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Review

A REVIEW OF AGRICULTURAL EXTENSION INNOVATIONS ACROSS THE WORLD - A CRITICAL ANALYSIS

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Abstract

Agricultural extension has undergone substantial innovation across countries and regions as governments and development agencies have sought more effective ways to transfer agricultural knowledge and technologies to farmers. This review examines major extension innovations from Africa, Asia, Europe, Australia and North America, including participatory extension systems, farmer field schools, pluralistic and private extension models, public–private partnerships, farmer organizations, digital advisory services, call centres, expert systems and technology centres. Across these cases, the literature shows that effective extension is not limited to information delivery; it also depends on farmer participation, institutional coordination, access to resources and responsiveness to local social and economic conditions. Many of the innovations reviewed move extension away from a top-down model toward more demand-driven, collaborative and context-specific approaches. The review suggests that no single extension model is universally appropriate. Instead, agricultural extension systems are most effective when they combine technical advice, institutional support and mechanisms that strengthen farmer learning, inclusion and adoption of innovations.

Keywords: Agricultural extension; extension innovations; farmer field schools; pluralistic extension; public–private partnerships; farmer participation; global review

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Introduction

Agricultural extension innovations have played a central role in transferring technologies from research systems to farmers. Across countries, extension approaches have varied according to local priorities, institutional arrangements, cultural conditions and resource availability. As a result, extension has evolved from a predominantly top-down technology transfer function into a more diverse set of participatory, pluralistic and technology-enabled systems. These innovations have improved the delivery of agricultural knowledge, strengthened farmer engagement and supported more efficient adoption of improved practices. This paper reviews major agricultural extension innovations from different regions of the world and critically examines their contributions, strengths and limitations.

Agricultural Extension innovations in African countries

Participatory Demonstration and Training Extension System (PADETES), Ethiopia

Ethiopia has historically adopted technologies through extension services (Jordan & Guerzoni, 2020). It is important to develop efficient, comprehensive, need-based and participatory agricultural extension services for raising rural household income

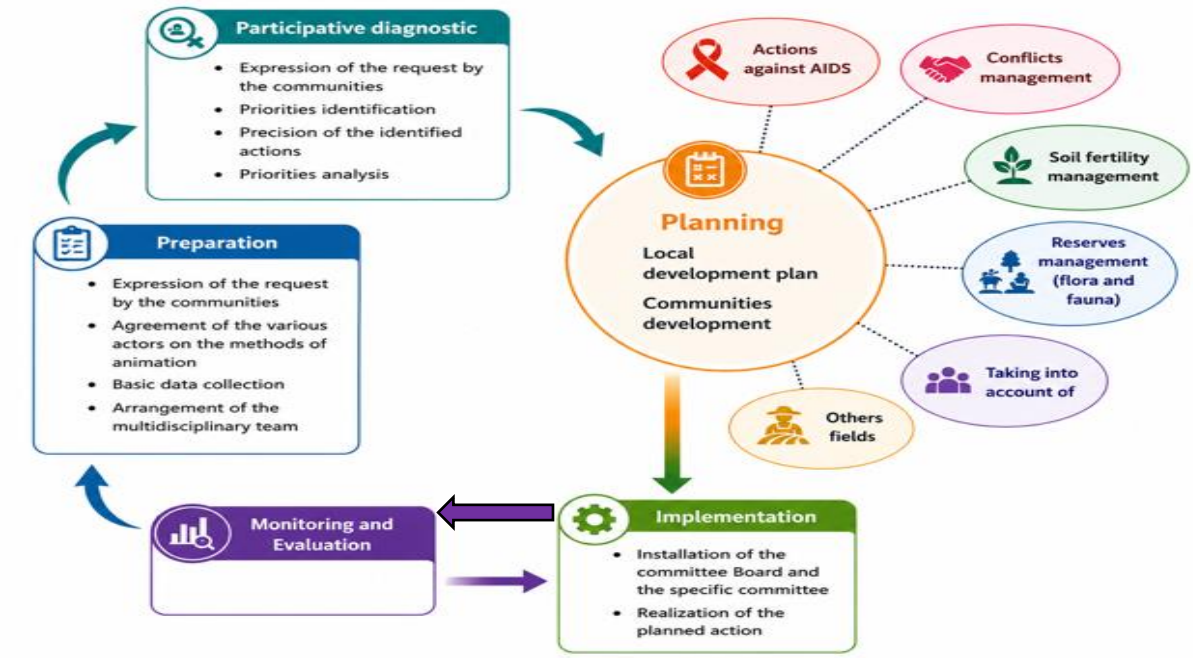
and welfare (Ambaye et al., 2021). In PADETES, smallholder farmers' productivity is increased; incomes are improved through enhancing productivity; farmers are empowered to participate actively in the development process; food production is self-sufficient; farmer organizations are established; export crops are increased; natural resources are conserved; and farmers' organizations are encouraged (Davis, 2008). The Extension Management and Training Plot (EMTP), typically a half-hectare on-farm demonstration plot run by farmers and used to instruct other farmers and extension workers on good agronomic and farm management practices, served as a vehicle for the model's promotion of the production of cereals (Egziabher *et al.,* 2011). This programme provided smallholders with improved seeds, fertilizer, pesticides, and other improved production practices to increase their productivity (Wubneh, 2007). A typical extension distributing fertilizers, not providing to provide technical advice (Davis, 2008). In contrast, other studies have found that extension workers and rural services significantly contributed to the massive increase in agricultural production (Ayele et al., 2005). Fewer women farmers are participating in PADETES (Lucky & Achebe, 2013).

National Agricultural Advisory Services (NAADS), Uganda

The NAADS extension service was established by the government of Uganda in 2001 as an innovative farmer-driven extension service aiming to improve farmers' productivity and livelihoods by introducing profitable agricultural enterprises and improved technologies (Benin *et al.,* 2011; Swanson & Rajalahti, 2010) The PMA's Plan for Modernizing Agriculture priorities included promoting agricultural research and technology; improving agricultural advisory services; improving agriculture skills and knowledge; improving rural finance access; promoting agro-processing and access to markets; and promoting sustainable natural resource management (Kasirye, 2013; Larsen *et al.,* 2009) . A key success element of NAAD was technology development, where revolving credit was provided to farmers to learn new skills and adopt new technologies and increase productivity and per capita income (Olayemi *et al.,* 2021). (Birner & Anderson, 2007) enumerated some of the features of NAADS, including decentralization, outsourcing, subcontracting, farmer empowerment, market orientation and cost recovery. In addition to providing farmers with current information, the programme increases farmer productivity via technologies and equips farmers with skills and knowledge so they can move from subsistence to commercial farming (Kasirye, 2013).

Participatory Approaches in Benin

A participatory approach is most often used in rural areas for diagnosing problems. As part of this diagnostic process, village communities identify and analyse their local assets and constraints, and develop strategies to exploit those assets and eliminate constraints (Philibert, 2008).



Source: (Philibert, 2008)

Farmer to Framer Extension in Ghana

Farmer field schools (FFS) were introduced into sub-Saharan Africa in the mid-1990s as a participatory method for learning, technology development, and dissemination, based on adult-learning principles. They are currently used in 27 SSA countries (Braun et al., 2006). FFS relies heavily on farmer-to-farmer information exchange to spread new ideas. Evaluation of the FFS' impact in Ghana indicates a high level of communication between farmers using techniques learned through the FFS farmers. FFS graduates organized small group meetings on their own. Several participants mentioned giving unsolicited advice to neighbours, although this was less common the majority of exchanges focused on specific technologies or management practices. Communications among FFS participants, however, tended to focus on emerging problems and technology spread (Ackah-Nyamike Jnr, 2008)

Pluralistic Extension in Mozambique

Mozambique has had a pluralistic extension system since the early 1990s (Gemo *et al.*, 2013). NGOs and private commodities extension organizations, in addition to the public extension system (MOA), play a significant part in Mozambique's pluralistic extension system.

Extension service	Public Extension System	Private extension organization	NGO
Focus on	The unified extension (crops, livestock, natural resource management, farmers' organizations, and market development support)	Commodity-oriented extension mainly for cotton and tobacco, and emerging out-grower farming for sesame	From often narrow-focused (for example only market development support)
How	providing free services through extension networks based at villages/ community/ district levels throughout the country	Offering sub-contracts (input and services credit) for smallholder farmers to grow and sell the harvest to the contractors, in agro-ecologically suitable regions	Offering free services through local extension agents at villages/ communities and district levels throughout the country

SOURCE: (Gemo et al., 2013)

Paid Private Extension System in Uganda

A system of paid private extensions has been implemented in Uganda This extension approach encourages farmers to pay certain costs related to knowledge and technology extension and to reduce public expenditures on extension (J. Anderson & Van Crowder, 2000; Babu *et al.*, 2015). In some nations, like Uganda, where a private extension has been adopted, (J. R. Anderson *et al.*, 2007; Babu *et al.*, 2015) observed that the privatization of agricultural extension services is reliant on the financial viability of the specific service. Farmers must have discretionary income to be "paid for," suggesting that this approach is best suited for commercially based farmers that operate as market rivals and have exportable crops This shows that its goal is to support industrial agriculture Systems of paid private extension enable farmers to identify their issues and look for a suitable solution from service providers (Lindner, 1993)

Commodity Extension system in Mali and Zimbabwe

A commodity-based extension system combines a variety of activities for promoting production, including technology extension, research, input, producing marketing and pricing, under one administration or organisation structure (Kidane & Worth, 2016). Extension delivery is typically efficient, focuses on just one product, and the organisation is typically small and mostly focused on inputs (Kenmore, 2002). According to (Anandajayasekeram, 2008; Eicher, 2007), the colonial forces introduced this paradigm to smallholder cotton farmers in Mali, Malaysia, and other francophone nations. As part of the commodity system, research and extension are self-funded through coordination with public extension systems. In addition, the system has been primarily organized by private firms that produce and market very important industrial cash crops (Kidane & Worth, 2016). A number of successful produce grower schemes have been established in some countries in Africa, including Zimbabwe (FAO 2016) due to strong support from private firms.

National Agriculture and Livestock Extension Programme (NALEP) in Kenya

The National Agricultural and Livestock Extension Programme in Kenya, which promotes common interest groups (CIGs) among farmers, was created in the year 2000. The widespread consensus is that groups advance technologies more quickly than individual farmers (Anandajayasekeram, 2008). The NALEP aim was to turn agriculture and livestock into a sustainable system to achieve food security, wealth creation, and national economic growth through science-based, market-oriented,

competitive, and lucrative agricultural systems (Chhettri, 2011). A problem to be addressed is the training and retraining of the extension staff on matters of marketing, packaging, and developing crops and animals to ensure they fulfil the expectations of farmers (Ngugi *et al.*, 2014)

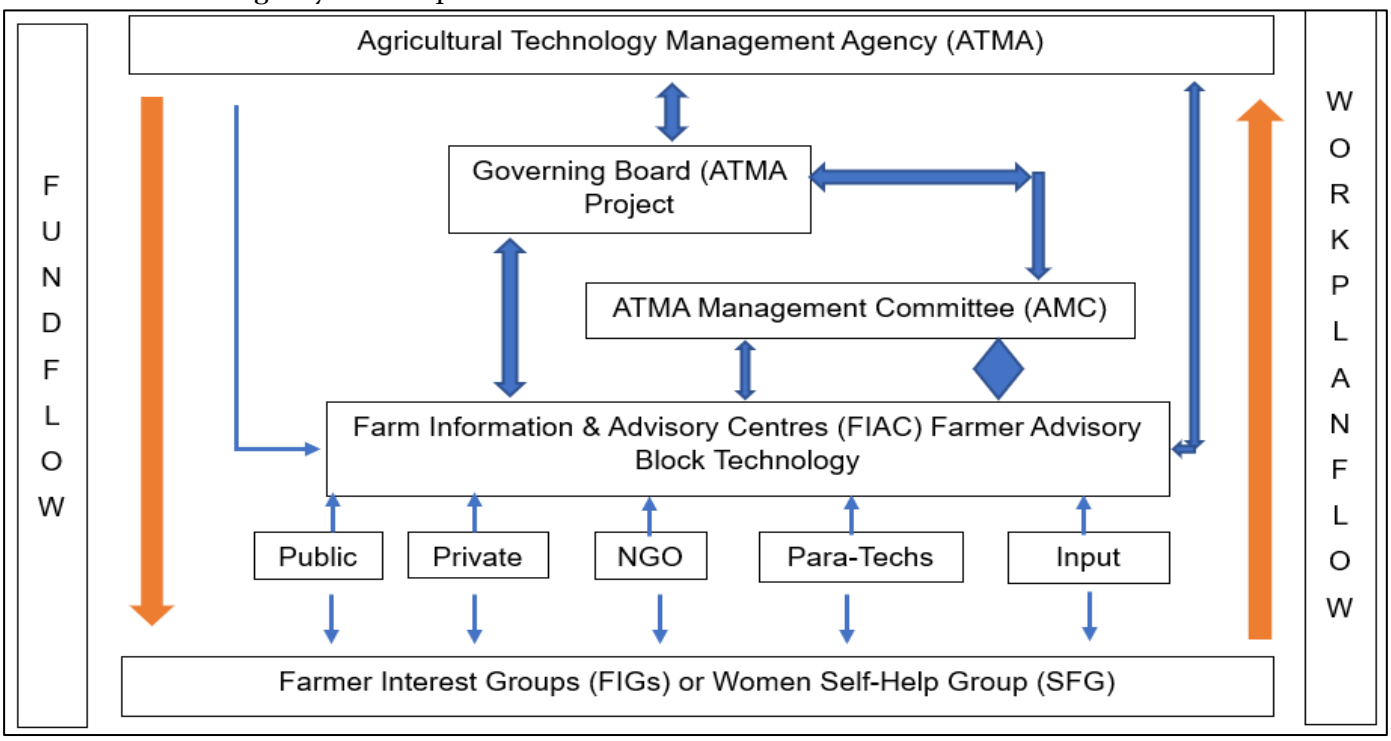
Public Private Partnership in Morocco

A case study from Morocco offers an intriguing example of institutional innovation and collaboration; the Moroccan tomato value chains show the usefulness of collaboration, interaction, and knowledge exchange in enhancing the effectiveness of the value creation process. The situation highlights how collaboration between farmer's organizations, the private sector, higher education institutions, and government agencies led to increased yields and quality (Mondal, 2013)

Agricultural Extension Innovations in Asia

The Agricultural Technology Management Agency (ATMA), India

Agricultural Technology Management Agency (ATMA) is a self-governing and market-driven Indian extension agency that represents a shift from technology transfer to better coordination (Singh *et al.*, 2006). Farm income and rural development are the primary objectives; extension services should be integrated across departments; and farmer organizations should be involved to increase productivity (Birner *et al.*, 2009; Swanson & Rajalahti, 2010) ATMA is a government extension initiative that aims to support state extension reform aimed at revitalizing state extension systems (H. Gupta & Shinde, 2013) . In India, the ATMA approach has been regarded as the most successful agricultural extension reform because it has been adopted in all 600 districts within five years (J. R. Anderson et al., 2007; Davis, 2008). A cross-section of stakeholders makes decisions on ATMA Governing Board priorities and extension activities (Ferroni & Zhou, 2012; Singh et al., 2006). According to (Ferroni & Zhou, 2012) some of the constraints of ATMA are the lack of qualified local manpower; delivery mechanism issues; technical and financial support and a clear framework for partnerships.



Source: (Singh *et al.*, 2006)

Krishi Vigyan Kendra (Farm science centre), India

Krishi Vigyan Kendra was introduced by the ICAR (Dubey *et al.*, 2008) Krishi Vigyan Kendra (KVK) is an innovative science-based institution whose participants include scientists, subject matter experts, extension functionaries, and farmers. The main objective of Krishi Vigyan Kendra is to improve the knowledge of the trainees about improved farm technologies, as knowledge is a cognitive component of an individual's mind and plays a crucial role in both covert and overt behaviour (S. Gupta & Verma, 2013). KVKs are grassroots organizations that assess, refine, and demonstrate proven technologies in different micro-farming situations (Das, 2007). Following (Kokate *et al.*, 2011), the KVK's mandates have changed with time as they gained strength and spread. The KVK began in 1974 with the mission to impart vocational training. On-farm testing and demonstration of technologies became the focus of the 1990s. During the Tenth Plan (2002-2007) technology assessment and refinement focused, and During the Eleventh Plan, KVKS acted as a knowledge and resource centre of agricultural technology. KVK can significantly

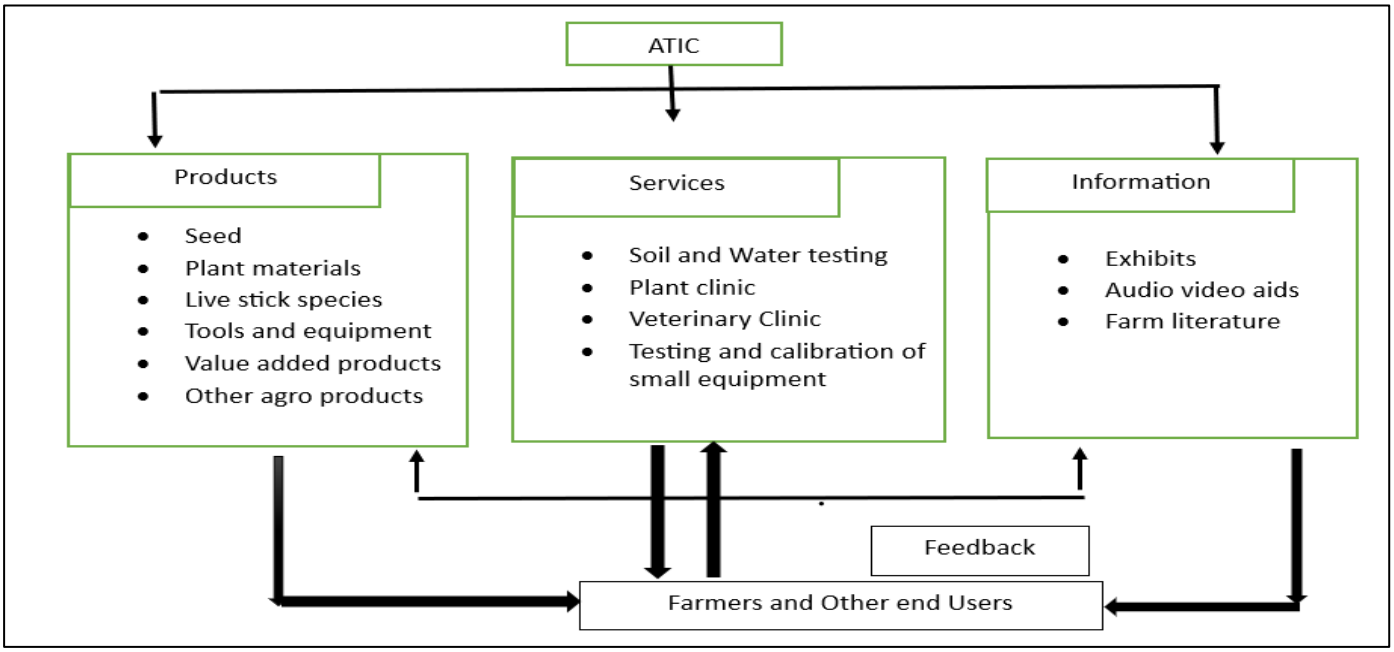
improve socioeconomic status as well as training levels among different classes of trainees, according to (Ajrawat & Kumar, 2012).

Flag method of Extension, Agricultural University Innovation, India

Flag method extension is a simple innovative effective transfer of technology tools developed by ANGRAU University where Extension persons use yellow, pink, and white colour flags to provide information about problems of crops and remedial measures in the field without a farmer present and general information on the backside of the flag (Mondal, 2013). The Flag method solves the problem immediately and builds rapport with extension scientists and strengthens the scientist-farmer linkage (Mondal, 2013).

Agricultural Technology Information Centre (ATIC), India

ATIC was established in 1999 by Punjab Agricultural University (PAU). An Agricultural Technology Information Centre (ATIC) connects the various units of a research institution with end users (farmers) and intermediary users to support decision-making and problem-solving exercises (D. Singh & Kalra, 2019a) . An expert in the fields of entomology, plant pathology, soil science and agronomy provide advice to farmers regarding their field problems. Agricultural advisory services are an integral part of the array of market and non-market entities and agents that provide critical information that can improve the welfare of farmers and rural people (J. R. Anderson, 2008) . In addition to advisory services, ATIC sells technological products, farm literature, and plant clinic services, and offers a helpline (D. Singh & Kalra, 2019b).



Source: (Mondal, 2013)

Kisan Call Centre (KCC), India

On January 21, 2004, the Department of Agriculture & Cooperation (DAC), Ministry of Agriculture & Farmers Welfare, Government of India launched Kisan Call Centre (KCC) to offer free tele agricultural advisory services to farmers. By calling 1800-180-1551, the farming community can receive services from 6 a.m. to 10 p.m. every day in their local language (Koshy & Kumar, 2016) The operation mechanism of KCC is presented following (Chole *et al.,* 2010)

Level :1 Answering the farmer's query immediately handled by Agri graduates

Level: 2Transferring the unanswered question to an agricultural university or other technical institutes for an immediate response (SMS)

Level :3 Experts will examine and provide the farmer with a detailed answer by mail, telephone or visit (SMS) at the nodal office

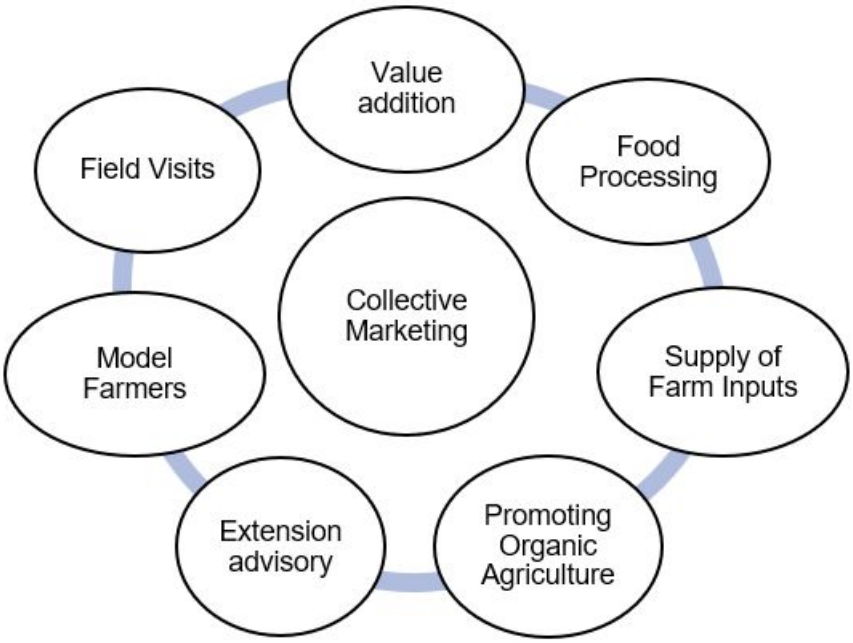
Group Approach in India

The transition of the public, private, and NGO expansion from individual to collective approaches helps extension planning and execution. It increases farmer accountability and promotes sustainability by allowing for group participation in decision-making, access to credit, value addition, and marketing (Rasheed Sulaiman, 2003)

Farmers producers' organisations (FPO) in India

FPOs aren't new to India. The cooperative movement started in India in the 1930s. Currently, several cooperatives represent about 70% of the agricultural producers in the country (Ministry of Agriculture, Govt. of India 2015). Most Indian farmers own less than five hectares of land, so they form farmer-producer organizations to overcome the challenges (Derle & Hasan, 2022). Farmers 'producers organisations like the Velliangiri Farmer Producer Company Ltd (VFPCL) in Coimbatore are essential in enhancing farmers'

knowledge and abilities through information sharing (Abraham & Raj, 2022).



Source: (Abraham & Raj, 2022)

The Farmer Field School Model in Philippines and Indonesia

The Farmer Field School (FSS) extension concept was developed in the Philippines and Indonesia in 1989. The FFS extension approach is a participative technology development and distribution strategy that offers farmers the chance to learn useful fieldwork skills (Olayemi *et al.*, 2021). FFS proved highly effective in lowering the usage of insecticides in the Philippines and Indonesia. The FFS model includes intensive training exercises that employ participatory methods to help farmers develop their analytical knowledge and skills, critical thinking, and creativity. As a result, they are able to learn how to make better decisions not only in their farming operations but also in their daily activities , at least once a week on a member's farmland (Anandajayasekeram, 2008; Kenmore, 2002). (Anandajayasekeram, 2008) listed a few difficulties with implementing FFS in developing nations, such as inadequate exposure of research and extension staff to the concepts and practices of FFS, rivalry and conflicts of interest between various donor agencies, sharing of proceeds from the school approach, and lack of coordination of FFS activities.

Family Approach Extension in Bangladesh

The International Maize and Wheat Improvement Centre's (CIMMYT) research in Bangladesh revealed higher adoption rates of wheat technologies when all family members were trained together which gave rise to the idea to test the family approach in extension in Bangladesh (Meisner, 1998; Meisner *et al.*, 2003). The Department of Agricultural Extension (DAE) in Bangladesh conducted training a full family (both husband and wife with children) to half a family (husband and wife without children) and spouse alone through the Poverty Elimination through Rice Research Assistance Project (PETRA), which was supported by the Department of International Development (DFID) The training courses covered – rice cultivation, plant health management, the post-harvest operation, and modern rice seed production (Sagar, 2013). One and half years later, a two-week evaluation mission revealed that training the entire family or half a family (husband and wife without children) had more advantages than training either spouse alone, particularly in terms of gaining more knowledge, applying new technologies, increasing rice production, and influencing others in the community to adopt technologies

Drawbacks according to (Mondal, 2013)

- Young children can occasionally make training sessions distracting.
- In certain places, removing social and cultural barriers that prevent women from participating in training is still a problem.

Pocket Package Strategy (PPS)in Nepal

The first step in implementing PPS is selecting viable pocket locations for chosen crops or commodities. Considerations for selecting pocket areas include their geo-environmental suitability, natural resource endowment, and accessibility to physical infrastructure. All Agricultural Knowledge and Information System stakeholders, including input suppliers and dealers, are expected to collaborate in each pocket region to attain the shared objective of higher productivity. A review of the PPS's implementation by several independent organisations and the implementing agencies revealed that the PPS tended to direct

public sector agricultural extension agencies' attention away from the poor and disadvantaged people who reside in marginal areas and towards resource-rich areas and resource-rich farmers (Ojha & Basnyat, 2008)

Agricultural technology parks in Sri Lanka

A quick information dissemination mechanism was recently introduced at this exhibit. Visitors will be able to see live demonstrations of some of the latest technical recommendations for food crops and self-explanatory digital posters. If visitors need further clarification, agricultural instructors are assigned to each section. Researchers assist with creating demonstrations and deciding on technical content. The Technology Park has become a popular agro-tourism site and serves as a "live agricultural university" for those interested. A park is also a place for students to discover learning (Hossain *et al.*, 2014)

Field Days in Sri Lanka

Even though field days are planned as a regular extension activity, researchers are occasionally invited when a notable field event takes place. They get a chance to talk to farmers, learn about various farming settings, and exchange experiences with farmers and extension specialists. In addition, field days are held by the Research Institute to demonstrate new technology. Researcher and extensionist communication can grow as a result of this (Hossain *et al.*, 2014)

Expert System, World Wide

According to (Prasad & Babu, 2008), an expert system is a technique for extracting knowledge-based information. It is a computer application created to encourage an expert in a certain field or profession to solve problems. Components Expert System presented following (Sriram & Philip, 2016)

1. ***The crop doctor:*** The crop doctor is the essential element of the expert system. With the aid of dot net and SQL server, it was created using a "if and then" rule-based software. The method only uses images to diagnose nematodes, illnesses, pests, and nutritional problems.
2. ***Decision Support System:*** Decision support systems help farmers make informed decisions about regular crop production procedures. It has been effectively designed and implemented to use DSS to provide information and recommendations on effective fertilizer usage, decreasing the use of herbicides, plant protection techniques, risk management for the environment, seasonal climate forecasting, land use planning, and other topics.
3. ***Information system:*** The information system is a web-based static and dynamic database that has been loaded with all the material and technologies relevant to the crops in question. This enables extension personnel and scientists to access up-to-the-minute data on the crop for their own use.

Comax: A cotton crop management expert system is called COMAX. The expert System is combined with the Gossym computer model, which promotes the growth of the cotton plant (Lemmon, 1986)

Cuptex: A cucumber production management expert system utilized by the Egyptian Ministry of Agriculture's agricultural extension department as well as the private sector. For fertigation plant care and disorder correction, CUPTEX consists of three expert systems (Rafea *et al.*, 1995)

Pomi: An expert system for integrated pest management of apple orchards was developed in Italy (Gerevini *et al.*, 1992).

Wheat Pakistani Expert System: (Khan *et al.*, 2008) created a web-based expert system for Pakistan's wheat crop.

Pluralistic Extension in Philippines

The Agriculture and Fisheries Modernization Act (AFMA) and the devolution of general agricultural extension in 1993 resulted in an implied pluralistic extension system in the Philippine agricultural extension system (Palis & Flor, 2008) . There are five key players in the nation, including

1. Local government units (LGUS) of the Department of Interior and Local Government
2. Bureaus and attached agencies of the Department of Agriculture including Agricultural Training Institutes (ATI)
3. State College and Universities (SCUs) of the Commission on Higher Education
4. Non-Governmental Organisations (NGOs), and
5. The Commercial private sector

Extension services for provinces, cities, and municipalities are no longer a primary responsibility and function of the Department of Agriculture (DOA)

Radio Programme, Nepal

Since its introduction in Nepal in 1951, radio has been the most successful medium for mass communication. In the nation, there are reportedly more than 3.0 million radios. Informing local farmers about agricultural commodity prices is a key function of FM stations. In addition to this, they are valuable resources for farmers to learn about agricultural practices directly from practitioners and to stay informed of significant agricultural events (Hossain *et al.*, 2014).

Agricultural Extension Innovation in Australia

Pluralistic extension services in Australia

According to (Klerkx & Nettle, 2013), the Australian agricultural research development and extension system (RD&E) is pluralistic and exhibits many characteristics of other countries' privatised

extension systems. However, the Australian RD&E system is acknowledged as being extremely complicated (Hunt *et al.*, 2012, 2014), being mostly driven by industry and driven by a number of public, private, and industry-good initiatives. (Shared Government-Farmer Levy-Arrangements by Agricultural Commodity) and farmer-owned R&D organisations, as well as Vocational training organisations engaged in agricultural extension. According to (Prager *et. al.*, 2016), we define a typology of advising and extension actors to distinguish between public actors (government), private players (commercial and independent fee-for-service advice), farmer-owned organisations, and third-sector actors (NGOs)

Agricultural Extension Innovation in European Countries

Cost Recovery Approach in Britain

The Agricultural Development and Advisory Services (ADAS) in England and Wales, are notionally "commercialized" and operate on a partial cost-recovery basis. Clients of ADAS pay a fee for advice which formerly was free of charge. This process of cost recovery introduced in 1987, was directed toward the agency receiving 50 percent of its income from commercial fees by 1993-94 (Bunney & Bawcutt, 1991)

Privatization in Netherlands

By shifting field extension staff to farmers groups with initial financial backing from the government, The Netherlands privatized around half of its public extension service in 1990. According to (Proost & Röling, 1992), the board that oversees the privatized extension service is equally composed of representatives from the government and farmers' organizations.

Farmer Association in Germany

Farmers' unions, marketing cooperatives (typically on commodity quality and pricing issues), and other organizations that specialize in providing information and assistance to farmers concerns) and farmer associations (via, for example, advising and controlling actions). These extension services are often supported by a combination of membership fees and state subsidies, however, their funding model is highly diverse (Hoffmann *et al.*, 2000)

Semi-Privatized Extension in Germany

While private agricultural extension specialists can provide their services either as an individual, in a partnership with other advisers, or as a corporation each extension agent and a firm must formally register with the state. Each state has now experienced the emergence of a regulated market for extension provision. Even when the private sector provides extensions, the state continues to play a role in covering the costs in each case (Hoffmann *et al.*, 2000)

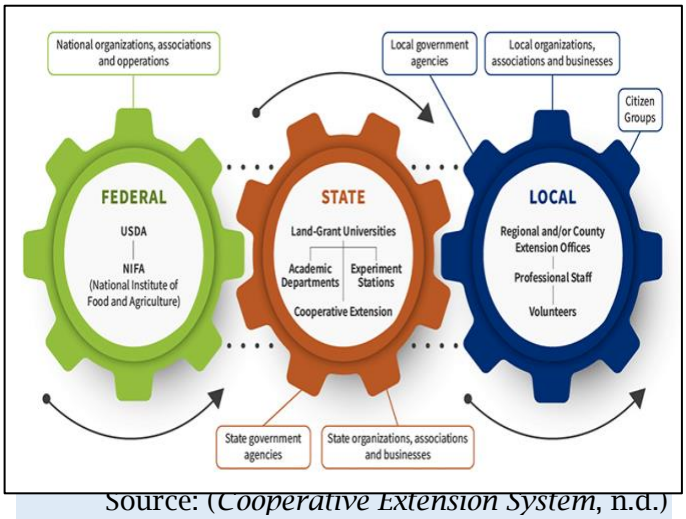
Private Extension in France

Extension services are offered in France by private sector companies and agricultural chambers. The chambers of agriculture are regarded as private organizations that rely on farmer dues for membership and services, although the French government provides sizable financing for operational and programme costs (Mondal, 2013)

Agricultural Extension Innovation in USA

Cooperative Extension System in USA

The National Institute of Food and Agriculture (NIFA), the National 4-H Council, and the Extension Foundation are working together with the Cooperative Extension System to translate research into action for agriculture, health, natural resources, and human sciences to quickly get useful tools and knowledge into the hands of people and communities who need them.



Source: (*Cooperative Extension System*, n.d.)

AGNIC IN USA

A network of public and private agricultural libraries and information centres called the Agricultural Network Information Centre (AgNIC) is connected over the internet and is managed by the National Agriculture Library (NAL) of the United States. Global access to agriculture is what the network intends to achieve. Access to a network of electronic sources on research and instruction in agriculture, food, natural resources, forestry, etc. is provided by the network through its website (Mondal, 2013)

4 H club in USA

The U.S. Department of Agriculture's (USDA) most successful youth development programme is 4-H. The 4-H (head-heart-hands-health) programme, which was originally known as "four-square education," aims to improve the quality of life by fostering positive youth development, facilitating learning, and involving young people in the work of their community. This is done through the Cooperative Extension Service. For more than a

century, 4-H has been committed to providing young people with experiences that widen their skills and goals and foster their full potential. A 4-H club's goals are to encourage educational opportunities connected to the Land Grant University's body of knowledge and to give positive youth development chances to address young people's requirements for the Essential Elements of belonging, mastery, independence, and charity. All young people may join a 4-H club starting at age 8 or the fourth grade (the precise enrolment date is decided by the state), although participation is only permitted until the age of 21. Youth of any race, colour, creed, religion, national origin, sex, marital status, disability, or receiving government assistance are welcome to join 4-H Club. Source: (What Is a 4-H Club?, 2011).

Conclusion

Agricultural extension has developed into a diverse and dynamic field shaped by institutional innovation, technological change, and the need for more responsive service delivery. The cases reviewed in this paper show a clear transition from conventional top-down extension toward participatory, pluralistic, and demand-driven approaches. Models such as farmer field schools, participatory demonstration systems, public–private partnerships, farmer producer organizations, advisory call centres, expert systems, and specialized institutions such as KVKs and ATICs demonstrate different ways of improving the flow of knowledge between research systems and farming communities.

The review also shows that there is no single extension model that is universally applicable. The success of any innovation depends on the institutional context, the availability of technical and financial support, the nature of farmer demand, and the extent to which the system is inclusive of smallholders, women, and marginalized groups. In several countries, pluralistic arrangements that combine public, private, and community-based actors appear to offer the greatest flexibility and reach. At the same time, commercialization and cost-recovery approaches may limit access for resource-poor farmers unless they are supported by appropriate public safeguards.

Overall, the future of agricultural extension lies in systems that are locally adapted, institutionally coordinated, and technologically responsive. Strengthening farmer participation, improving staff capacity, and ensuring equitable access to information and services will be essential for making extension more effective, inclusive, and sustainable.

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