

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

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1 **Evaluating the Role of Public Agricultural Extension and Advisory Services in Promoting**

2 **Agro-ecology Transition in Southeast Nigeria**

3 **Abstract**

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

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

21 **Introduction**

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

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

38 Agro-ecological farming approaches aim to achieve healthy food security without negative
39 impacts on the environment following ecological concepts to develop ecological structures that
40 limit the use of external inputs and allow ecosystem interaction (Altieri and Nicholls, 2012;
41 Altieri, Nicholls, and Montalba, 2017). The farming practice involves the application or use of
42 various techniques such as crop rotations, green manuring, composting and bush fallow
43 systems or shifting cultivation to improve soil nutrients and organic matter. Also, integration
44 of livestock into cropping systems, use of native seeds and local breeds of livestock, natural
45 farm water harvesting, biological pest and disease management, and polycultures are some of
46 the widely accepted practices applied in small-scale family farms across the world as organic
47 techniques (Altieri and Toledo 2011; Wezel et al. 2014). Organic agriculture developed as a
48 response to what appeared as pollution of the food supply by modern farming techniques, and
49 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

75 agriculture movements and associations geared towards enhancing organic agriculture
76 awareness and practice (Olaito 2014). These activities are yet to transform into significant
77 structured organic farm holding as certified organic products are still poorly marked, with most
78 of these activities taking place in the western part of Nigeria (Olaito 2014; Willer and Lernoud
79 2017). The few certified organic products include honey and lemongrass tea. There are other
80 non-certified products from agro-ecological farming which include turmeric, a local rice
81 cultivar known as ofada, black soap produced from wood ash and herbs, red hibiscus for local
82 soft drinks, tropical fruits, mushrooms and cashew nuts (AdeOluwa 2010; Kazeem 2010;
83 Mgbenka, Onwubuya and Ezeano 2015). For livestock production, a certification system was
84 reported to be in the developing stage (Kazeem 2010). These products are sold to the local
85 market and there are no organised sales outlets where consumers can access organic products,
86 a situation regarded as under-maximisation of the premium benefits in organic farming
87 (AdeOluwa 2010).

88 The underdevelopment of organic agriculture and slow transitioning to the practice by farmers
89 in Nigeria has been linked to limited access to organic agriculture information (AdeOluwa
90 2010). On the other hand, an effective agricultural extension delivery system is invaluable in
91 motivating farmers to adopt new or existing innovation (Aphunu and Otoikhian 2008; Rivera
92 and Qamar 2003; Zwane 2012). The National Agricultural Extension and Research Liaison
93 Services (NAERLS) is a public institute under the Federal Ministry of Agriculture and Rural
94 Development responsible for agricultural information dissemination in Nigeria. NAERLS
95 coordinates national agricultural training activities; planning and development of extension
96 liaison services throughout Nigeria; conducts research on agricultural technique transfer and
97 adoption; and collaborates with Research Institutes and Agricultural Development Programme
98 (ADP) in transferring existing knowledge and innovations (NAERLS 2017a). NAERLS
99 established the Research Extension Farmer Input Linkage System (REFILS) and adopted

100 village scheme to improve the agricultural information dissemination and utilisation (NARLS
101 2017b). In ensuring access to information and an effective delivery system, NAERLS selected
102 120 communities on the mandate of “adopted village scheme” within 20 kilometre distance
103 from the headquarter and respective zonal offices (NAERLS 2017b). The institute further
104 adopted a targeted information delivery method by setting up Information Resource Centres
105 (IRCs) in each of the selected communities to care for their agricultural information needs
106 (NAERLS 2017b; Sani et al. 2015). NAERLS has been reported to encounter various
107 challenges such as inadequate funding to support field extension activities, unsteady policies,
108 poor staffing, poor access roads, and negligence by the government, despite contributions to
109 the national economy (Anaeto et al. 2014; Chikerenma 2015). However, Sani et al. (2015)
110 observed that farmers’ access to agricultural information improved through IRCs in the various
111 adopted villages.

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

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

124 **Methodology**

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

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

133 ***Data Collection and Analysis***

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

144 The study was approved through Coventry University's ethical approval procedure and written
145 informed consent was obtained from each participant prior to the data collection. Ensuring a
146 suitable environment for the interviewees, the interviewing researcher visited the participants
147 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

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

181 **Results**

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

193 One of extension personnel explained:

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

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

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

203 A farmer explained:

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

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

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

213 One of the extension personnel explained:

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

216 ***The Impact of Extension Activities on Farming Practices and the Potential for Agro-ecology*** 217 ***Transitioning***

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

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

223 *Farmers' Perspectives*

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

231 One of the farmers explained that:

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

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

242 This is a typical narrative of one of the farmers:

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

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

251 This farmer explained that:

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

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

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

267 Among the farmers who keep ruminant animals, one explained:

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

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

276 *Extension Personnel Perspectives*

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

282 One of the personnel explained that:

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

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

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

292 Another explained that:

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

297 ***Factors Influencing Both the Extension Services and Agricultural Practices***

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

311 A farmer revealed:

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

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

316 Another farmer explained:

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

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

326 A farmer explained that:

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

330 Another farmer explained:

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

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

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

341 An extension personnel explained that:

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

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

347 Another personnel stated that:

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

352 Another extension personnel explained that:

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

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

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

362 **Discussion**

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

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

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

394 The local knowledge of the farmers should not be underestimated because it constitutes the
395 capacity needed for conserving the local ecosystems. According to Tella (2007), local or
396 indigenous knowledge is the systematic body of knowledge or skills acquired by a people
397 through accumulated experiences and informal trails that helped them to understand their
398 environment. Indeed, organic farming as an agro-ecological approach combines traditional
399 farmers' knowledge with modern ecology, soil management and crop production in designing
400 and managing the ecosystem. It improves and sustains on-farm production fertility which in
401 turn reduces farmers' reliance on external inputs and government subsidies helping vulnerable
402 smallholder farmers less dependent on loans (Altieri 2015). The findings confirm that organic
403 farming approaches can improve yield within the small-holder farming context. Furthermore,
404 the findings corroborate evidence from other parts of the world that the combination of
405 livestock and crop production enhances organic farming practices. This is because the animals
406 provide manure and other types of animal waste which can improve the nutrient cycle and
407 organic matter important for the maintenance of soil structure and fertility (Reents, Küstermann
408 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

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

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

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

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

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

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

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

490 **Conclusion and Recommendations**

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

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

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

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

521

522 **References**

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

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

528 AFSA. 2017. The Alliance for Food Sovereignty in Africa 'AGROECOLOGY: the bold
529 future of farming in Africa'. Accessed February 29, 2017.

530 <http://afsafira.org/agroecology-the-bold-future-of-farming-in-africa-2/>

531 Akinwumi, A. 2013. "Transforming Nigeria's Agriculture".
532 <http://agriculture.columbia.edu/events/past-events/inaugural-seminar-the-nexus-of->
533 [agriculture-environment-and-livelihoods/transforming-nigerias-agriculture/](http://agriculture.columbia.edu/events/past-events/inaugural-seminar-the-nexus-of-agriculture-environment-and-livelihoods/transforming-nigerias-agriculture/)

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

538 Altieri, M. A., and V. M. Toledo. 2011. The agroecological revolution in Latin America:
539 Rescuing nature, ensuring food sovereignty, and empowering peasants. *Journal of*
540 *Peasant Studies*, 38:587-612.
541 <http://www.tandfonline.com/doi/pdf/10.1080/03066150.2011.582947?needAccess=true>
542 [ue](http://www.tandfonline.com/doi/pdf/10.1080/03066150.2011.582947?needAccess=true)

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

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

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

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

555 challenges. *International Journal of Advance Agricultural Research*.
556 http://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/ijjkm/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

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

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

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

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

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

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

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

597 Haggmann, J., E. Chuma, K. Murwira. 2007. Improving the output of agricultural extension
598 and research through participatory innovation development and extension;
599 experiences from Zimbabwe. *European Journal of Agricultural Education and*
600 *Extension*, 2(4), 15-23. [10.1080/13892249685300041](https://doi.org/10.1080/13892249685300041)

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

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

607 Iyagba, A. G., and C. B. Ekpete. 2017. Perception and Practice of Organic Farming among
608 Secondary School Teachers in Ahoada East Local Government Area of Rivers State,
609 Nigeria. *British Journal of Applied Science & Technology* 20(4): 1-9
610 [http://www.journalrepository.org/media/journals/BJEMT_20/2017/Apr/Iyagba204201](http://www.journalrepository.org/media/journals/BJEMT_20/2017/Apr/Iyagba2042017BJAST32558.pdf)
611 [7BJAST32558.pdf](http://www.journalrepository.org/media/journals/BJEMT_20/2017/Apr/Iyagba2042017BJAST32558.pdf)

612 Iyagba, A. G., and N. S. Ovai. 2015. Opportunities and constraints to organic farming in
613 Abua/Odual Local Government Area of Rivers State, Nigeria. *International Journal*
614 *of Agriculture Innovations and Research*, 4(2), 361-365.
615 [https://ijair.org/administrator/components/com_jresearch/files/publications/IJAIR_15](https://ijair.org/administrator/components/com_jresearch/files/publications/IJAIR_1596_Final.pdf)
616 [96 Final.pdf](https://ijair.org/administrator/components/com_jresearch/files/publications/IJAIR_1596_Final.pdf)

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

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

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

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

629 [PDF/WWF-](#)
630 [Study Adverse impacts of mineral fertilizers in tropical agriculture.pdf](#)
631 Maxwell, J. A. 2010. Using numbers in qualitative research. *Qualitative inquiry*, 16 (6): 475-
632 482. <http://journals.sagepub.com/doi/pdf/10.1177/1077800410364740>
633 Mgbenka, R. N., E. A. Onwubuya, and C. I. Ezeano. 2015. Organic Farming in Nigeria:
634 Need for Popularisation and Policy. *World Journal of Agricultural Sciences*, 11:6,
635 346-355. [https://www.idosi.org/wjas/wjas11\(6\)15/4.pdf](https://www.idosi.org/wjas/wjas11(6)15/4.pdf)
636 Miles, M., M. Huberman, and J. Saldaña. 2014. *Qualitative data analysis: A methods*
637 *sourcebook* (Third ed.) Thousand Oaks, California: SAGE Publications.
638 [http://researchtalk.com/wp-content/uploads/2014/01/Miles-Huberman- Saldana-](http://researchtalk.com/wp-content/uploads/2014/01/Miles-Huberman-Saldana-Drawing-and-Verifying-Conclusions.pdf)
639 [Drawing-and-Verifying-Conclusions.pdf](#)
640 Morgera, E., B. Caro, and M. Durán. 2012. *Organic agriculture and the law*. Food and
641 Agriculture Organisation of the United Nations.
642 <http://www.fao.org/docrep/016/i2718e/i2718e.pdf>
643 Mustapha, S. B., P. M. Bzungu, and A. M. Sanusi. 2012. The need for Organic Farming
644 Extension in Nigeria. *Journal of Environmental Management and Safety*, 3(1), 44-53.
645 National Agricultural Extension and Research Liaison Services. 2017a. Working Process.
646 Accessed August 16, 2017 <https://naerls.gov.ng/#>
647 National Agricultural Extension and Research Liaison Services. 2017b. A Brief on NAERLS
648 Adopted Village and School Outreach. Accessed August 15, 2017.
649 <https://naerls.gov.ng/brief-on-naerls-adopted-village-school-operations/>
650 Nwachukwu, C. A. 2010. Adoption of Organic Agricultural Technologies:
651 Implications for Radio farmer Agricultural Extension Programmes in Imo State,
652 Nigeria. [http://iaald2010.agropolis.fr/proceedings/final-paper/NWACHUKWU-2010-](http://iaald2010.agropolis.fr/proceedings/final-paper/NWACHUKWU-2010-Adoption_of_organic_agricultural_technologies-IAALD-Congress-250_b.pdf)
653 [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](https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Organic%20Agriculture%20in%20Nigeria_Lagos_Nigeria_6-5-2014.pdf)
665 [%20in%20Nigeria_Lagos_Nigeria_6-5-2014.pdf](https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Organic%20Agriculture%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](http://www.tandfonline.com/doi/pdf/10.1080/10496505.2014.984038?needAccess=true)
687 [ue](http://www.tandfonline.com/doi/pdf/10.1080/10496505.2014.984038?needAccess=true)

688 Savci, S. 2012. Investigation of effect of chemical fertilizers on environment. *Apctee*
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-](https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html)
696 [population-prospects-2017.html](https://www.un.org/development/desa/en/news/population/world-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>

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

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

708 Zwane, E. M. 2012. Does extension have a role to play in rural development? *South*
709 *African Journal of Agricultural Extension*, 40:1, 16-24
710 [http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0301-](http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0301-603X2012000100002&lng=en&tlng=en)
711 [603X2012000100002&lng=en&tlng=en](http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0301-603X2012000100002&lng=en&tlng=en)