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"Empowering Farmers through Knowledge: The Evolving Role of Extension Services"

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Abstract

The otential of agricultural extension in reducing the gap between research institutions and the farming community is immense; it remains one of the most efficient tools for unlocking agricultural productivity and fostering rural transformation. With climate change, limited resources, market variability, and changing demographic dynamics constantly presenting new challenges for agriculture, the function of extension services has transformed from passing technology to empowering the farmers as a whole. Modern agricultural extension systems act as critical mechanisms for transferring knowledge, improving skills, and developing decision-making approaches among farmers in order to improve productivity, profitability, and sustainability. Traditional extension services were top-down, expert-driven, and farmer participation was minimal. However, recent trends in extension approach the immediate and innovative intervention of participatory methods, farmers innovations and blend with ICTs (information and communication technologies) to make extension services more accessible, responsive and inclusive. Digital platforms, mobile-based advisory services, and community-based organizations have changed the way knowledge is delivered and adopted in rural areas. There has been a significant role of PPPs, NGOs, and producer groups (FPOs) in the provision of services beyond the conventional public sector interface. Although significant progress has been made, extension systems in developing nations face challenges along with limited human resources, lack of infrastructure, inadequate training of extension personnel, and poor coordination among stakeholders. Also, gender equity, youth engagement and access for marginalized communities are emerging issues that need to be addressed urgently.

Introduction

Agriculture remains the backbone of many developing economies, providing livelihoods to a large proportion of the population and playing a critical role in ensuring food security But the sector faces growing challenges from climate change, soil degradation, market volatility, limited access to credit and inputs, and the increasing demand for sustainable resource use. Amidst this ever-evolving landscape, farmers need access to timely, relevant, and practical knowledge to adapt, innovate and thrive. This is where agricultural extension services can be transformational acting as a bridge between research and farming communities. Agricultural extension was traditionally envisioned as a top-down process, where subject-matter specialists shared technical information with farmers and assumed adoption. Although this modeling approach led to some innovations during the Green Revolution, in many cases it ignored local circumstances, indigenous knowledge systems, and the diversity of farming needs. This linear line of thinking soon revealed its limitations, paving the path for more participatory, inclusive, and farmer-centric extension models. Present scenario of agricultural extension is not merely focused on a system of technology transfer; rather it is not only an education and empowerment process but a capacity building process. All this helps farmers to optimize their decision-making process as regards crop management → pest control → soil health → irrigation → marketing and risk management. Extension services are important for providing farmers with scientific knowledge and practical skills to improve productivity, use resources efficiently, and promote environmental sustainability. Besides, the development of communication technologies has drastically transformed the extension landscape. Digital tools used, such as mobile apps, SMS alerts, video advisories and e-portals, have all scaled but extension services outreach and impact, especially in remote areas or underserved areas. In conjunction with these developments, collaboration between public agencies, private enterprises, NGOs, and community-based organizations has generated new avenues for providing farmers with timely and relevant information.

Historical Perspective of Agricultural Extension

Agricultural extension has undergone various stages of development, influenced by agricultural needs, socio-economic conditions, and changes in communication and education. The word "extension," which originated in early 19th century England, described the notion of "extending" university knowledge beyond campus walls for the good of the public. This conception quickly diffused across the globe, laying the groundwork for formalized agricultural extension systems. The genesis of agricultural extension in India dates back to the colonial period, particularly the establishment of the Department of Agriculture in 1871. But the systematic move towards extension started with Rabindranath Tagore's Sriniketan Experiment (1921) and the Grow More Food Campaign (1943) in the World War II. The focus of these early programs was to increase agricultural productivity through demonstration and persuasion. The actual transformation occurred through the Green Revolution in the 1960s and 1970s, when the introduction of high-yielding varieties along with chemical fertilizers with irrigation technology. Extension services contributed significantly to the dissemination of these technologies to farmers via a five times in-farm demonstration model of technology transfer. This period saw the birth of the Training and Visit (T&V systems that worked to establish a direct link between researchers and farmers through trained extension officers. While this model was effective at generating the most production possible, it was often denigrated for its lack of inclusiveness, poor feedback loops, and general inability to adjust to local conditions.

The limitations of the conventional model created the need for a paradigm shift in the 1980s and 1990s. A gradual shift in attention occurred toward participatory rural appraisal (PRA), farmer field schools (FFS), and group-oriented approaches, where farmers were partners of innovation instead of passive recipients. They validated the knowledge of the local populations and encouraged mutual learning. The advent of information and communication technologies (ICTs) has revolutionized extension practices further in the 21st century. Digital platforms, mobile-based advisory services, and e-extension have provided farmers solutions in real time

and using the location specific to them. As a result, public-private partnerships and non-governmental organizations have also gotten increasingly involved, resulting in a multi-stakeholder extension ecosystem.

Extension Services: Empowering Farmers

Impact of Agricultural Extension ServicesAgricultural extension services provides necessary training and skill development to farmers to empower them to take decisions on informed basis and adopt better practices of farming. They serve as a link between research institutes and rural populations through the dissemination of scientific innovations, technologies, and practical solutions to the grassroots. Focus on improving agricultural productivity, sustainability, and socio-economic benefits for farming households. Technology dissemination is one of the major functions of extension services. By connecting farmers with modern agricultural practices—by promoting high-yielding crop varieties, or integrated pest management, or water-saving practices, or mechanization—extension agents support farmers' pursuit of more efficient and productive farming. Demonstration farms, field days, and trainings are established as strong frameworks for helping with learning through hands-on experiences and awareness creation. Extension services are not only limited to information sharing but also extends to capacity building and skill development which helps farmers to manage their farms better. They assist with crop planning, input management, soil health, post-harvest, and marketing. Farmers are enabled to be proactive rather than relying on the advice of neighbours and best practices through bespoke advisory services and a group-based approach to learning.

Another One is linkage facilitation, By facilitating linkages between farmers and diverse support services, extension workers serve as a vital conduit to agricultural input suppliers, financial institutions, markets, and government schemes. This also improves farmers' access to credit, insurance, subsidies and marketing access, and boosts their income and decreases vulnerabilities. More recently, extension services have also focused on sustainable agriculture and climate resilience. Extension Agents are leading the way on conservation agriculture,

organic farming, agroforestry, and climate-smart practices to protect the environment and ensure that farms can be sustainable in the long term. And they are also part of disaster preparedness and risk management, assisting farmers in managing uncertainties such as drought, floods and pest outbreaks. Likewise, social empowerment goals such as gender inclusion, youth engagement and community mobilization are increasingly mainstreamed into extension systems. Goods manufacturing, artisanal businesses, and agricultural growth can be more equitable when women farmers and rural youth are trained in self-help and entrepreneurship programs.

Trends in Agricultural Extension Research in Nigeria

Recent years have seen critical advancement in the context of extension services, driven by technology, changing farmer needs and changing development priorities. Extension in the modern era adapts to make information transmission more effective, inclusive, and responsive to farmers' complex challenges (FAO, 2021). Such trends represent a departure from conventional top-down approaches toward systems that are participatory, technology-driven, and farmer-centered. ICT based extension is one of the major trends. Now, mobile phones, SMS alerts, mobile apps, call centres, and video advisories can provide timely and customized agricultural information. Farmers now have access to weather forecasts, market prices, pest alerts, and recommendations on best practices, all delivered directly to their phones, leading to prompter decision making that decreases reliance on physical visits to farmers by extension agents.

One of the new approaches is the emergence of e-extension platforms and digital portals like India's Digital Green, Kisan Call Centres and mKisan. Farmers use these platforms to access interactive, multimedia-based content where they can watch videos and go through virtual training and knowledge repositories in their own local dialects. These platforms can be especially useful in remote locations where access to physical infrastructure is limited. Farming Field Schools (FFS) as well as Participatory Technology Development (PTD) are also gaining more attention, emphasizing a learning by doing and participative research ethos. These

approaches promote hands-on experimentation, local knowledge sharing, and co-development of solutions to make learning more meaningful and tailored to local conditions.

The increase of Public-Private Partnership (PPP) model in agriculture extension. Regulated private agribusinesses, NGOs, and cooperatives are working with government institutions to increase outreach and enhance the quality of service. These partnerships bring innovation, investment, and efficiency, which complements public sector initiatives. At the same time, we see the increasing importance of gender-sensitive and youth-oriented extension that directly targets women farmers and rural youth to have equal access to appropriate information, training and decision-making at the community level. Programs are being developed to fit their specific needs, increasing inclusivity and long-term sustainability. Extensive content is being developed in climate-smart and sustainable agriculture practices to strengthen resilience to climate variability. Awareness campaigns and training promote methods like crop diversification, water conservation and organic farming.

Current Challenges in Extension Services

Agricultural extension systems have undergone considerable development and modernization over the years but continue to face several challenges which limit their effective delivery, coverage and impact. Such challenges ultimately affect the capacity of extension services to deliver on their goal of empowering farming communities and supporting sustainable agriculture development. The shortage of trained and motivated extension personnel is one of the most pressing issues. Numerous regions have too few extension employees to cater to the large number of farmers. As a result, there is low coverage, delayed service delivery, and restricted farmer-extensionalist interactions. In addition, extension agents are often not able to avail themselves of continuous professional development and training, which renders their knowledge out-of-date and limits their capacity to respond to emerging agricultural challenges. Resource constraints are another big concern. Extension departments are generally poorly funded, both financially, infrastructurally, and logistically. Transport availability, lack of Information and

communication technology (ICT) tools, and insufficient equipment and accessories for usual demonstrations degrade the outreachability of these facilities at remote and tribal areas.

The limited uptake of participatory approaches continues to be a challenge, especially in contexts where traditional top-down models still dominate. Agricultural scientists: In such situations, farmers are perceived as passive members of knowledge, instead of as equal members of innovation and public policy. Such efforts are often low on relevance, adoption rate, and behavior change. In some regions, the level of technology and data-driven tools integration is low, leading to disparity in service delivery. Although digital platforms have enhanced outreach in certain regions, a large number of small and marginal farmers still remain unreached due to low digital literacy, inadequate connectivity or absence of mobile devices. The gender bias is also evident in extension services. Thus, women, who comprise a large part of the agricultural labor force, are most often excluded from access to information, training, and resources due to social norms, time constraints, and male-dominated extension systems. Like urban youth, rural youth are also under-engaged and underserved by a large number of extension efforts, even as they have the potential to catalyze innovation. Other challenges include poor synergy among stakeholders such as government agencies, research institutions, NGOs, and private sector. The result is wasted effort, contradictory messages, and an improper allocation of resources. Finally, monitoring and evaluation (M&E) of extension programs is too often weak or lacking. It can make it tricky to measure impact, find gaps and improve programme design without good feedback mechanisms.

Policy and Institutional support

Well-designed policy and institutional support are central to the establishment of a strong and responsive agricultural extension system. Who they are, and who they will become, is increasingly shaped by government and institutional frameworks of agriculture in a world where food needs are growing, climate adaptation is necessary, and livelihoods must be sustainable. To provide inclusive, adaptive and accessible extension services, we need well-designed policies,

funding and institutional coordination. Bacterial infections are often treated with antibiotics; however, S. aureus is rapidly becoming resistant to many of these drugs. These include earmarking specific budgets, harnessing capacity building by hiring well-trained personnel, and establishing farmer-focused programs at national and regional levels. In India, for example, the National Mission on Agricultural Extension and Technology (NMAET) and the Agricultural Technology Management Agency (ATMA) are policies backed initiatives that have been launched for decentralized and need-based extension delivery. Measures to decentralize and localize extension systems through institutional reforms have increased the responsiveness of service delivery. The extension process becomes more participatory and rooted in local contexts through the involvement of Panchayati Raj Institutions (PRIs), local cooperatives and farmer producer organizations (FPOs). At the same time it strengthens accountability and ownership over the extension process at the community level.

Policy frameworks are increasingly recognizing and encouraging public-private partnerships (PPPs). These partnerships leverage the best of both worlds from the public sector including strategic outreach and from the private sector including tailored and timely advisory support, market access and availability to quality inputs. The success of this partnership lies in clear policies outlining the roles, responsibilities, and accountability of those involved. On the second thing is an area of institutional support which is building of capacity and training of extension personnel. Well established training institutions, including Krishi Vigyan Kendras (KVKs), State Agricultural Management and Extension Training Institutes (SAMETIs) and National Institute of Agricultural Extension Management (MANAGE), provide continuous skill upgradation of field staff along with subject matter specialists. Furthermore, there is a shift towards evidence-based decision-making in agriculture, where extension policies are tailored based on ground-level data aggregated from farmer inputs, real-time analytics and development inputs. This improves the accuracy of planning and targeting interventions. Strengthened policy and institutional frameworks ultimately ensure that extension services are technically sound, socially inclusive, economically viable and environmentally sustainable. Thus, continuous political

commitment, inter-sectoral partnerships and evidence-based policies are needed for agricultural transformation to be effective.

Conclusion

Agricultural extension services have long been a vital connection between scientific research and farming communities, helping to transform agriculture and enhance rural livelihoods. In the context of the sector facing emerging challenges—these include, but are not limited to, climate change and market volatility, resource degradation and socio-economic inequalities—the task of extension services has become even more complex, dynamic and very much vital than ever.

As the agricultural development narrative has shifted from a linear model of technology diffusion to a more inclusive, participatory, technology-embedded process, the need to view farmers as active risk takers, a process which is much more is recognised in terms of development approaches, traditional extension services have had to adapt to remain relevant. Today, we have realized that extension systems will not stand up by only adoption of technology and hence capacity building, empowerment and resilience are significant to date. They play a crucial role in empowering farmers and overcoming local and national rural-urban national challenges by improving on-farm resource management and promoting sustainable practices through their activities, thereby enhancing food security and helping to alleviate poverty and develop rural areas. But extension services can unlock their full potential only if some of the persistent challenges they face, including a shortage of human resources, poor infrastructure, weak coordination, digital divides, and gender inequalities, are resolved. There is urgent need to strengthen institutional capacities, invest in human resources, improve the use of digital tools and ensure services are demand driven and responsive to the diverse needs of smallholders, women, and youth. Policy frameworks need to provide an enabling environment not just for the technological innovation, but for inclusive development, equitable access, and local ownership as well. Technologies such as Artificial Intelligence, big data, drones, remote sensing, etc., in extension services in the future will become an inevitable component for precise

advisory, early warning systems, and making informed real-time decisions. And it will also be essential to scale-up successful on-the-ground models such as Farmer Field Schools, community-based extension, and public-private partnerships. This is to say agricultural extension is not only about knowledge transfer anymore; it is about how farmers can adapt, innovate and stay relevant in a dynamic environment. An extension system, reimagined and repurposed, grounded in sound policies and institutional reforms, with inclusive strategies, will be crucial for the future of sustainable agriculture. To genuinely empower farmers, extension must have a strong farmer-centric approach, context & technology smart, climate resilient, and firmly anchored on the tenets of equity, participation, and learning.

References

1. Anderson, J. R., & Feder, G. (2007). *Agricultural extension*. In R. Evenson & P. Pingali (Eds.), **Handbook of Agricultural Economics** (Vol. 3, pp. 2343–2378). Elsevier.
2. Davis, K. E. (2008). *Extension in sub-Saharan Africa: Overview and assessment of past and current models, and future prospects*. **Journal of International Agricultural and Extension Education, 15**(3), 15–28.
3. Swanson, B. E., & Rajalahti, R. (2010). *Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming, and evaluating extension systems*. World Bank.
4. Qamar, M. K. (2005). *Modernizing national agricultural extension systems: A practical guide for policy-makers of developing countries*.
5. Rivera, W. M., & Sulaiman, R. V. (2009). *Extension: Object of reform, engine for innovation*. **Outlook on Agriculture, 38**(3), 267–273.
6. Glendenning, C. J., Babu, S., & Asenso-Okyere, K. (2010). *Review of agricultural extension in India: Are farmers' information needs being met?* International Food Policy Research Institute (IFPRI).

7. World Bank. (2012). *Agricultural Innovation Systems: An Investment Sourcebook*. World Bank Publications.
8. Sulaiman, R. V., Hall, A., & Raina, R. (2006). *From disseminating technologies to promoting innovation: Implications for agricultural extension*. **International Journal of Technology Management & Sustainable Development, 5**(1), 5–23.
9. Feder, G., Murgai, R., & Quizon, J. B. (2004). *Sending farmers back to school: The impact of farmer field schools in Indonesia*. **Review of Agricultural Economics, 26**(1), 45–62.
10. Van den Ban, A. W., & Hawkins, H. S. (1996). *Agricultural extension* (2nd ed.). Blackwell Science Ltd.