

Full Length Research Paper

An overview of agricultural extension in Ghana and Burkina Faso and implications for sustainable agriculture in West Africa

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Agricultural extension is the medium through which external agricultural technologies have been transferred to and transplanted in Africa to improve agricultural performance. Over a period of close to a century, different agricultural extension models have been proposed but their structure and content has virtually been the same: top-down, linear, non-participatory transfer of technology with no feedback loops for reverse diffusion. This presumably explains the poor performance of Africa's agriculture and the scale of food security challenges facing the continent. In this review paper, we trace the history of agricultural extension and examine various agricultural extension delivery models to identify their major strengths and weaknesses, using Ghana and Burkina Faso as case studies. We then review the most recent literature in the field about the philosophy, scope, content, delivery, and outcomes of agricultural extension. The conclusion that agricultural extension has consistently remained out of sync with the needs and aspirations of stallholder farmers was reached. Smallholder farmers are now calling for new agricultural extension delivery models that are truly farmer-led, indigenous knowledge-based, context-specific, culturally-relevant and environmentally-sustainable to guarantee efficient farming systems into the future.

Key words: Extension delivery, smallholder farmers, indigenous knowledge, top-down, Ghana, Burkina Faso, sustainable agriculture.

INTRODUCTION

Agricultural extension is the medium through which external agricultural technologies have been transferred

to and transplanted in Africa, ostensibly to transform agriculture and improve food security and nutrition.

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Extension addresses the productivity differential between the actual productivity on the farmers' farms and what could potentially be produced with better know-how, subject as always, to farmers' preferences and resource constraints (Anderson, 2008). This productivity differential can be broadly classified into two types of "gaps": a technology gap and a management gap. The former might entail additional investment and higher recurring costs (e.g., for inputs such as fertilizers or seeds of improved cultivars or fertilizers) while the latter may offer the farmer a low-cost means of raising productivity by applying improved management practices. It is not surprising therefore, that typically, farmers in Africa receive both technical training (e.g., fertilization of crops and pest control) and management training (e.g., cash flow planting and gross margin analysis) as part of agricultural advisory services and agricultural extension" (Kanu et al., 2016).

All strategic frameworks and plans of the governments of Ghana and Burkina Faso identify agricultural research and extension as a focus area of policy intervention to achieve greater agricultural productivity for improved livelihoods (FAO, 2015). Admittedly, extension delivery has achieved significant successes in terms of farm productivity, but pluralistic information transmission channels between researchers, farmers and agricultural extension services providers have remained consistently weak (Bikuba and Kayunze, 2019).

Thus, the different extension delivery models have repeatedly failed to incorporate farmer indigenous knowledge to the extent that productivity differentials still exist, and food insecurity remains a daunting challenge (Napoli, 2011). Also, researchers, through agricultural extension agents and researchers often appropriate the indigenous knowledge of farmers as technology borne out of scientific experimentation (Santuah, 2018a, b). In all this, the structure of extension delivery has not significantly changed (Christoplos, 2011; Tladi-Sekgwama, 2019; Amayo et al., 2021).

The purpose of this review paper is to trace the evolution of agricultural extension in West Africa and examine the variance in effectiveness of agricultural extension, with Ghana and Burkina Faso as case studies. Specifically, (1) what extension delivery models have been proposed and what aspects of the productivity differential do they address? (2) what have been the key characteristics, strengths and weaknesses of the extension delivery models? What are the pathways for developing extension delivery models that are more responsive to farmer needs and aspirations in West Africa?

METHODOLOGY

Study design

This study primarily reviewed secondary data, which consisted of an extensive literature survey of agricultural extension models in

Ghana and Burkina Faso mainly from government sources, books, journal articles, students' dissertations, and journalistic reports. The study then compares these case studies with what pertains in agricultural extension worldwide to draw general conclusions. This study is therefore limited in the lack of empirical evidence to back the findings of the literature review, though much of the reviewed literature is based on empirical research.

LITERATURE REVIEW

Agricultural extension in Ghana and Burkina Faso

Agricultural extension has been defined as a network of systems which should facilitate access to knowledge, information and technology by farmers, their organisations, and other market-oriented stakeholders; it should facilitate their interactions with partners of research and educational institutions, or agrifood sectors and other interested institutions; it has to assist them to develop their core competences and technical practices in organisation and management (Sare, 2012).

Other terms for agricultural extension include "rural extension" and "participatory extension" which generally refer to "the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods" (Anderson, 2008).

Agricultural extension in Burkina Faso dates back to the first quarter of the 20th century when Governor Hesling of the French colony of the then Upper Volta introduced techniques for agricultural intensification into the country which initially accompanied the compulsory cotton production programme decided in 1924 (MAHRH, 2010). By 1932, the management of "agricultural affairs" was directly under the purview of the administrative structures. Generally however, the history of agricultural extension, in Burkina Faso research and development can be subdivided into five major historical periods, each distinguished by milestone extension initiatives. Emphasis will be placed on the colonial period, the first 20 years after independence, and extension delivery from the 1980s to date. The colonial period (1944-1960) was characterized by the intervention of several foreign research and development, and extension structures focused on cash crop production, and the setting up in 1944, of the directorates of Agriculture, Livestock, Water and Forests to facilitate the progressive establishment of technical structures. However, as far as agricultural extension in Burkina Faso is concerned, the most significant events in agricultural extension in Burkina Faso occurred in the first 20 years after independence (1960-1980). During that period, national governments progressively assumed ownership of agricultural policies and strategies, characterized by the top-down, donor-driven "Training and Visits" (T&V) approach to agricultural extension was in full force. Extension delivery from the 1980s have seen the development of national extension

system that focuses on providing agricultural and advisory support adapted to the needs of farmers (Sare, 2012).

This sharply contrasts with Ghana, which launched the T&V agricultural extension system nationwide much later, between 1992 and 1999, under the concept of Transfer of Technology (TOT) by Agricultural Extension Agents (AEAs). The focus was to reach farmers with only information as the T&V system was based on pupil-teacher relationship in which the farmer was the pupil and the extension agent the expert teacher (Beyuo, 2011). According to Lauer (1995) this approach became dominant because, “overseas agencies have assumed coercive power through field workers who interpret the real needs of the poor and who invigilate local authorities to monitor the appropriation of programme benefits”.

Whereas Burkina Faso created its National Extension Service in 1981, and transformed it into the Extension Service and Rural Animation (SVAR) in 1985, Ghana established the Directorate of Agricultural Extension Services (DAES) in 1987 to bring under one umbrella all splinter Ministry of Food and Agriculture extension services.

Liberalization of agricultural extension services resonated throughout the period 1990-2000 under the full effects of the Structural Adjustment Program (SAP). The removal of subsidies on agricultural inputs took away the incentives the traditional extension service depended upon to attract farmers in both countries to adopt available technology (MoFA & CDCI, 2017).

Like in Burkina Faso, the T&V extension initiative in Ghana was supported by the World Bank (Bagchee, 1994). Within the same framework, the World Bank supported the National Agricultural Research Project (NARP) in 1991 to, among others, forge a close working relationship between research, extension and farmers, and “ensure that research is responsive to farmers’ needs” (Asuming-Brempong et al., n.d). But evaluation studies supported showed that the T&V system was deficient in both content and learning techniques and therefore did not satisfy user needs (Don Richardson, 2006). Towards the year 2000, Burkina Faso officially abandoned the T&V approach to extension due to high cost and insufficient numbers of agricultural extension agents (MAHRH, 2010).

Under the revised Food and Agriculture Sector Development Policy II (FASDEP II 2007), being implemented through the Ghana’s Medium Term Agriculture Sector Investment Plan METASIP II (2014-2017), limited access to appropriate technology at all levels in the crop, livestock and fisheries sub-sector is recognized as one of the major obstacles to agricultural development (MoFA & CDCI, 2017). Currently, state technical services, including research institutes in Burkina Faso, continue to actively provide extension services, technology transfer and advisory support to rural communities (Institut de l’Environnement et de

Recherches Agricoles [INERA], 2009). Universities are also increasingly involved in academic training, particularly through the new training courses for extension engineers at the Polytechnic University of Bobo-Dioulasso with the support of Sasakawa Global 2000 (INERA, 2009).

Ghana also experimented with various alternative extension approaches such as Participatory Technology Development and Extension (PTD&E) and Farmer Field Schools (FFS), in collaboration with development agencies like the German Technical Co-operation (GTZ) and FAO, under which the role of the Agricultural Extension Agent (AEA) was expanded to include facilitating learning among farmers instead of only transferring technology and information (MoFA, 2005a). In 1997, Ghana’s MoFA’s activities were decentralized ostensibly to further make extension more participatory and demand-driven as well as diversify extension services in the face of dwindling public funding (MoFA & CDCI, 2017). But this was viewed as a euphemism for yielding to donor pressure to transfer some aspects of extension to private or other non-government providers (Anderson, 2008). Ghana’s Agricultural Extension Policy (MoFA, 2005a) and the Extension Regulatory Framework and Standards for Extension Delivery (MoFA, 2005b) contain the guiding principles of agricultural extension delivery in the country. In reality, the overarching emphasis is on establishing a pluralistic extension and advisory services by “*encouraging private sector participation in extension delivery and funding*” (MoFA, 2005a).

In the 1990s Burkina Faso created the Système National de Vulgarisation Agricole (SNVA) (National Extension System) to champion the transfer of technologies to support farming and livestock raising, soil fertility management and the conservation of water sources. Its mandate was expanded in accordance with the priorities of the African Forum for Agricultural Advisory Services (GFRAS) which was created to develop more “innovative approaches for the provision of agricultural advisory services and better consideration of user demand” (Sare, 2012). It then became le Système National de Vulgarisation et d’appui Conseil Agricoles (SNVACA) (the National Agricultural Extension and Advisory Support System), Burkina Faso’s current national extension delivery system. Two key objectives of SNVACA are (1) to “provide agricultural and advisory support adapted to the needs of the beneficiaries” and 2) “to promote consultation frameworks between all the actors involved in the agricultural advisory support services for a synergy of actions and interventions” (Sare, 2012). In executing its mandate, SNVACA enables producers to work with research institutions to develop more efficient crop varieties that adapt to climatic and soil conditions (Sare, 2012).

The model of extension services, exemplified in a schematic representation of the work structure of Burkina

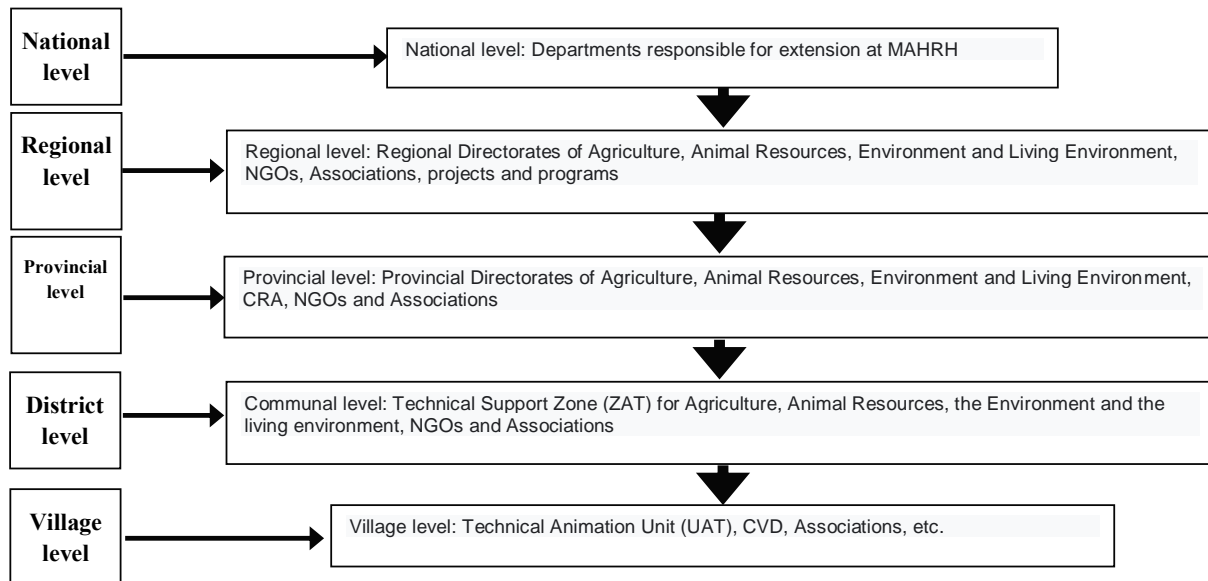


Figure 1. Extension delivery regimen in Burkina Faso.
Source: MAHRH (2010)

Faso's extension service (SNVACA) (Figure 1), depicts the top-down approach to agricultural extension. As the arrows show, instructions emanate from the national level through the regional level, to the provincial level to the commune (District) level then to the village level. As Figure 1 clearly shows, the extension activities of the current SNVACA are focused on providing unidirectional agricultural technologies, services and information, without regard to the fact that the dissemination of knowledge is not a one-way street; from the scientific community to the producers but a two-way interaction and cross-fertilization of technical and practical knowledge between extensionists and smallholder farmers. But the agricultural advisory services and agricultural extension are not serving the needs of smallholder farmers because "the system is designed in a uniform way for producers with different needs and technical levels" (Sare, 2012).

Marc GANSONRE, Deputy General Secretary of the Confédération Paysanne du Faso (CPF - Faso Peasant Farmers Association) has criticized SNVACA in uncharitable terms:

The SNVACA, in its current formulation, is not suitable for Farmer Organisations (FOs) because the text is vague on the modalities of its implementation and the concerns of FOs are not taken into account. The SNVACA remains a text drafted by agents of the state without taking into account existing dynamics contrary to what the GFRAS enunciated (Confédération paysanne du Faso [CPF] NOUVELLES, 2010, with emphasis).

The SNVACA does not recognize the importance of indigenous knowledge of the smallholder farmers - the

end-users of extension services. The formulation of the SNVACA strategy itself was not participatory, its implementation has been predictably chaotic, and it has failed to impact the lives of smallholder farmers the way it should (CPF, 2013). Since 2013, the CPF action points have consistently highlighted the need for the participation of its members in agricultural policy discussions, but it lacks the requisite human resources to undertake the needed advocacy (Sare, 2012). Besides, "successful advocacy on agricultural policies requires solid training of peasant leaders" which is currently not up to scratch d'appui aux organisations paysannes africaines (PAOPA, 2013).

Effectiveness of agricultural extension services

Most impact evaluations conducted in Africa have reported a positive impact of agricultural extension programmes (Waddington et al., 2010; Taye, 2013). For instance, in their assessment of the impact of agricultural extension service on adoption of chemical fertilizer, and the implications for rice productivity and development in Ghana, Donkor et al. (2016) found that access to extension services significantly promotes adoption of chemical fertilizer, which in turn has a positive influence on rice productivity.

Innocent and Vasanthakaalam (2018) report the success of "a self-sustaining agricultural extension system" in Rwanda, which is "based on a pluralistic approach involving farmer to farmer extension model with many actors from both public and private sector playing different roles". This extension system uses Farmer Field

Schools and Farmer Promoters to diffuse “good agricultural practices” which means the so-called “self-sustaining agricultural extension system” is no more than an extended version of the failed Farmer Field Schools approach.

However, others have asserted that at best these positive results have been context specific and at worse negative (Purcell and Anderson, 1997; Taye, 2013).

Though the reasons for the contradictions results of the evaluations may emanate from the nature and methodologies used, Rivera et al. (2001) found that extension systems had become “failing” and “moribund”, or been in a state of “disarray or barely functioning at all”.

In their review of projects in a World Bank study, Purcell and Anderson (1997) reported that, an “entrenched top-down” attitude of extension staff accounted for 75% of failed extension projects, which explains why extension “programmes paying more attention to consultations with farmers to identify local needs tended to result in greater adoption and impact” (Waddington et al., 2010). The authors also pointed out that, research-extension linkages were generally weak, and neither research nor extension was sufficiently conscious of the need to understand the constraints and potentials of the different farming systems as a basis for determining relevant technology and technology development requirements.

Millar et al. (2012) have made a similar observation that the research-policy-practice nexus in Ghana is weak. There is no formal institutional linkage between the Council for Scientific and Industrial Research (CSIR) and the universities neither is there such a linkage between it and the Ministry of Agriculture (Millar et al., 2012). They describe smallholder farmer participation in extension as “pretence” and conclude that “farmers only matter in their role as ‘passive users of technical information’, never as ‘active generators of information’” (Millar et al., 2012).

Though the benefits of extension have been touted loud enough (Zoogah and Nakuja, 2020), and the determinants of adoption of agricultural extension are known (Hiko et al., 2020), up to this minute the problems besetting agricultural extension have persisted. The failure of agricultural extension in Ghana and Burkina Faso mirror the reality of the failure of agricultural extension in Africa. In their study to understand factors limiting the adoption of improved agricultural technology in the Upper East Region of Ghana, Azu et al. (2021) found that farmers did not adopt improved sorghum varieties because the varieties did not meet their preferences. Though Tasisa et al. (2021) found that improved varieties of millet had higher yield and were more disease tolerant than local cultivars, Mtyobile and Mhlontlo (2021) evaluated tillage practices in OR Tambo District of South Africa and discovered that the minimum tillage being practiced by farmers had higher levels of P (Phosphorous) and K (Potassium) soil macro elements that increased maize yield than the conventional tillage

being promoted by extension.

Also, in addition to not being targeted to benefit those most in need, agricultural subsidies have been abused (Andani et al., 2020). Despite farmers’ willingness to pay for extension services (Shaasi et al., 2019; Farooq et al., 2020), public and private sector extension services providers work in competition instead of complementing each other (Farooq et al., 2020). Agricultural policies do not address gender disparities in extension services and access to productive resources such as credit (Hassen, 2019), and this excludes women from routine extension training programmes (Amayo et al., 2021). Besides, agricultural research and extension focus more on supplying technologies related to maize production whereas farmers have holistic expectations that go beyond production technologies to include the entire marketing chain (Come et al., 2021). These holistic expectations also mean farmers’ age, education, awareness, perception of risks and uncertainties about new varieties, availability of planting materials and scale of operation have significant association with, and are significant predictors of, adoption of agricultural technology (Cheruiyot, 2021). Chete (2021) has therefore highlighted the need to improve farmers’ education, expand coverage and depth of extension services and strengthen the link between researchers, innovators and farmers. This should foster inclusive community participation, which is currently used more as a means than an end (Bikuba and Kayunze, 2019).

Being essentially market-oriented, extension delivery is biased in favour of the more affluent and already successful farmers or farmers with the requisite characteristics to succeed in commercial farming while ignoring poor and non-literate farmers (Gwary et al., 2019; Mbavai et al., 2019).

Tladi-Sekgwama’s (2019) overview of agricultural extension delivery in Botswana since 1926 concluded that the national extension system has not been responsive to the needs of farmers. Though the Agricultural Extension Agent (AEA) remains the main source of information for the majority of farmers (Aboe, 2021), agricultural extension, as is currently structured, cannot solve the problems facing agriculture in Africa (Tladi-Sekgwama, 2019). The need for a redefinition and reconfiguration of agricultural extension is therefore long past due:

(as a result of the complex nature of the functions, tasks and roles of extension in agri-food systems and natural resource management, a more integrated perspective is needed to enable extension to play its facilitation role...) (Sare, 2012).

In the words of Ameyaw and Jayne (2016), extension approaches can only be effective if the Agricultural Advisory Services [AAS] that use them: (1) have information and recommendations that are relevant,

appropriate for and useful to farmers; (2) have the needed attitude and skills to train farmers; (3) have operational budgets to implement programs; and (4) have systems to elicit feed-back from farmers and use it to modify programs.

The authors claim that many extension systems have critical deficiencies in one or more of the areas they have listed. They recommend conducting simple diagnostic assessments at a national or district level to identify key constraints limiting the performance of agricultural advisory services.

Despite the myriad of difficulties, agricultural extension has face over the course of the century, three major challenges of extension have remained which resonate across both Ghana and Burkina Faso. These are [1] “the lack of consideration of local knowledge and socio-cultural realities in the processes of generation and diffusion of technologies; [2] the almost total dependence of the extension service on external donors; and [3] numerical reduction and aging of extension agents” (MAHRH, 2010, pp. 11-12).

Conclusion

Agricultural extension has evolved considerably over the past century, and the role of the Agricultural Extension Agent (AEA) has theoretically expanded to include facilitating learning among farmers instead of only transferring technology and information. But extension ought to have been an on-going, socially-constructed and negotiated process for transferring agricultural innovations to raise agricultural productivity. Instead, it has retained its original top-down, unidirectional flow of its one-size-fits-all information that does not address the real needs of West African smallholder farmers. All this leads to the conclusion that, the current design, content, cost and method of delivery of agricultural extension do not support Africa’s agricultural transformation to benefit smallholder farmers. The need for new extension delivery models is therefore long overdue. However, smallholder farmers are calling for agricultural extension delivery models that are indigenous knowledge-based, context-specific, culturally-relevant and environmentally-friendly to sustain farming systems into the future. This requires that the initiatives are truly farmer-led. The next logical step therefore, is to assemble the requisite human resources to undertake sustained advocacy for a change in agricultural policy. Since farmers currently have limited or no political influence, government itself must commit to train the leaders of farmers to cascade empowerment training for their members.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Aboe PAT (2021). Farmers' Access to Agricultural Extension Services in the Dangme West District of Ghana. A Thesis Presented to the Department of Sociology, University of Ghana, Legon, in Partial Fulfillment of the Requirements for the Award of the Master of Philosophy in Sociology; Legon.
- Amayo F, Akidi IL, Esuruku RS, Kaptui PB (2021). Farming methods and the livelihood outcomes of women in Eastern Uganda. *Journal of Agricultural Extension and Rural Development* 13(3):182-191.
- Andani A, Moro AHB, Issahaku G (2020). Fertilizer subsidy policy and smallholder farmers crop productivity: The case of maize production in North-Eastern Ghana. *Journal of Agricultural Extension and Rural Development* 12(2):18-25.
- Anderson JR (2008). *Agricultural Advisory Services. A background paper for Innovating through science and technology.* World Development Report 2008. Washington DC.
- Bagchee A (1994). *Agri'cultural Extension in Africa.* World Bank Discussion Papers. No. 231. Africa, Technical Department Series. Washington D.C.
- Asuming-Brempong S, Sarpong DB, Asante F (n.d.). Institutional Bottlenecks of Agricultural Sector Development: The Case of Research and Extension Provision in Ghana. ISSER. University of Ghana. Retrieved October 11, 2021 from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.533.1713&rep=rep1&type=pdf>
- Azu E, Elegba W, Asare AT, Blege PK, Amoatey HM, Danquah EY (2021). Responses of smallholder farmers on sorghum production preferences and constraints in the Upper East Region of Ghana. *Journal of Agricultural Extension and Rural Development* 13(3):202-216.
- Beyuo AN (2011). Exploring the synergic potentials of Indigenous and imported agricultural technologies use in Ghana. In CCEIR Annual Interfaculty Lectures Working Papers, Tamale: University for Development Studies.
- Bikuba JR, Kayunze KA (2019). Enhancing community participation to improve sustainability of irrigation projects in Geita District, Tanzania. *Journal of Agricultural Extension and Rural Development* 11(10):169-175.
- Cheruiyot JK (2021). Socioeconomic and demographic predictors for adoption of new sugarcane varieties in Nandi County, Kenya. *Journal of Agricultural Extension and Rural Development* 13(2):115-124.
- Chete OB (2021). Factors influencing adoption of improved maize seed varieties among smallholder farmers in Kaduna State, Nigeria. *Journal of Agricultural Extension and Rural Development* 13(2):107-114.
- Christoplos I (2011). Mobiliser les potentialités de la vulgarisation rurale et agricole. Organisation des Nations Unies pour l'alimentation et l'agriculture. Bureau de l'échange des connaissances, de la recherche et de la vulgarization. Rome: Forum mondial pour le conseil rural.
- Come SF, Neto JAF, Cavane EPA (2021). Do agricultural research and rural extension organizations satisfy households agricultural demands? Evidence from maize growers in Sussundenga district, Mozambique. *Journal of Agricultural Extension and Rural Development* 13(2):138-146.
- Confédération paysanne du Faso [CPF] (2010). Mensuel d'information et de liaison de la Confédération paysanne du Faso. NOUVELLES CPF.(N°04). Mai 2010. Retrieved August 6, 2018 from http://www.inter-reseaux.org/IMG/pdf_NOUVELLES_CPF_MAI_2010.pdf.
- Don Richardson (2006). Les TIC transformant-elles la vulgarisation agricole? Sixième Réunion Consultative d'Experts de l'Observatoire du CTA sur les TIC. TeleCommons Development Group, CTA Working Document, Number 8035.

- Donkor E, Owusu-Sekyere E, Owusu V, Jordaan H (2016). Impact of agricultural extension service on adoption of chemical fertilizer: Implications for rice productivity and development in Ghana. Research paper. NJAS - Wageningen Journal of Life Sciences 79:41-49.
- Food and Agriculture Organization (FAO) (2015). Biodiversity for Food and Agriculture: the perspectives of small-scale food providers. International Planning Committee for Food Sovereignty (IPC) Agricultural Biodiversity Working Group. DRAFT for COMMENT. Retrieved April 29, 2019 from https://www.foodsovereignty.org/wp-content/uploads/2016/03/Draft_CSO-SoW-BFA_ThematicStudy_20Nov2015.pdf.
- Farooq MZ, Siddiqui BN, Masud K, Khan MR, Ali M, Rayit A, Shah SA, Dawood KM, Naeem G (2020). Comparison between public and private extension services for sugarcane production in Muzaffargarh District, Punjab, Pakistan. *Journal of Agricultural Extension and Rural Development* 12(1):1-5.
- Gwary MM, Makinta AA, Wakawa RC (2019). Review on market re-orientation of extension services for value chain development in Borno State, Nigeria. *Journal of Agricultural Extension and Rural Development* 11(10):162-168.
- Hassen NA (2019). Determinants of adoption of improved sorghum package in agro-pastoral households of Somali Region of Ethiopia: A gender perspective. *Journal of Agricultural Extension and Rural Development* 11(11):192-199.
- Hiko MS, Mosisa W, Dinku A (2020). Determinants of adoption of agricultural extension package technologies by smallholder households on sorghum production: Case of Gemechis and Mieso districts of West Hararghe Zone, Oromia Regional State, Ethiopia. *Journal of Agricultural Extension and Rural Development* 12(3):62-75.
- Innocent M, Vasanthakalam H (2018). Success story of implementing the self-sustaining agricultural extension system in Rwanda. *Journal of Agricultural Extension and Rural Development* 10(9):175-185. DOI: 10.5897/JAERD2018.0981.
- Institut de l'Environnement et de Recherches Agricoles [INERA]. (2009). Révolution verte dans les zones arides de l'Afrique: un lien avec les marchés des engrais microdosage entrées-sorties pour les petits agriculteurs les moyens de subsistance au Burkina Faso. *Projet de l'Institut de l'Environnement et de Recherches Agricoles (INERA). (2009-2011). Ouagadougou: Hunger Project-Burkina.*
- Lauer H (1995). Two Dogmas of Modernity: Potential Impediments to Enlightened Development in Ghana. *Legon Legon Journal of the Humanities* 8:37-51.
- Kanu BS, Odhiambo W, Yamdjeu AW, Sile E (2016). New Ways of Financing African Agriculture. In *Africa Agriculture Status Report, Progress towards Agricultural Transformation in Africa* pp. 150-171.
- Ministère de l'Agriculture, de l'Hydraulique et des Ressources Halieutiques, MAHRH (2010). *Le Système national de vulgarisation et d'appui conseil agricoles (SNVACA). Ouagadougou.*
- Mbavai JJ, Shitu MB, Abdoulaye T, Oyinbo O, Kamara AY (2019). Factors influencing the adoption of improved cowpea varieties in the Sudan Savannas of Northern Nigeria. *Journal of Agricultural Extension and Rural Development* 11(11): 200-207.
- Mtyobile M, Mhlontlo S (2021). Evaluation of tillage practices on selected soil chemical properties, maize yield and net return in OR Tambo District, South Africa. *Journal of Agricultural Extension and Rural Development* 13(3):158-164.
- Millar D, Haverkort B, Shankar D, Apusigah AA (2012). Learning together: Developing inclusive knowledges and sciences towards operational methods for endogenous research, education and development. *Guidebook for CAPTURED. Vol. 2.* www.captured-edu.org; www.compasnet.org.
- Ministry of Foreign Affairs and Consular Service Centre (MoFA & CDC) (2017). *Draft Regulatory Impact Assessment for Agribusiness Reforms in Ghana.* Accra.
- Ministry of Foreign Affairs (MoFA) (2005a). *Agricultural Extension Policy (Abridged Version).* Accra: Directorate of Agricultural Extension Services.
- Ministry of Foreign Affairs (MoFA) (2005b). *Extension Regulatory Framework and Standards for Extension Delivery.* Directorate of Agricultural Extension Services, Accra.
- Napoli M (2011). *Towards a Food Insecurity Multidimensional Index (FIMI). (Master in human development and food security dissertation).* Università Degli Studi.
- Programme D'appui Aux Organisations Paysannes Africaines, PAOPA (2013). *Rapport-Bilan du projet de la mise en œuvre du Projet d'appui aux organisations paysannes africaines (PAOPA), Phase pilote, 2009-2012 (pp. 85-93).* Retrieved August 16, 2018 from http://www.sfoap.net/fileadmin/user_upload/sfoap/docs/2013_Mission_Supervision_FIDA_2013_ROPPA_30_sept_-_12_oct__AM_signe_.pdf.
- Purcell DL, Anderson JR (1997). *Agricultural extension and research: Achievements and problems in national systems. A World Bank Operations Evaluation Study, pp. xxi + 264, a summary, Washington, DC: World Bank.* Available at <http://wbli1023.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewF orJavaSearch/4CC2B2C8CC4DB10A852567F5005D5A14?opendocument>.
- Rivera WM, Qamar MK, Crowder LV (2001). *Agricultural and rural extension worldwide: options for institutional reform in developing countries, p. 15, Rome: FAO.*
- Santuah NF (2018a). CSIR's antidote to armyworm is infested with controversy (1). *The Ghanaian Times, p. 8.*
- Santuah NF (2018b). CSIR's antidote to armyworm is infested with controversy (2). *The Ghanaian Times, p. 9.*
- Sare L (2012). *Le conseil agricole dans les politiques publiques au Burkina Faso. Inter-Réseaux Développement rural. Fert. Paris (inter-reseaux@inter-reseaux.org; fert@fert.f).*
- Shausi GL, Ahmad AK, Abdallah JM (2019). Factors determining crop farmers willingness to pay for agricultural extension services in Tanzania: A case of Mpwapwa and Mvomero Districts. *Journal of Agricultural Extension and Rural Development* 11(12), 239-247.
- Tasisa HF, Chela CB, Lule D, Lemu KD (2021). On-farm evaluation and pre-scaling up of improved finger millet technologies under rainfed condition in Western Oromia, Ethiopia: A case of East Wollega Zone, Ethiopia. *Journal of Agricultural Extension and Rural Development* 13(3):165-172.
- Taye H (2013). Evaluating the impact of agricultural extension programmes in sub-Saharan Africa: Challenges and prospects. *African Evaluation Journal* 1(1), Art. #19, 9 pages. <http://dx.doi.org/10.4102/aej.v1i1.19>.
- Tladi-Sekgwama FM (2019). An overview of agricultural extension in Botswana and needed reforms. *Journal of Agricultural Extension and Rural Development* 11(3):67-77.
- Waddington H, White H, Anderson J (2010). *The Impact of Agricultural Extension Services. 3ie Synthetic Reviews – SR00 9 Protocol.*
- Zoogah AT, Nakuja T (2020). Modernizing extension services to improve rice productivity: Lessons from Ghanas planting for food and jobs program. *Journal of Agricultural Extension and Rural Development* 14(4):110-115.