

Modernization And Adoption of New Practices in Farming: An Agri-Extension Programme

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Abstract

Over the past four decades, agricultural extension has evolved from a rigid, top-down bureaucratic system into a dynamic, pluralistic network. Driven by tight public budgets, decentralization, complex new technologies, and the explosion of ICT, the traditional model has given way to lower-cost, blended ecosystems where public agencies, private input suppliers, and NGOs co-finance and deliver advisory services. This shift has fundamentally changed how farmers adopt innovations. While information now diffuses at a fraction of the cost, adoption increasingly hinges on peer networks and digital access rather than formal visits to offices. To maximize impact—particularly in developing countries—policymakers must transition from being sole information providers to active ecosystem facilitators. By investing in hybrid models that combine digital outreach with local, trust-based farmer groups, agencies can bridge the digital divide and build a truly demand-driven innovation pipeline.

Key words: *Agricultural extension, technology adoption, pluralistic.*

Introduction

Agricultural extension disseminates information from local and global research to farmers by facilitating knowledge transfer and aiding farmers in enhancing their management skills (Huffman 1977; Anderson and Feder 2007). It enhances the decision-making abilities of farmers and boosts productivity, which may lead to agricultural advancement and increased incomes (Anderson and Feder 2004, 2007). Agricultural extension services are widespread globally, with over 90% of public extension agents operating in developing nations (Swanson and Davis 2014). China is estimated to have more than 600,000 extension agents, while India has 90,000, Indonesia has 54,000, and Ethiopia has 46,000 (Hu, Huang, and Chen 2012, p. 21; Swanson and Davis 2014, p. 12). In comparison, the United States has fewer than 8,000 extension agents, supported by 3,000–4,000 specialists primarily working at Land-Grant universities.

In the last forty years, extension services have changed a lot. They used to focus mainly on technology transfer and farm management in the public sector. Now, the extension includes both public and private advisory services on topics such as marketing, environmental sustainability, pest diagnostics, and risk management. Extension systems have become more diverse for several reasons. Today, they use different delivery methods and get funding from both public and private sources (Rivera, Qamar, and Van Crowder 2001; Bitzer, Wennink, and de Steenhuijsen Pijters 2016; Davis and Franzel 2018). New information and communication technologies (ICT) have made it easier to share information. Because of this, extension work is less about delivering messages and more about helping farmers access scientific advances (World

Bank 2017). This paper looks at global changes in extension, the reasons for these changes, and what they mean for technology adoption. It also discusses whether policymakers and public extension agencies, especially in developing countries, should make any changes.

Changes in how extension is delivered and what it covers show that the field is going through a scientific revolution. As with other scientific revolutions (Kuhn 1962), two main factors are behind these changes: first, there is evidence that current models are no longer effective; second, new paradigms are emerging, thanks to better knowledge and improved delivery tools. Changes in extension may also be influenced by changing ideas about the government's role in the economy and shifts in ideology, which are not always based on evidence, about what works best (Marsh and Pannell 2000).

Over time, there has been a growing body of evidence showing that top-down "transfer of technology" models are ineffective in many contexts, that strict recommendations that do not allow for substitution or adaptation are likely to be rejected, and that teaching models that were created without a thorough understanding of how farmers learn fail to effectively increase farmer capacity. Research has emphasized the significance of gender and widespread stakeholder participation, for instance by employing techniques like participatory variety selection. Sequential and selective technology adoption is common; farmers learn by doing and experimenting rather than quickly adopting complex packages of technologies (Pannell and Claassen 2020). Even in relatively small areas, farmers and farming conditions differ greatly, necessitating the use of diverse technologies, adaptable packaging, and the freedom to select from a variety of options.

The role and comparative advantage of extension services are becoming increasingly recognized in developing nations. They use the newest ICT tools for distance learning and smartphone apps to raise public awareness of better practices rather than providing interventions like supervised credit. In addition to providing farmers with timely information, these tools also give them comprehensive training, assess their progress, and support other practical diffusion mechanisms.

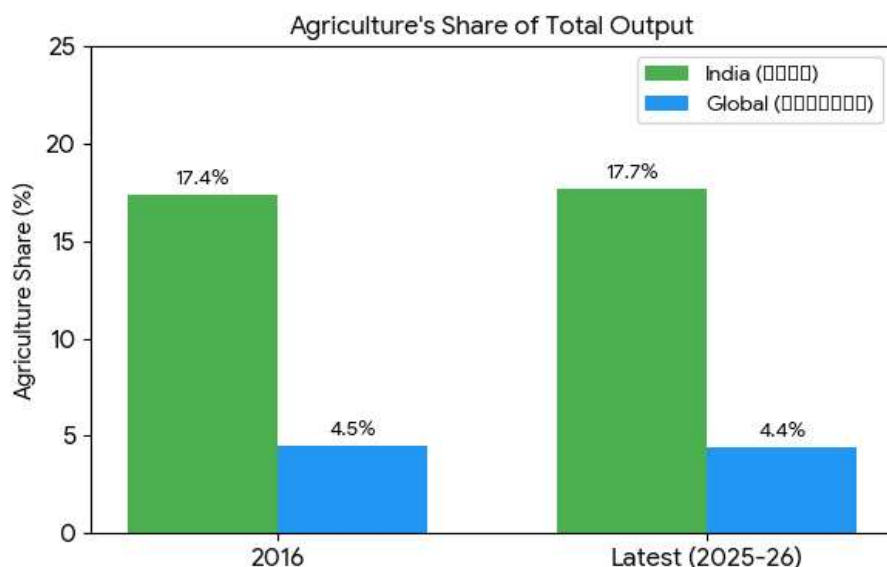
Changes in Extension:

Extension's main goal is to help farmers make better decisions and develop the skills necessary to implement agricultural innovations. This role has traditionally been fulfilled by delivering information in person. With the development of agricultural economies and sectors, as well as the emergence of new agricultural and information/communication technologies, the ways in which and by whom information is provided and supported have changed. The following factors have been the main drivers of changes in extension: (i) structural changes in agriculture that coincide with economic development; (ii) the development and dissemination of new agricultural technologies and related information; (iii) new information and communication technologies; (iv) uncertain and declining public-sector funding for extension; and (v) decentralized government with increased local government involvement in funding and providing extension services. Extension information has always been both a public and a private good, and the lines between the two are constantly changing.

Changes in Structure:

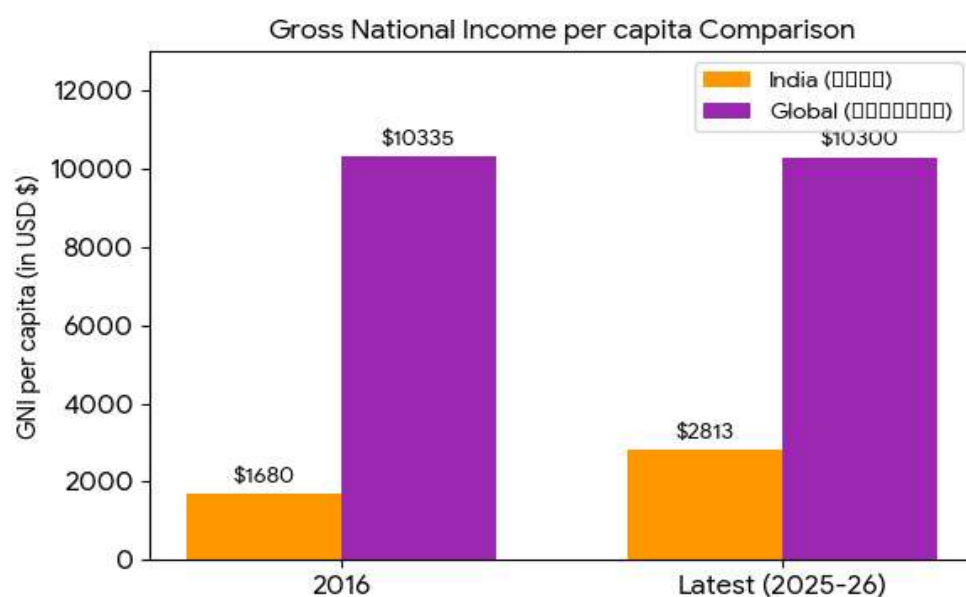
Agricultural productivity growth has led to an economic transformation in many countries, with nonfarm income and employment growing in relation to agricultural income and employment, partly because of the successes in agricultural research and extension (figures 1 and 2). In order to satisfy the increasing demand for both the quantity and quality of agricultural products, farms are becoming more commercialized as the nonfarm sector grows. In developing nations, small but expanding commercial farms coexist with smaller semi-subsistence farms, and in developed nations, large commercial farms coexist with smaller, primarily part-time commercial farms, making agriculture more dualistic.

Figure 1: Share of agriculture in total production (%)



This graph shows that the share of the agricultural sector in the total output (GDP/GVA) of the economy

Figure 2: National Income per capita (GNI per capita - USD)



Based on the World Bank's Atlas methodology and dollar (USD) values for international comparison.

These figures highlights about the stable agricultural contribution despite changing times in India, the share of agriculture in total output has remained around **17.4% to 17.7%**, maintaining the importance of this sector in the Indian economy. Further, India's per capita income (\$2,813) is still very low compared to the global average per capita income (\$10,300), but still, inspite of gap in income, India has recorded good growth in percentage terms since 2016.

Farm commercialization raises the need for client-specific extension information, which private companies can supply (Umali-Deininger 1997). According to Alex, Zijp, and Byerlee (2002), farmers seek information that increases productivity and aids them in making market and other decisions that will increase profits for their increasingly valuable products. With an increasing level of farm and field specificity, this information may be obtained from private advisory services and input suppliers. When there are more financial incentives to sell information directly to farmers or incorporate it into inputs, information becomes more individualized and enters the private sector. Due to the privatization of some extension services, public extension services can now focus their efforts on other matters, like the needs of small-scale, non-commercial farmers or solving environmental and natural resource issues for which the information is still useful to the general public. In developed nations, extension has felt that way.

Technological and Informational Changes in Agriculture:

Agricultural information can be disembodied information about markets or agricultural practices, or it can be embodied in purchased inputs like improved seeds, machinery, and biopesticides (Umali-Deininger 1997; Anderson and Feder 2004, 2007). Disembodied information can be either a privately charged (excludable, fee-for-service) good, like pest diagnoses or fertilizer recommendations for particular plots on individual farms, or a public good (nonexcludable), like market trends or weather-based crop-disease forecasts. As global capital and material expenditures have grown dramatically over time, the percentage of information embedded in inputs has also increased. Large-scale commercial farmers in particular have increased demand for farm-specific fee-for-service information on agricultural practices in both developed and, to some extent, developing nations (Rivera, Blum, and Sulaiman 2009). These days, the majority of US states impose fees.

Compared to when more of the information was for the public good, the private sector now has an incentive to contribute more to the dissemination of agricultural knowledge. The public sector's focus, size, and structure have all changed as private sector participation in extension has increased. Nongovernmental organizations (NGOs) and private advisory services have sometimes taken the place of the public sector in developing nations, despite the fact that many NGOs receive some funding from the government. Compared to the days when public extension services dominated the field, extension is now more diverse. In many nations, extension has also made progress toward gender neutrality, albeit slowly. Gender bias can limit agricultural productivity, according to research (Jafry and Sulaiman 2013; Quisumbing et al. 2014), a fact that, forty years ago, extension services appeared to be largely ignorant of. In many nations today, extension services operate with a greater gender balance in reaching out.

Technological Changes:

The majority of farmers now have cell phone access thanks to the information and communication technology revolution, which allows agricultural extension and advisory systems to target them with timely and inexpensive messages (Aker 2011). While extension and advisory systems are quickly gaining clients for a wide range of mass media programming among large and small commercial farmers, some low-resource farmers in developing nations are still at a disadvantage when it comes to certain types of mass media hardware, such as computers and smartphones. The number of farmers reached is increasing at a comparatively low cost, even though many, but not all, of the messages are simpler than those conveyed through in-person instruction. A few examples include better weather and disease forecasts, market data, insect and disease diagnostics and recommendations, and prompt reminders of important farm procedures. Research on the efficacy of some of these methods for providing extension has surfaced.

Financial Supports:

Agricultural extension funding from governments and foreign donors was substantial in the 1970s and 1980s, but it has since actually decreased in many nations (Davis and Franzel 2018). In the 1980s and 1990s, the World Bank supplied resources to numerous nations for its Training and Visit extension system (Anderson and Feder 2007). However, many nations significantly cut funding for extension programs in the 1990s due to mounting evidence that the T&V system was not very cost-effective, a public debt crisis that afflicted many nations, particularly in Latin America and Africa, and pressure from donors to reduce fiscal deficits. The reductions in extension were politically feasible due to the declining share of agriculture in the economy, the fast urbanization of the population, and the increased visibility of investments in other public assets like roads, water, and irrigation systems. It was hoped that the private sector would intervene.

Decentralization of Power:

Several nations have shifted to decentralized government service delivery, which includes public agricultural extension. Certain administrative tasks are transferred from the central to the local level as a result of this decentralization (i.e. the state and local) governments, strengthening their autonomy from the federal government while necessitating the restructuring of public services like extension offices. Instead of reporting to higher-level ministry or extension agency administrators, extension agents relocate from national and regional offices to local communities. This change aims to make extension accountable to locally elected officials and to be driven by farmer demand. Lack of sufficient funding has been a significant problem for many extension systems, and local

governments may be more motivated to provide financial support for the programs. Decentralization may also make it easier to produce and distribute site-specific information.

Effects of Changes in Extension:

The organization and financing of extension delivery systems have gradually changed as a result of changes in economic structure, agricultural innovations, ICT innovations, funding, and extension decentralization. Table 1 shows a typology of how different extension services are currently offered and funded. With the exception of farmers with limited resources, some services, like in-person on-farm advice, have shifted over time from being almost entirely provided by the government to becoming more and more privately provided (with the farmer paying). Farmers themselves and non-governmental organizations (NGOs), which frequently act as intermediaries for government and donor funding, have increased financing for group meetings with farmers, field days, demonstrations, and workshops, which are still primarily provided by the public. The majority of the public funding for the season-long farmer field school training is provided by NGOs with donor and public support. These field schools may become less common due to the cost per farmer participant.

Table 1: *Typology of Typical Extension Services*

Extension services	Delivery mechanisms	Financing mechanisms
Face-to-face advisory services for individual farmers	Public & Private	Public & Private (Farmers)
Group meetings with farmers/ demonstrations/ field days/ workshops	Mostly Public	Public & Private
Season-long farmer field schools/training	Public & Private (NGOs)	Public
Printed extension reports and pamphlets	Public	Public
Radio and TV programs targeted at farmers	Public & Private	Public & Private
Phone and computer messaging for farmers (mass media)	Public & Private	Public & Private
(Pest) diagnostic services	Public & Private	Public & Private (Farmers)
Product quality certification	Public & Private	Public & Private (Farmers)

The nature and significance of mass media in agricultural extension have changed significantly as a result of the ICT revolution (Aker 2011). The number of printed reports, pamphlets, and flyers—which are mostly created and funded by the public sector—has drastically decreased, while the importance of all forms of electronic mass media has skyrocketed due to their capacity to quickly and affordably reach a large audience. In developing nations, there is currently a struggle between electronic mass media approaches, which swiftly and affordably disseminate information to the general public, and participatory, intensive extension strategies like farmer field schools, which target a specific small-farm audience. Individualized information can also be obtained through electronic media. Despite the development, farmer field school programs have grown significantly.

NGOs and private agri-business input and information providers have increased the amount of funding for private extension as well as the range of extension techniques used in developing nations. For many years, public extension initiatives in developing nations have been supported by donor-funded projects. The majority of developing nations have made progress toward pluralistic extension systems, even if inadvertently (Bitzer, Wennink, and de Steenhuijsen Piters 2016). However, the extent and institutionalization of these systems vary widely across nations. Extension is still greatly impacted by the structural changes in agriculture that take place globally. Countries can more readily afford to support agricultural extension services, but fewer people are aware of the needs of farmers as the agricultural sector declines in comparison to the non-agricultural sector and incomes rise. Donors frequently have a big say in the strategy and content of extension in developing nations.

Has agricultural productivity or returns on extension investments been impacted by changes to extension systems? Public resources for extension are scarce, and many countries still have limited adoption

of sophisticated, knowledge-intensive technologies, but most countries continue to see growth in agricultural productivity and the diffusion of agricultural innovations. Total factor productivity (TFP) growth accounts for roughly three-fourths of the 2.5 percent annual growth in agricultural output that occurs globally (Fuglie and Rada 2013). Unfortunately, in Sub-Saharan Africa, where public and private extension are the weakest, productivity growth has had less of an impact on agricultural growth. Although TFP growth has only averaged around 1% in recent years (Fuglie and Rada 2013), it does seem to be increasing in certain nations over the past ten years. In Sub-Saharan Africa, economic rates of return on agricultural extension have often been reported between 30 and 100 percent.

Suggestions for Policy Makers and Public Extension Agencies:

Tight public budgets, reform initiatives like decentralization, and new ICT technologies have resulted in pluralistic extension and advisory services that combine public and private methods for funding and carrying out extension activities in many nations, particularly in the developing world (Davis and Franzel 2018). This pluralism reduces the financial burden on the public sector, promotes demand-driven services, and allows for flexibility. To guarantee that the needs of all farmers, not just big commercial farmers, are satisfied, it also makes coordination more difficult. It makes it difficult to guarantee that extension providers are held responsible, that economies of scale are realized, and that the public sector extension service is neither starved of funding nor discontinued. Eliminating public extension could result in unfulfilled demands for environmental improvement or for farmers with limited resources. The various extension service providers, including public extension, have different roles.

It is necessary to decentralize program planning and management with strong client involvement that connects public extension to new information sources, keeping the system just political enough to secure resources but not so political as to be taken over by those in positions of power. When farmers see overly politicized systems as the government's eyes and ears rather than information providers, they lose credibility and ultimately lose funding. Public extension agencies in Ecuador and Honduras were disbanded a few years ago due to their politicization. Due in part to the cost of T&V, India, which has the second-largest extension system in the world, transitioned from a centralized T&V system in the 1970s and 1990s to a decentralized model more recently under the direction of the Agricultural Technology Management Agency (ATMA). With connections to research through the I, ATMA is an autonomous multistakeholder organization that includes farmer associations, NGOs, private organizations, and public extension agents.

If female access to ICT is not less than that of men, ICT-based extension information could lessen gender bias by giving information to women-headed households with limited resources in their homes (World Bank 2017, p. 71). If given the opportunity, women are frequently just as eager as men to engage in online or offline social networks. Virtual networks and farmer groups are becoming more and more significant in the spread of technology. These networks must be utilized by extension services (World Bank 2017). For instance, even in developing nations, products like WhatsApp and other mobile networking and messaging apps are becoming widespread, and their use in extension is expanding quickly for subjects like crop pest diagnosis and recommendations (Davis and Franzel 2018; Beriya and Saroja 2019). As farmers' access to computers increases in developing nations, webinars and other distance learning tools can be used to impart in-depth decision-making skills. Effective in-service training is essential.

References

- [1] Aker, J. C. (2011). Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries. *Agricultural economics*, 42(6), 631-647.
- [2] Alex, G., Zijp, W., & Byerlee, D. (2002). Rural Extension and Advisory Services: New Directions (Rural Development Strategy Background Paper 9). *Washington, DC: World Bank*.
- [3] Alig, R. J., Kline, J. D., & Lichtenstein, M. (2004). Urbanization on the US landscape: looking ahead in the 21st century. *Landscape and urban planning*, 69(2-3), 219-234.
- [4] Alston, J. M., Chan-Kang, C., Marra, M. C., Pardey, P. G., & Wyatt, T. J. (2000). *A meta-analysis of rates of return to agricultural R&D: Ex pede Herculem?* (Vol. 113). Intl Food Policy Res Inst.
- [5] Anderson, J. R., & Feder, G. (2004). Agricultural extension: Good intentions and hard realities. *The World Bank Research Observer*, 19(1), 41-60.
- [6] Anderson, J. R., & Feder, G. (2007). Agricultural extension. *Handbook of agricultural economics*, 3, 2343-2378.

- [7] Bank, World (2017). ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions. Updated Edition. Washington, DC: World Bank. doi: 10.1596.
- [8] Bashaasha, B. (2011). Decentralization and rural service delivery in Uganda.
- [9] Bitzer, V., Wennink, B., & de Steenhuijsen Piters, B. (2016). The governance of agricultural extension systems. *KIT Sustainable Economic Development and Gender Working Paper. Royal Tropical Institute*.
- [10] Blum, M. L., Cofini, F., & Sulaiman, R. V. (2020). Agricultural extension in transition worldwide.
- [11] Dercon, S., Gilligan, D. O., Hoddinott, J., & Woldehanna, T. (2009). The impact of agricultural extension and roads on poverty and consumption growth in fifteen Ethiopian villages. *American Journal of Agricultural Economics*, 91(4), 1007-1021.
- [12] Dinar, A., & Keynan, G. (2001). Economics of paid extension: Lessons from experience in Nicaragua. *American Journal of agricultural economics*, 83(3), 769-776.
- [13] Emerick, K., & Dar, M. (2017). Enhancing the diffusion of information about agricultural technology. *Unpublished manuscript*.
- [14] Ferroni, M., & Zhou, Y. (2012). Achievements and challenges in agricultural extension in India. *Global Journal of Emerging Market Economies*, 4(3), 319-346.
- [15] Fuglie, K., & Rada, N. (2013). Growth in global agricultural productivity: an update. *Amber Waves: The Economics of Food, Farming, Natural Resources, and Rural America*, (10).
- [16] Ghini, R., Hamada, E., Pedro Júnior, M. J., Marengo, J. A., & Gonçalves, R. R. D. V. (2008). Risk analysis of climate change on coffee nematodes and leaf miner in Brazil. *Pesquisa agropecuária brasileira*, 43(2), 187-194.
- [17] Gregory, P. J., Ingram, J. S., & Brklacich, M. (2005). Climate change and food security. *Philosophical transactions of the royal society b: Biological Sciences*, 360(1463), 2139.
- [18] Hu, R., Huang, J., & Chen, K. Z. (2012). The public agricultural extension system in China: Development and reform. *background paper prepared for the Roundtable Consultation on Agricultural Extension, Beijing, March*, 15-17.
- [19] Jafry, T., & Sulaiman V. R. (2013). Gender inequality and agricultural extension. *The Journal of Agricultural Education and Extension*, 19(5), 433-436.
- [20] Jin, Y., & Huffman, W. E. (2016). Measuring public agricultural research and extension and estimating their impacts on agricultural productivity: new insights from US evidence. *Agricultural Economics*, 47(1), 15-31.
- [21] Kristin, D., & Franzel, S. (2018). Extension and advisory services in 10 developing countries: A cross-country analysis. *Developing Local Extension Capacity (DLEC) project. USAID Feed the Future*.
- [22] Kuhn, T. S. (1997). *The structure of scientific revolutions* (Vol. 962). Chicago: University of Chicago press.
- [23] Larochelle, C., Alwang, J., Travis, E., Barrera, V. H., & Dominguez Andrade, J. M. (2019). Did you really get the message? Using text reminders to stimulate adoption of agricultural technologies. *The Journal of Development Studies*, 55(4), 548-564.
- [24] Marsh, S. P., & Pannell, D. (2000). Agricultural extension policy in Australia: the good, the bad and the misguided. *Australian Journal of Agricultural and Resource Economics*, 44(4), 605-627.
- [25] Marsh, S. P., Pannell, D. J., & Lindner, R. K. (2000). The impact of agricultural extension on adoption and diffusion of lupins as a new crop in Western Australia. *Australian Journal of Experimental Agriculture*, 40(4), 571-583.
- [26] Marsh, S. P., Pannell, D. J., & Lindner, R. K. (2004). Does agricultural extension pay? A case study for a new crop, lupins, in Western Australia. *Agricultural Economics*, 30(1), 17-30.
- [27] Meinzen-Dick, R. (2014). *Gender in agriculture: Closing the knowledge gap*. Springer.
- [28] Pannell, D. J., & Claassen, R. (2020). The roles of adoption and behavior change in agricultural policy. *Applied Economic Perspectives and Policy*, 42(1), 31-41.
- [29] Pardey, P. G., Andrade, R. S., Hurley, T. M., Rao, X., & Liebenberg, F. G. (2016). Returns to food and agricultural R&D investments in Sub-Saharan Africa, 1975–2014. *Food policy*, 65, 1-8.
- [30] Ricker-Gilbert, J., Norton, G. W., Alwang, J., Miah, M., & Feder, G. (2008). Cost-effectiveness of alternative integrated pest management extension methods: An example from Bangladesh. *Review of Agricultural Economics*, 30(2), 252-269.
- [31] Rivera, W. M. (2001). Agricultural and rural extension worldwide: Options for institutional reform in the developing countries.

- [32] Rola-Rubzen, M. F., Paris, T., Hawkins, J., & Sapkota, B. (2020). Improving gender participation in agricultural technology adoption in Asia: from rhetoric to practical action. *Applied Economic Perspectives and Policy*, 42(1), 113-125.
- [33] Swanson, B. E., & Rajalahti, R. (2010). Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming, and evaluating extension systems. *Agriculture and rural development discussion paper*, 45, 1-187.
- [34] Swanson, B., & Davis, K. E. (2014). Status of agricultural extension and rural advisory services worldwide: Summary report. Global Forum for Rural Advisory Services.
- [35] Umali-Deininger, D. (1997). Public and private agricultural extension: partners or rivals? *The World Bank Research Observer*, 12(2), 203-224.
- [36] Valenzuela, M. A. B., Saavedra, D., & Davis, K. (2017). Honduras: In-depth assessment of extension and advisory services. *Washington: USAID, mar*.
- [37] Wang, S. L. (2014). Cooperative extension system: Trends and economic impacts on US agriculture. *Choices*, 29(1), 1-8.
- [38] Wilson, M. (1991). Reducing the costs of public extension services: initiatives in Latin America.
