REVIEW PAPER

ISSN 1849-1146
UDK 631+338.1(1-773)
DOI: https://doi.org/10.69680/ac.15.2.4

Farmer-Led Innovations, Agricultural, and Economic Development in Developing Countries: A Systematic Review

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ABSTRACT

For farmers to explore and contribute to the growing needs of agricultural technologies, farmer-led innovations have been supported by mainstream research activities through donor funding. This research aims to identify different innovations introduced by farmer innovators and determine their impacts and challenges in its implementation. Through a systematic review, a multi-database approach was used to source relevant scientific publications key to the topic of review. Articles originating from developing countries, on farmer-led innovation and mostly peer-reviewed journal sources were used. The findings revealed several specific farmer-led innovations under broad category of livestock, crop husbandry, agro-processing and storage and post-harvest innovations. In some cases, productivity and incomes were improved due to the adoption of farmer-led innovations. Challenges in farmer-led innovations in developing countries include low education, a lack of donor interest, limited research capacity and lack of cost sharing. These challenges can negatively impact food security improvement in smallholder farm households.

Keywords: farmer-led innovations, impact, challenges, agricultural development, systematic review

INTRODUCTION

The achievement of the Sustainable Development Goals (SDGs) requires stakeholders, including farmers, to be innovative. Even long before the constitution of the SDGs, farmers have always been thinking of new ways to improve on existing practices of agricultural development for the purpose of achieving food and nutrition security. The leading role farmers play in this perspective has been accepted in scientific literature and has been widely labelled as farmer-led innovations (FLIs). Farmers are active experimenters who continuously generate remarkable and locally adapted innovations (Tambo & Wünscher, 2014a, 2017). Farmer innovative practices are identified along the chain of production of crops and livestock, storage and post-harvest management and agro-processing (Hall et al., 2003; Tambo & Wünscher, 2016). Farmer-led innovations are therefore the processes of individuals or groups of farmers producing new or modifying, adapting, and experimenting with their own or external ideas, methods, techniques, or products without the assistance of external actors or formal study (Asare-Nuamah et al., 2021; Waters-Bayer et al., 2020). Farmer-led innovation leads to agricultural productivity and diversity, more job opportunities, reduced poverty and hunger, and social and political stability.

Several reasons account for why farmer-led innovations should be given important attention. First, farmer-led innovations significantly increase household income and consumption expenditure per adult equivalent (Tambo & Wünscher, 2017). An important aspect of farmer-led innovation is learning and knowledge generation. Thus, a focus on learning helps deepen understanding of key mechanisms and processes that define and deliver innovation (Ensor & de Bruin, 2022). Knowledge generation and the interactions that allow for knowledge exchange are key processes of innovation (McKenzie, 2013).

Local capacity to innovate is strengthened through farmer-led innovation initiatives in continents such as Africa, Asia, and Latin America (Waters-Bayer et al., 2015). Providing support for farmer-led innovation gardening experiments enables farmers to systematically evaluate the merits of the improvements they decide to research (Sturdy et al., 2008). Through farmer-led innovations, informal agricultural research and development initiatives can be documented and thus made accessible to formal researchers for possible improvement, with farmers as the main stakeholders (Waters-Bayer et al., 2015). Bacon et al., (2023) state that over 70% of farmers were engaged in farmer-led innovation diversification activities.

There are myriad studies of farmer adoption of technologies or practices, but most of the practices do not elicit enough information for readers to know whether such studies were developed by farmers or through mainstream research-led introduction. The results of such adoption studies are usually a bundle of innovations adopted. Such studies are usually silent on the contributions of both farmers and researchers to the technologies they use (Odoom et al., 2023). It has emerged that the best way to improve technology adoption is to take it up from the perspective of farmers. Thus, participation in farmer field forums can play a positive role in strengthening farmers' innovation-generating capacity (Tambo & Wünscher, 2014a, 2017) and hence enhance the high rate of adoption of production, storage, and processing technologies.

Top-down technology adoption has proven to be low (Dosso et al., 2023), especially when such technologies involve huge investment costs and neglect the use of local materials that can easily be found in farmers' environments (Baliwada et al., 2017).

While there has been some investment in farmer-led innovations, some objectives are still relevant to achieve. From the foregoing, the first objective of the review is to document the specific areas of farmer-led innovations that can influence policy towards achieving food security. The second objective is to understand how farmer-led innovations impact farm households' livelihoods. The third objective is to appreciate the challenges of farmer-led innovations adoption.

The purpose of this review is to reduce bias and build consensus on farmer-led innovations, by adopting the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) method, to assess the relevance of farmer-led innovations in developing countries. The review is focused on developing countries, which have been hit hard by climate change and variability and have developed various strategies to adapt to climate change.

This review is being organized into five sections, with section one being the background. Section two dealt with the methodology, while Section three provided the results and discussion. The gaps and future research, as well as the conclusions and policy recommendations, are in sections four and five, respectively.

MATERIAL AND METHODS

Selection of Scientific Literature

Based on the scope of this review, a thorough literature search was conducted to get the required information for the purpose. The review made use of multiple databases available at the University of Ghana library system. The databases used include *Agora*, *Aluka*, *Google Scholar*, *SAGE Journals Online*, *ScienceDirect*, *Scopus*, *Taylor & Francis*, and *Wiley Online Library* There are important reasons for the selection of multiple databases for this review. The reason for the use of multiple databases is based on few published articles on farmer-led innovations in scientific journals Waters-Bayer et al. (2015). Therefore, we expanded the scope to obtain relevant literature covering the 2003–23 period.

Search Criteria

This section provides the exclusion and inclusion criteria of the articles used in the review. The topic under review "farmer-led innovations and agricultural development in developing countries" was the main search item used throughout the search for relevant publications associated with it. The "Developing countries" was replaced with "Africa" and "Ghana" in some cases, across the selected databases, to ascertain the scope of research on the topic.

The topic was pasted on the search bar of each of the search engines, which gave results of many papers from the beginning (fig. 1). The strength of the Scopus system is designed so that the search pathway or string can be copied and replicated. The lack of pathway generation by the rest of the databases used in this review is one of their weaknesses. The AGORA database strength is such that it is possible to apply the same criteria as in Scopus, but it is not possible to obtain the search pathway. However, those other six databases also have some strengths since they allow the researcher to impose limitations on the search engines to obtain relevant literature. Such limits include the possibility to choose a range of years of publication for papers, specific disciplines (e.g., agricultural sciences, social sciences, environmental science, business and economics, etc.), content type (e.g., research article, review article, book, book review, etc.), language type (e.g., English, French, Afrikaans, etc.) and name of author(s), among others. Publication at final, and not those in press, were selected. Illustrating with how the Scopus database were used to search for literature, for example, the following stages/pathway/string or iteration were obtained:

farmer-led AND (innovat* OR research OR technolog* OR practices) AND agricultur* AND development AND developing AND countries AND (LIMIT-TO (SUBJAREA , "AGRI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "ECON")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English"))

This procedure was repeated in the AGORA database and the imposition of limits in all databases to obtain the first step of the relevant literature (1171 papers). For this first step, paper titles, abstracts, and keywords were migrated to an Excel sheet, where possible, and later merged to obtain one Excel file. This allowed for checking and the removal of duplicates, leaving with 562 papers. The titles and abstracts of the remaining papers were read, and those that were relevant to the study were secured, eliminating those that did not meet the criteria, bringing the number of articles to 209. The 209 articles were then downloaded, and the abstracts were read again, but together with the conclusions of each paper, to further find relevant papers. This brought the number to 98. Further, full paper readings were done, and 36 papers were used for the review (fig. 1).

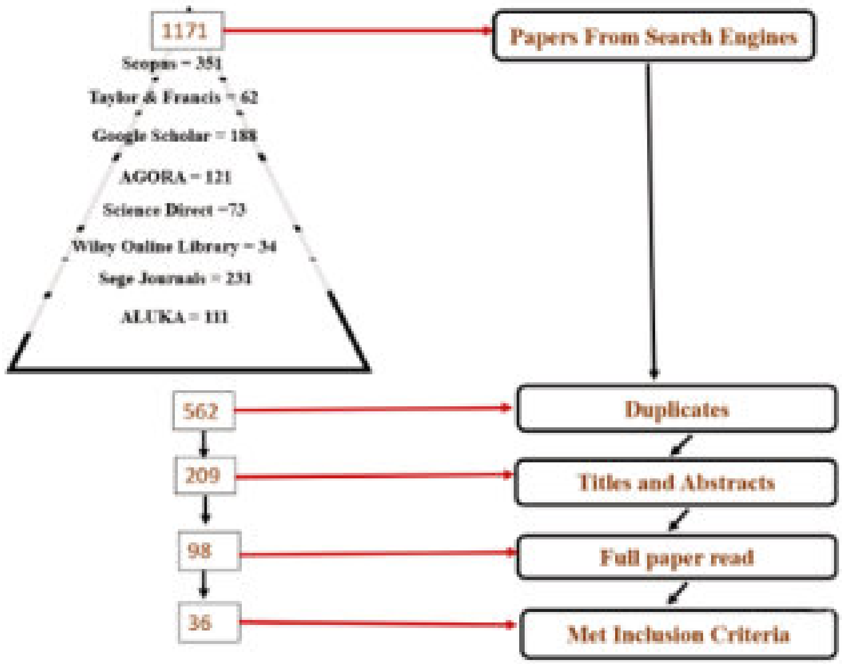

Figure 1. Flowchart of the papers retrieved.

Generally, while conducting the above exclusion and inclusion criteria, there was a lookout for the following requirements for inclusion; (i) Research conducted in developing countries. (ii) Research that employed either quantitative or qualitative or both methods in its methodology. (iii) Research related to farmer-led innovations in developing countries and (iv) Studies that were published in English language only were considered to avoid the intricacies associated with translation from other languages to English.

RESULTS AND DISCUSSION

Descriptive Statistics of Reviewed Papers

The reviewed papers are characterized into four areas: (i) publishers; (ii) databases through which the papers were sought; (iii) regional focus of the papers; and (iv) year of publication.

Papers Reviewed by Publishers

The 36 papers used for the review were obtained from the following publishers: International Commission on Irrigation and Drainage (ICID), Agricultural Extension Society of Nigeria (AESN), Canadian Centre for Science Education (CCSE) and African Centre for Gender, Social

Research, and Impact Assessment (AC4GSRIA). Others are Water Alternatives Associations (WAA), Cambridge University Press (CUP), and others (books, book chapters, reports, etc.). Figure 2 provides the number of papers obtained from each publisher.

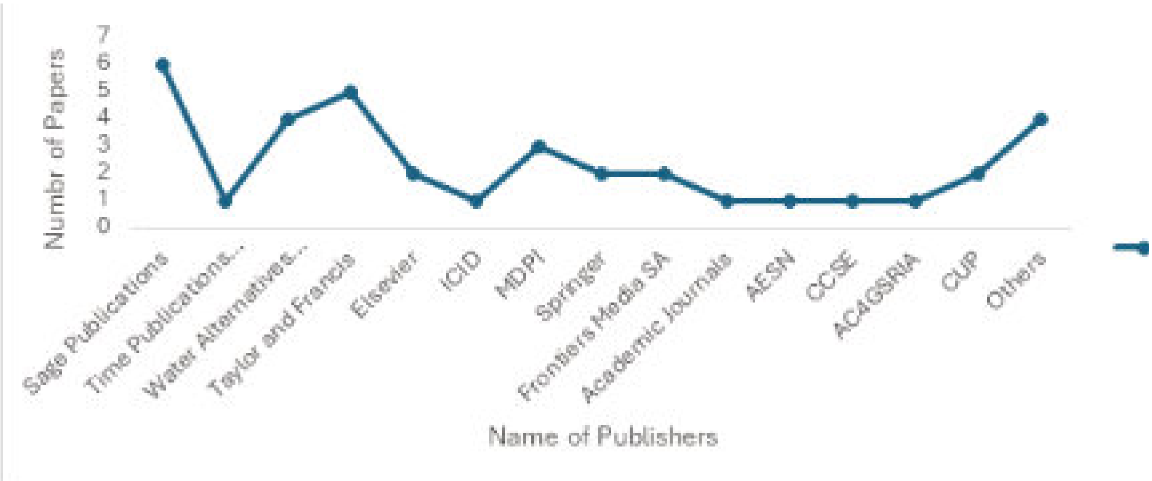

Figure 2. Papers reviewed by publishers

Papers Reviewed by the Databases Used

With respect to the databases, majority of the articles were sourced from *Google Scholar* (13 articles), and followed by *Agora* with seven (7) articles. The *SAGE Journals Online* follows with five (5) articles, while there were four (4) articles from *Scopus*. Also, three (3) articles were obtained from *Taylor & Francis*, with a total of two (2), one obtained from *ScienceDirect* and one from *Wiley*. No paper was reviewed from the *Aluka* database.

Papers Reviewed by Regional Focus

The study countries were mainly of developing country origin, but mostly from Africa, with some from India, Brazil, Asia, and Latin America. Two papers from developed countries were used to illustrate key points discussed in the findings. The countries were then grouped according to regional blocks, as shown in figure 3.

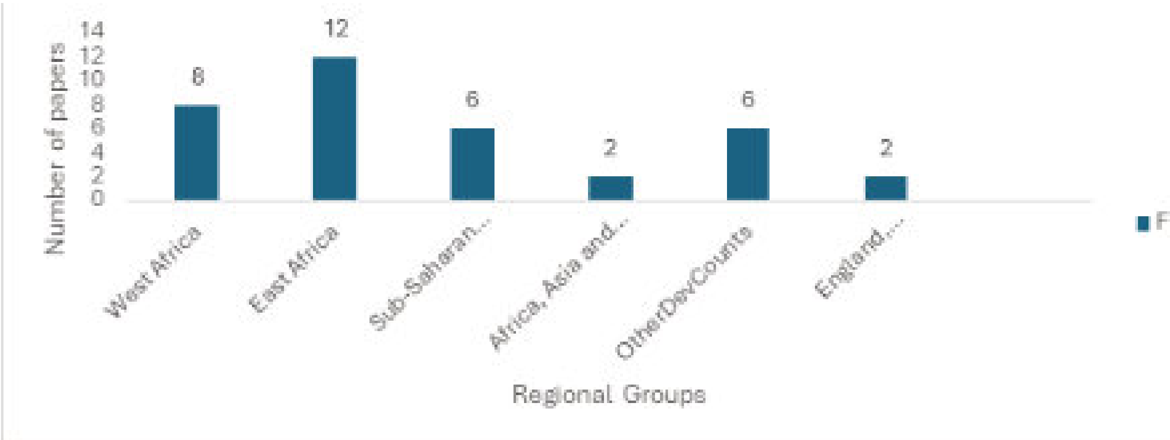

Figure 3. Papers reviewed by regional focus.

Papers Reviewed by Year of Publication

To appreciate the current state of the information around the topic, the majority (25) of the papers were obtained in the last 6 years, as shown in figure 4.

Figure 4. Papers Reviewed by the Years of Publication.

Conceptual Framework of the Role of Farmers in Farmer-Led Innovations

Literature on farmer-led innovations guided the conceptualization of the review (fig. 5). Given the scope, the main research question is: what impact do farmer-led innovations have on farmers? The work of Baliwada et al. (2017) revealed why farmers innovate, to include curiosity, food insecurity, increased safety and environmental challenges. Though there are several studies on the impact of farmer-led innovations (Baliwada et al., 2017; Luambano et al., 2021; Morrison et al., 2023; Osewe et al., 2020), there has not been a systematic consideration of the growing population of the African continent relative to the studies on impact evaluations.

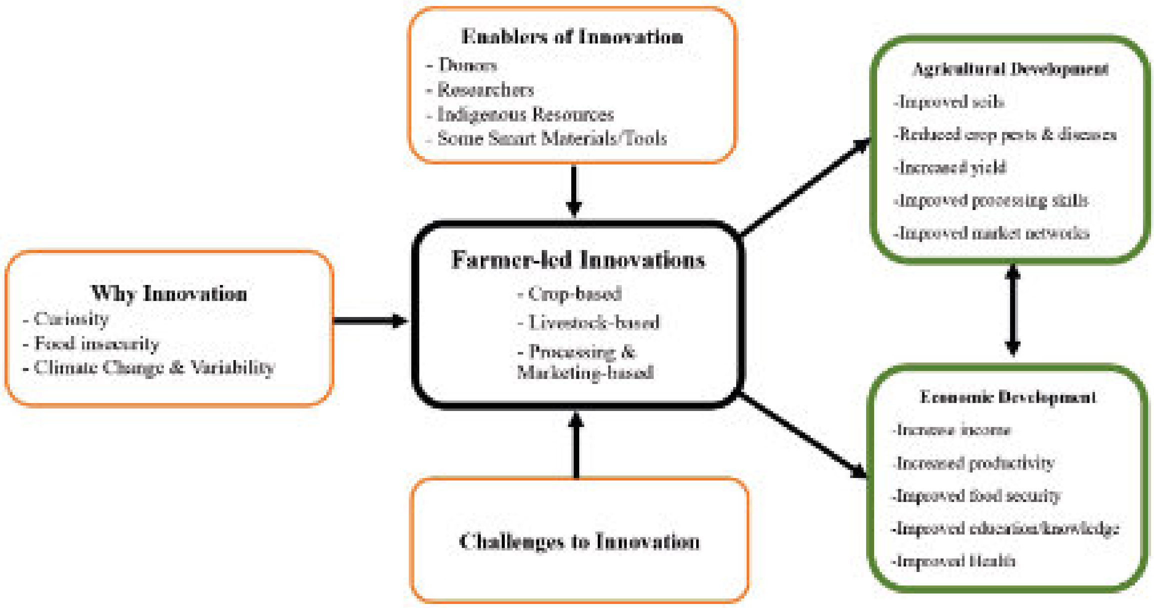

Figure 5. Conceptual framework of the review.
Adapted from: Luambano et al. (2021)

The African continent is expected to reach 2.5 billion by 2050, and this will put pressure on the available innovations. Moreover, the out scaling of farmer-led innovations to reach many people has not been effective, probably due to the geo-specificity nature of many innovations. Thus, it is difficult to develop one-size-fits-it all innovations. Furthermore, to the best of our search for literature, no research has used both qualitative and quantitative methods together in a study to determine which type is robust to outcome indicators. With this thinking, there is a need to continuously make attempts to evaluate the impacts of the innovations to inform policy for improvement.

Findings

The application of farmer-led innovations is varied (Ensor & de Bruin, 2022). It can be applied in crop and livestock production, storage and agro-processing (Baliwada et al., 2017; Nain et al., 2015). The results are reported and discussed in the following thematic areas.

Areas of Farmer-led Innovations

a) Crop Production Based Farmer-Led Innovations

The review shows that the irrigation sector is by far the extensive area where farmer-led innovations has been applied (Buechler & Mekala, 2005; de Bont et al., 2019; Duker et al., 2023; Froebrich et al., 2020; Harmon et al., 2023; Kafle et al., 2022; Kamwamba-Mtethiwa et al., 2021; Mdee & Harrison, 2019; Merrey et al., 2017; Minh et al., 2020; Nkoka et al., 2014; Osewe et al., 2020; Srinivasan et al., 2017; Svendsen & Changming, 1990; Veldwisch et al., 2019; Woodhouse et al., 2017). The reason for investing heavily in irrigation might be due to the low level and erratic nature of rainfall patterns in many developing countries.

Nonetheless, Venkatesan et al. (2023) report that 32.9% (representing most innovations), were on field crops, with much lower percentages on innovations associated with horticulture, livestock, natural resource management, enterprises and integrated farming systems. It also revealed that farmer-led innovations associated with crops can be tested on a variety of soils and across higher slopes of land than researcher-led innovations. The soil conditions of researcher-led innovations are usually defined, sometimes with specific range of soil micronutrients (Koehler-Cole et al., 2023). In Zimbabwe, Asare-Nuamah et al. (2021) found planting "Kanongo," an open pollinated variety of maize, pen fattening, over mulching, cassava cultivation, and staggered planting as examples of farmer-led innovations. The authors found that over mulching yielded 3 tons of maize in a half- hectare plot of land. Also, open pollinated maize varieties were found to be resilient to climate change and yield higher than hybrid maize varieties under drought conditions Asare-Nuamah et al. (2021).

In Ghana, some innovations associated with crop production include the following: (i) reproduction of sweet potato vines under artificial shade; (ii) unique production of compost using animal droppings and crop residue (Kangmennaang et al., 2017);(iii) control of vegetable pests using local plants; (iv) multiple uses of neem extract as fertilizer, pesticide, and insecticide; and (v) the use of salt to control striga (Tambo & Wünscher, 2014b). This finding is consistent with (Tambo & Wünscher, 2016), who reported different categories of adoption of farmer innovations such as crop varieties, planting methods, soil fertility management, weed control, land preparation, cropping pattern and pest and disease control.

b) Processing and Marketing-Based Farmer-Led Innovations

Farmer-led innovations require farmers (producers) to be innovative for local economic development. Support for agriculture, technical aid, and rural extension are elements that make it easier for producers to accept technology (Balconi et al., 2023). Thus, there is a positive correlation between entrepreneurship and innovation. Innovations related to processing include yoghurt production from cattle milk and local fishmeal formulation (Tambo & Wünscher, 2014b). The production of yoghurt and local fishmeal preparation could have a positive implication for youth employment in local economies.

c) Storage-based Farmer-Led Innovations

Post-harvest problems are usually a problem for crop farmers. It is reported that 36% of grain crops harvested are lost to postharvest in northern Ghana (Sugri et al., 2021). This may not be significantly different for many crops. Farmers must therefore innovate to reduce losses. Applications of post-harvest technology are frequently a part of complex techno-economic systems with several participants, all of whom have distinct talents and are motivated by various incentives (Hall et al., 2003). Tambo & Wünscher (2014b) reported that innovations associated with the storage of food products include (i) the use of boiled aqueous extract of shea tree to store Bambara beans and (ii) the use of neem-seed oil to store seeds. Another method reported is the use of pungent powdered pepper to preserve seeds.

d) Livestock-based Farmer-Led Innovations

Farmer-led innovations have been used in the dairy industry system to improve food security for animals and eventually for humans. Appropriate production of forages for animal production improves high-yielding and quality milk production in dairy animals. This has been achieved by adopting the Agricultural Innovation System (AIS) framework. The AIS seeks to bring together all actors, institutions, and organizations, with farmers at the center-stage, to collectively address a situation (Morrison et al., 2023).

According to (Tambo & Wünscher, 2014b), innovations that fall under this category include the following: (i) reducing guinea fowl mortality using sorghum malt and pepper solution as a dewormer; (ii) improving the hatching rate of guinea fowls eggs by exposing it to the sunlight that precedes sunset; (iii) treatment of fowl pox using herbal mixture; (iv) use of honey and mahogany bark extract to treat intestinal worms in guinea fowls and other diseases among poultry; (v) improving vision of animals using herbal mixture;(vi) treatment of Newcastle disease in poultry using a herbal extract; (vii) use of kenaf seed to hatch guinea fowl eggs; (viii) use of cotton and rag to hatch guinea fowls eggs; (xi) a herbal solution of ebony and mahogany bark to treat diseases; and (x) use of onion mixture to control diseases among poultry (Tambo & Wünscher, 2014b).

Methodological Approaches and Impact of Farmer-led Innovations on Livelihoods

Impact studies on farmer-led innovations are very limited given the scope of the literature searched. However, impact studies on general agricultural technologies are numerous. This suggests that the impact studies of farmer-led innovations might have been imbedded with most studies on the impact of general agricultural technologies. This therefore informs a potential research gap for researchers who are interested in farmer innovation studies. Nonetheless, this review conducted an extensive search in the literature and found the following results.

Approaches to measuring the impact of agricultural innovations have largely used quantitative rather than qualitative methods. For instance, Venkatesan et al. (2023) used the Difference-in-Difference (DID) method to measure the impact of aligning agricultural research and extension for sustainable development goals. The study focused on farm income, cropping intensity, manure availability, fertilizer use, pesticide use, and nutritional security as the main indicators. The review reveals that farm households that adopt multiple innovations can improve their living standards (e.g., higher income and nutritional security) than those that adopt fewer innovations (Venkatesan et al., 2023).

By using the Tobit model, Morrison et al. (2023) found that access to markets had a negative relationship with forage adoption intensity in Kenya, but market integration had a positive relationship with forage adoption intensity in both Kenya and Ethiopia. In Ethiopia, the presence of a milk collection center in a village also had a negative relationship with forage adoption intensity. This observation has implications for innovation. There is a need to adopt forage seeds that can withstand the shortages of rainfall since both countries have been reported to experience shortages of pasture (i.e., five months in Kenya and approximately four months in Ethiopia).

In respect to identifying local innovations in northern Ghana, (Tambo & Wünscher, 2014a; Wünscher & Tambo, 2016) used a concept known as "farmer innovation contest", to identify promising local innovations for validation. The identified innovations were ranked using a Multi-Criteria Decision Making (MCDM) tool, and the first three innovations were (i) the use of local herbs to store onion seeds; (ii) the control of striga using onion residue; and (iii) the design of an integrated aquaculture-agriculture system. This shows that many of the innovations are associated with the production of crops and animals. The MCDM uses weights assigned to innovations based on identified criteria (e.g., economic and dissemination potential, environmental sustainability, and being socially friendly, among other criteria).

Baliwada et al. (2017) used Friedman's test static to determine the economic impact of farmer-led innovations in India. Their results revealed that sociopsychological determinants, including problem-solving nature and creativity in thinking, were the major factors that impacted farmers' innovative behavior. In Tanzania, Luambano et al. (2021) used qualitative and quantitative data from a cross-sectional survey to document farmers' practices on agroecology. The authors found that the determining factors of innovation, using a binary logit model, were experience in farming, ease of availability, and access to agroecological inputs, as well as zeal to experiment and farm size. The use of agroecological practices has been found to aid farmers in producing sustainably

(Razanakoto et al., 2021). For instance, in the production of manure, farm households may recycle available home-based waste materials and crop residue to improve soil fertility.

The studies of (Tambo & Wünscher, 2017; Waters-Bayer et al., 2015) have revealed the impacts of farmer-led innovations. First, farmer-led innovations have increased food and nutrition security by producing higher and more consistent yields than were possible with earlier methods. Secondly, research on ecological farming methods conducted by farmers has frequently increased household incomes compared to conventional farming methods that rely on outside inputs. Thirdly, increased crop diversity has been proven as the result of farmer-led innovations. Thus, it may be inferred that farmer-led innovations are crucial for climate change adaptation and might even lower greenhouse gas emissions.

In irrigation research associated with farmer-led innovations in Tanzania, Osewe et al. (2020) revealed that the per capita net crop income of farmers who adopted such innovations had increased based on results of Propensity Score Matching (PSM) method. Factors that influenced the significant positive effect on adopters' income include drought experience, membership in water users' groups and farmer organization and the provision of extension services by government agencies. The results suggest the surviving nature of farmers in sub-Saharan Africa. Thus, farmers who experience drought may have come together to form a water user association and participate in farmer-based organizational activities to learn new farming practices.

In Ghana, the use of an Endogenous Switching Regression (ESR) model revealed that farm household income and consumption expenditure increased with increased adoption and use of farmer-led innovations (Tambo & Wünscher, 2016). The review reveals that the ESR is the best method for addressing biases in both observable and non-observable variables. Other methods of dealing with selection bias include Heckman selection, Instrumental Variables (IV) and PSM. The weakness of the Heckman selection and IV is that they both impose a functional form on the intercept variable by assuming an intercept shift instead of a slope shift in the outcome variable. While PSM can correct the weaknesses of Heckman selection and IV, its weakness is the selection of variables or units based on observable variables when there is a tendency for unobservable variables to be measured in a study. The ESR addresses all these biases by estimating separate outcome indicators for each unit of study (e.g., household wellbeing) (Tambo & Wünscher, 2016).

The impact of innovations is not only positive. There are negative impacts (moral hazards and adverse selection) due to the adoption of innovations. The wrong use of agrochemicals and poor disposal of chemical residues introduces and expose farmers to health hazards (Kangmennaang et al., 2017). This affects farm labor and the food security of farm households.

Challenges of Implementing Farmer-Led Innovations

Nin-Pratt & Stads (2023) revealed that developing countries with low quality education and weak scientific research systems are the main drivers of low levels of innovation capacity. Furthermore, multilateral funders may still have a vested interest in how research money should be used (Harmon et al., 2023). This has shown to shift the focus of farmer-led irrigation efforts (Harmon et al., 2023).

The management of post-harvest innovations is challenging. Hall et al. (2003) have emphasized the difficulty involved in managing post-harvest innovation, especially one that favors the poor. This suggests that post-harvest innovations can be expensive for poor farmers, as many require buying costly, advanced equipment and chemicals to extend shelf-life and protect stored grains from insects. In Ghana, the government has built warehouses across many districts to support producers store their harvest.

Another dimension of the challenges in implementing farmer-led innovations is the constitution of research teams. Many farmer-led innovation activities constituted teams of biophysical researchers without the involvement of social scientists who have the rigor to identify sustainable, profitable, and socially acceptable innovations with farmers (Van Asten et al., 2009). Furthermore, Maiangwa et al. (2010) reported that the main challenge is initiating and implementing cost-sharing of extension services among the government, local assemblies, farmer-based organizations and groups, NGOs, etc. They believe that extension delivery cannot be achieved when the budget needs of extension services are limited to what the national government can provide. Additionally, there are also poor linkages among researchers, extension workers, farmers, and other stakeholders in many developing countries. In Ghana, for example, regional Research-Extension-Farmer Linkages Committees (RELC) have been formed by the Ministry of Food and Agriculture (MoFA) to see to the realization of the transfer of research outputs.

Another challenge worth stating is the poor decentralized system in many developing countries. Decentralization has been identified as the best way to improve rural development. In Ghana, while the agricultural system is decentralized, there seem to exist invisible forces that direct how agricultural inputs (e.g., fertilizer and seeds) should be allocated, even at the decentralized areas. In addition, the implementation of farmer-led innovations faces challenges due to nonexistent entry points. The point of entry for agricultural projects is mostly through farmer groups or organizations. Many farming communities lack such groups due to a lack of community cohesion arising from differences in ideologies associated with chieftaincy, religious, political, and tribal or clan lineages. Where researchers must be involved in creating groups for agricultural project delivery, the objective(s) of the innovation may not be met.

CONCLUSION

The review centered on areas of farmer-led innovations, methodological approaches to impact assessment and challenges of farmer-led innovations. It revealed that there are sub-innovations under each of the broader categories of farmer-led innovations on crop and livestock production, agro-processing and storage and post-harvest management. It further revealed that the innovations have had a significant positive impact on the growth of rural economies by increasing agricultural productivity and farm income.

There are important policy considerations for farmer-led innovations. While farmers are their own innovators, the scaling up of innovations would be easier if developing country governments were able to fund research instead of donor-funded sources, which are usually prescriptive and top-down. In many situations, donor-funded institutions have a vested interest in the research output, and therefore, the research approach is usually top-down. With the use of state funds to fund research, the bottom-up approach would remain crucial, which would enhance higher adoption, productivity, and income.

National educational institutions should start discussions on how to develop curriculum and mainstream farmer-led innovation studies into the educational systems of developing countries. The study concludes that most of the farmer-led innovations are centered on production, with little improvement in agro-processing. Youth employment can be enhanced through training by providing them with the requisite knowledge related to recipe development and the processing of agricultural products into ready-to-eat foods.

The limitation of the review is that it considered articles only from developing countries. It is also limited to a 20-year period from 2003 to 2023. It is also limited to the use of eight databases from which literature was sought. The review revealed several research gaps associated with farmer-led innovations. These include: (i) factors that influence the adoption of farmer-led innovations; (ii) impact of farmer-led innovations on agricultural productivity and sustainability and gender empowerment/gender dimensions of farmer-led innovations; (iii) ways in which farmer-led innovations can be scaled up (improved) and out (replicated); (iv) examine how the introduction of digital marketing would affect the income of farmer innovators; (v) examine the factors influencing farmer innovators to spend less on nutritious diet (this is because, while there exists a positive contribution of farmer innovation to production and income, it does not significantly translate to nutritious diet); and (vi) assess how specific types of farmer innovations contribute to household wellbeing.

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Inovacije pod vodstvom poljoprivrednika, poljoprivredni i gospodarski razvoj u zemljama u razvoju: sustavan pregled

SAŽETAK

Kako bi poljoprivrednici mogli istraživati i doprinositi sve većim potrebama za poljoprivrednim tehnologijama, inovacije pod vodstvom poljoprivrednika podupiru se u okviru institucionalne istraživačke djelatnosti financirane donatorskim sredstvima. Cilj je ovoga istraživanja identificirati različite inovacije koje uvode inovativni poljoprivrednici te utvrditi njihove učinke i izazove povezane s njihovom provedbom. U okviru sustavnoga pregleda uporabljen je višebazni pristup kojim su prikupljene relevantne znanstvene publikacije ključne za temu rada. U analizu su uključeni radovi koji potječu iz zemalja u razvoju, bave se inovacijama pod vodstvom poljoprivrednika te su većinom objavljeni u recenziranim znanstvenim časopisima. Nalazi su pokazali niz konkretnih inovacija pod vodstvom poljoprivrednika u širokim kategorijama stočarske proizvodnje, biljne proizvodnje, prerade poljoprivrednih proizvoda te skladištenja i inovacija u posliježetvenim postupcima. U pojedinim su slučajevima, zbog usvajanja inovacija pod vodstvom poljoprivrednika, poboljšana produktivnost i povećani prihodi. Izazovi povezani s inovacijama pod vodstvom poljoprivrednika u zemljama u razvoju obuhvaćaju nisku razinu obrazovanja, manjak interesa donatora, ograničene istraživačke kapacitete i izostanak zajedničkoga sudjelovanja u troškovima. Ti izazovi mogu negativno utjecati na poboljšanje prehrambene sigurnosti u malim obiteljskim poljoprivrednim gospodarstvima.

Ključne riječi: inovacije pod vodstvom poljoprivrednika, učinci, izazovi, poljoprivredni razvoj, sustavan pregled