOLOGY: the bold future of farming in Africa'. Accessed February 29, 2017. http://afsafrica.org/agroecology-the-bold-future-of-farming-in-africa-2/

Akinwumi, A. 2013. "Transforming Nigeria's Agriculture". http://agriculture.columbia.edu/events/past-events/inaugural-seminar-the-nexus-of-agriculture-environment-and-livelihoods/transforming-nigerias-agriculture/

Altieri, M. A. 2015. Agroecology: Key Concepts, Principles and Practices. Main Learning Points from Training Courses on Agroecology in Solo, Indonesia (June 2013) and Lusaka, Zambia (April 2015). The World Network and SOCLA 2015. file:///C:/Users/emeanae/Downloads/AgroecologytrainingmanualTWN-SOCLA.pdf

Altieri, M. A., and V. M. Toledo. 2011. The agroecological revolution in Latin America: Rescuing nature, ensuring food sovereignty, and empowering peasants. *Journal of Peasant Studies,* 38:587-612. http://www.tandfonline.com/doi/pdf/10.1080/03066150.2011.582947?needAccess=true

Altieri, M. A., and C. I. Nicholls. 2012. Agroecology scaling up for food sovereignty and resiliency. In *Sustainable agriculture reviews* 1-29. Springer, Dordrecht. http://www.dphu.org/uploads/attachements/books/books_2046_0.pdf

Altieri, M. A., C. I. Nicholls, A. Henao, and M. A. Lana. 2015. Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, *35*(3), 869-890 http://dx.doi.org/10.1007/s13593-015-0285-2

Altieri, M.A., C. I. Nicholls, and R. Montalba. 2017. Technological Approaches to Sustainable Agriculture at a Crossroads: An Agroecological Perspective. *Sustainability*, 9(3):349. file:///C:/Users/emeanae/Downloads/sustainability-09-00349-v2.pdf

Anaeto, F. C., C. C. Asiabaka, A. O. Ani, and E. O. Okoroma. 2014. Up-scaling and re-branding agricultural extension service in Nigeria: Policy issues, options and

555 challenges. *International Journal of Advance Agricultural Research.*
556 ttp://www.bluepenjournals.org/ijaar/pdf/2015/March/Anaeto_et_al.pdf

557 Aphunu, A., and C. S. O. Otoikhian. 2008. Farmers' perception of the effectiveness of
558 extension agents of Delta State Agricultural Development Programme
559 (DADP). *African Journal of General Agriculture*, *4*:3, 165-169.
560 http://www.asopah.org/journals/ajga/ajga4/ajga430607080.pdf

561 Atoma, C. N., and J. O. Atoma. 2015. Analysis of organic farming practices amongst crop
562 farmers in Delta State, Nigeria. *Information Impact: Journal of Information and*
563 *Knowledge Management*, 6 (3).
564 https://www.ajol.info/index.php/iijikm/article/view/144672/134323

565 Aziz, T., M. A. Maqsood, S. Kanwal, S. Hussain, H. R. Ahmad, and M. Sabir. 2015.
566 Fertilizers and environment: issues and challenges. In Crop Production and Global
567 Environmental Issues 575-598. Springer International Publishing.
568 https://link.springer.com/chapter/10.1007/978-3-319-23162-4_21

569 Bhandari, G. 2014. An overview of agrochemicals and their effects on environment in
570 Nepal. Applied Ecology and Environmental Sciences, 2:2, 66-73.
571 http://pubs.sciepub.com/aees/2/2/5/index.html

572 Chikerenma, I. C. U. A. 2015. Redefining the Nigerian Agricultural Extension System for
573 Effective Agricultural Transformation.
574 http://www.iiste.org/Journals/index.php/DCS/article/view/23087/23606

575 De Schutter, O. 2010. Report submitted by the Special Rapporteur on the right to food. UN
576 General Assembly, Human Rights Council, 16th session, agenda item 3.
577 http://www2.ohchr.org/english/issues/food/docs/A-HRC-16-49.pdf

578 De Schutter, O. 2014. Report of the Special Rapporteur on the right to food, Olivier De
579 Schutter. Final report: The transformative potential of the right to food. Human Rights

Council of the United Nations. http://www.srfood.org/images/stories/pdf/officialreports/20140310_finalreport_en.pdf

Federal Ministry of Agriculture and Rural Development. 2000. Agriculture in Nigeria: The New Policy Thrust. http://extwprlegs1.fao.org/docs/pdf/nig149296.pdf

Federal Ministry of Agriculture and Rural Development. 2013. Agricultural Transformation Agenda Support Program – Phase 1 (ATASP-1) https://www.afdb.org/en/projects-and-operations/project-portfolio/p-ng-aab-003/

Federal Ministry of Agriculture and Rural Development. 2016. The Agriculture Promotion Policy (2016-2020): Building on the successes of the ATA, closing key Gaps, Policy and Strategy Document. http://fscluster.org/sites/default/files/documents/2016-nigeria-agric-sector-policy-roadmap_june-15-2016_final1.pdf

Food and Agriculture Organisation of the United Nations. 2017a. The Future of Food and Agriculture – Trends and Challenges. http://www.fao.org/3/a-i6583e.pdf

Food and Agriculture Organisation of the United Nations. 2017b. Nigeria at a glance. Accessed March 22, 2017. http://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/

Gliessman, S. R. 2014. *Agroecology: the ecology of sustainable food systems*. CRC press.

Hagmann, J., E. Chuma, K. Murwira. 2007. Improving the output of agricultural extension and research through participatory innovation development and extension; experiences from Zimbabwe. *European Journal of Agricultural Education and Extension*, *2*(4), 15-23. 10.1080/13892249685300041

Hodges, R. J., J. C. Buzby, and B. Bennett. 2011. Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *The Journal of Agricultural Science*, *149*(S1), 37-45.

Igudia, P.O. 2017. A Qualitative Analysis of the Agricultural Policy Dynamics and the Nigerian Economy: 1960-2015. *European Scientific Journal, ESJ*, 13(34). https://eujournal.org/index.php/esj/article/view/10305

Iyagba, A. G., and C. B. Ekpete. 2017. Perception and Practice of Organic Farming among Secondary School Teachers in Ahoada East Local Government Area of Rivers State, Nigeria. *British Journal of Applied Science & Technology* 20(4): 1-9 http://www.journalrepository.org/media/journals/BJEMT_20/2017/Apr/Iyagba2042017BJAST32558.pdf

Iyagba, A. G., and N. S. Ovai. 2015. Opportunities and constraints to organic farming in Abua/Odual Local Government Area of Rivers State, Nigeria. *International Journal of Agriculture Innovations and Research*, 4(2), 361-365. https://ijair.org/administrator/components/com_jresearch/files/publications/IJAIR_1596_Final.pdf

Kalia, A., and S. K. Gosal. 2011. Effect of pesticide application on soil microorganisms, Archives of Agronomy and Soil Science, 57:6, 569-596. http://www.tandfonline.com/doi/abs/10.1080/03650341003787582

Kankara, A. I., G. K. Adamu, R. Tukur, and A. Ibrahim. 2013. Examining environmental policies and laws in Nigeria. *International Journal of Environmental Engineering and Management*, 4 (3), 165-170. https://www.ripublication.com/ijeem_spl/ijeemv4n3_02.pdf

Kazeem, O. 2010. Organic farming gets a boost in Nigeria. The Nation Newspaper. May 25, 2010.

Kotschi, J. 2015. *A Soiled Reputation: Adverse Impacts of Mineral Fertilizers in Tropical Agriculture; Fertilization, Conservation of Resources, Food Security; Study*. Heinrich-Böll-Stiftung. https://www.wwf.de/fileadmin/fm-wwf/Publikationen-

PDF/WWF-Study_Adverse_impacts_of_mineral_fertilizers_in_tropical_agriculture.pdf

Maxwell, J. A. 2010. Using numbers in qualitative research. *Qualitative inquiry*, 16 (6): 475-482. http://journals.sagepub.com/doi/pdf/10.1177/1077800410364740

Mgbenka, R. N., E. A. Onwubuya, and C. I. Ezeano. 2015. Organic Farming in Nigeria: Need for Popularisation and Policy. *World Journal of Agricultural Sciences*, *11*:6, 346-355. https://www.idosi.org/wjas/wjas11(6)15/4.pdf

Miles, M., M. Huberman, and J. Saldaña. 2014. *Qualitative data analysis: A methods sourcebook* (Third ed.) Thousand Oaks, Californinia: SAGE Publications. http://researchtalk.com/wp-content/uploads/2014/01/Miles-Huberman-Saldana-Drawing-and-Verifying-Conclusions.pdf

Morgera, E., B. Caro, and M. Durán. 2012. *Organic agriculture and the law*. Food and Agriculture Organisation of the United Nations. http://www.fao.org/docrep/016/i2718e/i2718e.pdf

Mustapha, S. B., P. M. Bzungu, and A. M. Sanusi. 2012. The need for Organic Farming Extension in Nigeria. *Journal of Environmental Management and Safety*, *3*(1), 44-53.

National Agricultural Extension and Research Liaison Services. 2017a. Working Process. Accessed August 16, 2017 https://naerls.gov.ng/#

National Agricultural Extension and Research Liaison Services. 2017b. A Brief on NAERLS Adopted Village and School Outreach. Accessed August 15, 2017. https://naerls.gov.ng/brief-on-naerls-adopted-village-school-operations/

Nwachukwu, C. A. 2010. Adoption of Organic Agricultural Technologies: Implications for Radio farmer Agricultural Extension Programmes in Imo State, Nigeria. http://iaald2010.agropolis.fr/proceedings/final-paper/NWACHUKWU-2010-Adoption_of_organic_agricultural_technologies-IAALD-Congress-250_b.pdf

654 Oakland Institute. 2017. Agroecology Case studies. Accessed February 11, 2017.
655 https://www.oaklandinstitute.org/agroecology-case-studies
656 Odoemelam, L. E., and P. N. Ajuka. 2015. Indigenous Farm Management Practices
657 among Rural Farmers: Implications for Sustainable Environment in South-East Agro-
658 Ecological Zone, Nigeria. *Discourse Journal of Agriculture and Food Sciences*, *3*:1,
659 7-14. http://www.resjournals.org/JAFS/PDF/2015/Odoemelam_and_Ajuka.pdf
660 Oguamanam, C. 2015. Organic farming in Nigeria in the era of agro-biotech and biosafety.
661 *Journal of Advances in Agricultural Science and Technology*, 3(6)
662 http://www.watchpub.org/jaast/issues/2015/september/pdf/Oguamanam.pdf
663 Olaito, P. 2014. Organic Agriculture in Nigeria: A Report.
664 https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Organic%20Agriculture
665 %20in%20Nigeria_Lagos_Nigeria_6-5-2014.pdf
666 Palys, T. 2008. Purposive sampling. In L. M. Given (Ed.) The Sage Encyclopedia of
667 Qualitative Research Methods. (Vol.2). Sage: Los Angeles, 697-8.
668 https://www.sfu.ca/~palys/Purposive%20sampling.pdf
669 Patton, M. Q. 2014. *Qualitative research and evaluation methods: Integrating theory and*
670 *practice*. 4th ed. SAGE, Thousand Oaks, CA
671 Ponisio, L. C., L. K. M'Gonigle, K. C. Mace, J. Palomino, P. de Valpine, and C. Kremen.
672 2015. Diversification practices reduce organic to conventional yield gap. In *Proc. R.*
673 *Soc. B* (Vol. 282, No. 1799, p. 20141396). The Royal Society.
674 http://rspb.royalsocietypublishing.org/content/royprsb/282/1799/20141396.full.pdf
675 Reents, H. J., B. Küstermann, and M. Kainz. 2008. Sustainable land use by organic and
676 integrated farming systems. *In Perspectives for Agroecosystem Management* 17-39.
677 https://doi.org/10.1016/B978-044451905-4.50004-0

678 Rivera, W. M., and M. K. Qamar. 2003. *Agricultural extension, rural development and the*
679 *food security challenge*. Rome: Food and Agriculture Organization of the United
680 Nations.
681 https://pdfs.semanticscholar.org/cb80/9beb1cf462981be748fdd6103aec638a657f.pdf
682 Sani, B., Z. Omenesa, I. Sambo, J. Abdullahi, and M. Yuguda. 2015. Effect of Targeted
683 Agricultural Information Delivery Approach on Farmers' Access to
684 Agricultural Information in Nigeria. *Journal of Agricultural and Food*
685 *Information, 16*:1, 72-79.
686 http://www.tandfonline.com/doi/pdf/10.1080/10496505.2014.984038?needAccess=tr
687 ue
688 Savci, S. 2012. Investigation of effect of chemical fertilizers on environment. Apcbee
689 Procedia, 1,287-292.
690 http://www.sciencedirect.com/science/article/pii/S2212670812000486
691 Tella, R. D. 2007. Towards promotion and dissemination of indigenous knowledge: a case of
692 NIRD. *The International Information & Library Review*, 39 (3-4): 185-193.
693 https://doi.org/10.1080/10572317.2007.10762748
694 United Nations. 2017. World Population Prospects: The 2017 Revision. Accessed September
695 29, 2016. https://www.un.org/development/desa/en/news/population/world-
696 population- prospects-2017.html
697 Varca, L. M. 2002. Impact of agrochemicals on soil and water quality. Food and Fertilizer
698 Technology Center.
699 http://www.fftc.agnet.org/htmlarea_file/library/20110804160130/eb520.pdf
700 Watts, M. 2000. Political ecology. *A companion to economic geography*, 257, 274.
701 http://onlinelibrary.wiley.com/doi/10.1002/9780470693445.ch16/pdf

Wezel, A., M. Casagrande, F. Celette, J. F. Vian, A. Ferrer, and J. Peigné. 2014. Agroecological practices for sustainable agriculture. A review. *Agronomy for Sustainable Development* 34 (1-20). http://dx.doi.org/10.1007/s13593-013-0180-7

Willer, H., and J. Lernoud. 2017. The World of Organic Agriculture Statistics and Emerging Trends. FiBL and IFOAM – Organics International 2017. Frick and Bonn. https://shop.fibl.org/CHen/mwdownloads/download/link/id/785/?ref=1

Zwane, E. M. 2012. Does extension have a role to play in rural development? *South African Journal of Agricultural Extension*, *40*:1, 16-24 http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0301-603X2012000100002&lng=en&tlng=en