

Extension Systems in Tanzania: Identifying Gaps in Research

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Abstract

Research relies on extension to disseminate findings. This was a library study to facilitate writing of a research background paper on extension system research in Tanzania for Innovative Agricultural Research Initiative (iAGRI) project. The specific objectives were to: review research in Tanzania on agricultural extension systems; review research globally on agricultural extension systems; and identify knowledge gaps in research on extension systems in Tanzania. Secondary data were collected from library survey of literature, websites, studies conducted between 1993 to 2012 in Tanzania on extension systems and lead international articles within the last 10 years. The study reviewed agricultural extension research documents focusing on methodology, analytical techniques, unique results and major recommendations. It employed a content analysis design and identified 12 research gap areas which were re-organized into five major research themes and 32 research sub-topics/questions. The identified knowledge gaps in research on extension system need to be addressed, in order to contribute to objectives of Feed the Future, and especially iAGRI in Tanzania.

Keywords: Extension Systems; Research Gaps; Tanzania

Introduction

The terms extension systems (ES) and Agricultural extension systems (AES) in this review paper will be used interchangeably. However, the focus will be on AES defined as an agricultural information exchange system which shows the actors, people and institutions, their interactions and communication networks among these actors to coordinate the information related processes (from generation to transfer, utilization and diffusion) (Limbu, 1999). The history of extension has brought about social developments which affect current practice of extension: criticism of public sector extension; the systems model controversy; the lesson of experience. It has been noted by several authors (Wambura, 1993; NEPAD, 2003; URT, 2004; Qamar, 2005; URT, 2010) that beginning in the 1980s extension came under criticism from policy-makers, donors, economists, etc. People started questioning the efficiency, effectiveness/

impact, the relevancy, etc. of public extension. As a result of this criticism, some systems responded, eg: privatization; revitalization; institutional pluralism, including NGOs; institutional changes (involvement of research and academic institutions).

The theoretical framework for use in organizing review of research done in Tanzania and globally was based on Azadi and Filson (2009) proposed framework (Figure 1). for systemic comparison of agricultural extension systems (AESs), who argue that an increasing volume of literature deals with different meanings of the term 'extension' due to the many different AESs in use. Acknowledging the diversity of AESs, Azadi and Filson recognize that there is usually a bias towards some specific aspect of these interventions that indicates a need to consider a systemic framework for comparative studies. They observe that three levels of analysis

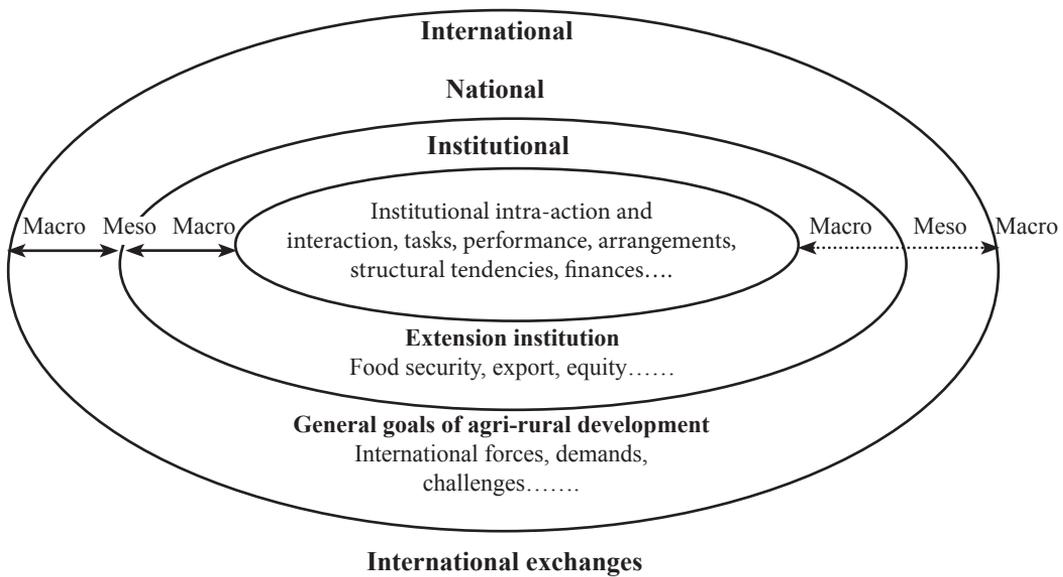


Figure 1: The proposed framework: to make systemic comparison of agricultural extension systems

Source: Azadi and Filson (2009)

should be scrutinized for considering a systemic view: micro (institutional), meso (national) and macro (international). At the most basic level, all AESs are involved in both intra-actions and interactions of the extension institution. For this reason, the aim of many studies has been to evaluate the institutional functions of extension practices. The functions at this lowest level are used to predict not only how extension professionals think and act, but how they react to their different target groups. The main question at the micro level is therefore to understand how a country can reach its agri-rural development goals through extension institutions and what institutional arrangements and funding trends help to achieve those goals. At the meso level, the most important considerations are national expectations, which lead to governmental support for or restrictions on the extension institution. Socio-economic conditions and their consequences largely determine what the extension tasks should be. The main question at this level is why a country needs extension services, which define the different missions for them in different countries. Finally, at the macro level of analysis, it is important first to consider international components and their impact on the level of socio-economic development of particular countries and, then, the extension

missions. The main issue at this level is therefore to understand what international forces and considerations affect the present situation of a country.

This review was based on research done on agricultural extension in its entirety in order to provide the definition of stakeholders and structure of the system; show how different information sources use and support each actor, the relationships and interfaces among the system components; provide an understanding of research done on AES and its impact in improving the AES performance in Tanzania; and show existing research gaps when compared to international extension systems experience. The main focus of the review was to guide implementation of the Innovative Agricultural Research Initiative (iAGRI) that is being implemented within the framework of the United States (US) Government's Global Hunger and Food Security Initiative (GHFSI) in Tanzania, which has the following key objectives: (a) increase sustainable market-led growth across the entire food production and market value chains; (b) prevent and treat undernutrition; and (c) increase the impact of humanitarian food assistance and social safety nets.

Materials and Methods

An original, comprehensive literature survey and critical analysis of the agricultural extension research documents that has been done on agricultural extension in Tanzania between 1993 to 2012 was conducted in order to identify knowledge gaps on extension systems as it pertains to food security in Tanzania given the current demand, focusing on: participation; client-focus; demand-driven; pluralism; privatization; decentralization; location and purpose-specific original extension methodologies; staff motivation for effective performance; broader technical mandate of extension in line with global development; development and application of information technology (IT) tools; monitoring, evaluation and impact assessment; and institutional linkages. The review was conducted on 9 single micro-studies which were available under 12 of the above listed areas based on methodology, analytical techniques, unique results and major recommendations. All the documents reviewed were one-time cross-sectional micro-studies.

The reviewed leading international academic articles published on agricultural extension and extension systems, with emphasis on the past ten years, focused on the main global developments on extension systems, including: globalization, market liberalization, privatization, pluralism, decentralization and devolution, client participation in decision-making, natural and man-made disasters, rural poverty, food insecurity, HIV/AIDS epidemic, and emphasis on integrated, multi-disciplinary, holistic and sustainable development.

The identified research areas in reviewed literature both in Tanzania and internationally were re-organized to form proposed innovative research agenda on extension systems, focusing on a research agenda for generation of knowledge that addresses the gaps identified. A gap, in this particular case, refers to the knowledge that would be needed for effective implementation of good policies and programs on extension services in Tanzania needed to implement national agricultural policies and programs that would address extension systems.

Results and discussion

Research done on agricultural extension in Tanzania

Participation

While the practice of extension may have stuck in technology diffusion, more general thinking on the nature of agricultural technology, development and promotion has advanced considerably in the last two decades. It is widely recognized that innovation comes from multiple sources, including farmers and how the agendas of different stakeholders are represented affects the 'appropriateness' of new technology developed. Farmer participation in technology development and participatory extension approaches have emerged as a response to such new thinking. Laizer (1999) conducted a field study which assessed the role of participatory approaches in smallholder farmers rice production in Morogoro Region using a case of the National Special Program on Food Production (NSPPF). Data were collected from 75 participatory farmers groups (PFGs) and 75 non-PFGs, 6 extension staff and 5 key informants using personal interviews, focused interviews, group interviews and structured questionnaire. Data were analyzed by Statistical Package for Social Sciences (SPSS) and content analysis technique. It was found that the Program contacted more farmers than other extension programs due to use of PFGs and concluded that PFGs facilitate the use of participatory approaches, establishment of linkages with agricultural support services and interaction among the key actors in agricultural production. The research gaps under this area include: participatory grassroots extension program planning, and monitoring and evaluation of extension activities.

Client-focus

Client-focus is a new radically different model for extension that has emerged in recent years. The main elements of these new extension service systems, include deepening decentralization; changing the role of the extension worker from advisor/teacher to facilitator; changing the relationship between smallholders and extension providers, by increasing farmers influence and control over

the extension service and contracting out of services. Mwaseba (2005) reports a study which focused on the experiences based on agricultural research conducted during the period 1980-1990 in the Southern Highlands and Eastern Zones of Tanzania. The findings reported in this study were based on a review of earlier impact studies and fieldwork focusing on the impact of rice research programs in the two zones. The latter, in particular, paid attention to the adoption of selected rice research-based innovations, impact of rice research on food security, and the economic costs and benefits of rice research. The review of the impact studies showed that unlike at the international level where, since the 1990s, attention has largely focused on the poverty reducing effects of agricultural research, no similar attention has been given to the role of agricultural research in poverty reduction in Tanzania. This fits in within a broad context in which agricultural research and extension have hardly been sufficiently able to address the needs of the poor farmers. Moreover, the limited use of selected rice research-based innovations is further evidence of the inability of agricultural research to generate innovations that cater for the different categories of farmers including the poor.

This study also showed a weak impact of rice research on food security. Although this could be attributed to the limited impact of rice research on crop productivity, the multiple livelihoods that farmers seek to achieve through rice production imply that food security should be understood in the context of livelihood strategies pursued by the farmer. In reference to the economic impact of rice research, besides the rates of return, which vary widely depending on assumptions informing the analysis, the study also found great fluctuation of the benefits of research reflecting the unstable nature of rice farming carried out under rainfed conditions and limited inputs. The research gaps under this area include: identification of types of farmers whose extension needs are to be addressed with tailor-made extension strategies and methodologies and materials; women participation in value chain development, savings, micro-credit and wealth management; and linking gender

and extension services: the effects of cultural barriers on access to extension services.

Demand-driven

Emphasis in Tanzania is placed on making extension services demand-driven. The concept of demand-driven extension emphasizes the need to provide services that meet needs and priorities of farmers in the context of changing domestic and international environments for agriculture. Wambura (1993) conducted a study which assessed the impact of extension strategies on farmers' participation in development activities at village level in Morogoro Region, Tanzania under Sokoine University Extension Project (SEP). Data were collected from 40 field agents and 162 farmers/villagers by use of interview schedules and directed discussions of study author with 48 key informants. Notes in diary form from project records and observation record forms were also used. Data analysis mainly involved univariate, bivariate and multi-variate methods using programs from Statistical Package for Social Sciences (SPSS). It was revealed that farmers/village groups were involved by village extension workers and participated in planning, implementation and evaluation of their agricultural production programs/projects, and thus, concluded that farmers should be assisted to participate in prioritization, identification, implementation and evaluation of their programs/projects. The research gaps under this area include: establishment of farm-to-market chain links.

Privatization

With regard to privatization of extension services, agricultural extension, either public or private, cannot properly function without a continuous flow of appropriate innovations from a variety of sources, local and foreign. All providers need a system to assess extension outcomes and feed this information back to policy and coordination units. Mdemu (2000) conducted a field study using personal interviews, structured questionnaires, informal discussions and non-participant observation and likert-type interview on farmers' opinions on privatization of extension services in Mbeya region. Data were analyzed by SPSS and

content analysis techniques. It was found that farmers and extension staff are in favor of cost-sharing and that farmers are willing to share the cost of extension. However, it was concluded that there is little involvement of private organizations in extension delivery with major concern on the quality of the produce they are interested in, and that farmers encounter many problems in agricultural production, amongst which inadequate extension service being one of the major problems. The research gaps under this area include: the extent to which extension services are adopting the value-chain approach and market oriented; effects of globalization and market liberalization on farmers; how private traders, processors and retailers have contracted extension services to ensure a reliable and timely supply of quality agricultural product; and the extent of farmers utilization of different extension messages.

Decentralization

Extension services should be part of the decentralization and devolution agenda, engaging full involvement of local government units and grass-root organizations. New approaches such as Farmer Field Schools (FFS) and the Agricultural Knowledge and Information System (AKIS) have been developed. Direct farm level links are stressed between researchers and farmers. More recently, the notion of extension as part of a wider system has emerged. Sikira's (2001) study on decentralization of extension services to the local government in Morogoro and Tabora Municipalities used structured questionnaires, informal discussions and personal observations. Data were analyzed by SPSS and content analysis techniques. It was revealed that the majority of extension staff had the opinion that decentralization will not improve extension service provision due to factors such as lack of personal emolument, and incentive package like promotion, lack of logistic support and operational funds, and concluded that government should rectify the existing working condition of extension officers. The research gaps under this area include: organization of farmers for empowerment and group extension approach; and the impact of farmer to farmer extension approaches on

agricultural productivity.

Staff motivation for effective performance

Addressing new challenges requires extension to play an expanded role with a diversity of objectives, which include: linking farmers more effectively and responsively to domestic and international markets; enhancing crop diversification; coupling technology transfer with other services relating to input and output markets; poverty reduction and environmental conservation; viewing agriculture as part of a wider set of the rural development process that includes enterprise development and non-farm employment; and capacity development in terms of strengthening innovation process, building linkages between farmers and other agencies, and institutional development to support the bargaining position of farmers. Mwemezi (2000) conducted a field study using personal interviews and structured questionnaires on influence of organizational culture on job satisfaction of agricultural extension staff in Dodoma Region. Data were analyzed by SPSS and content analysis techniques. It was found that the management support and reward system were the major organizational cultural characteristics that contribute to job dissatisfaction. The agricultural extension staff were dissatisfied due to low salary, no promotion, job security, government policies and practices, opportunity for growth and poor working conditions. It was concluded that there was a need for: training to improve their skills; extension policy to ensure fair promotion on the basis of performance expectation and regular evaluation of extension service delivery. The research gaps under this area include: economic and social impact assessment of extension interventions.

Development and application of information technology (IT) tools

Kaliba *et al.* (1998) conducted a study on the adoption of maize production technologies in Central Tanzania which formed part of a larger study to evaluate the impact of maize research and extension throughout Tanzania over the past 20 years. Using a structured questionnaire, interviewed researchers, extension officers

and farmers in June–November 1995. Survey data were grouped by agroecological zone: the lowlands, intermediate zone, and highlands. A two-stage least squares procedure was used to analyse factors affecting farmers' allocation of land to improved maize varieties and use of inorganic fertilizer across zones. Germplasm characteristics, production potential of the area, and extension were the most important factors affecting the amount of land allocated to improved maize and use of inorganic fertilizer. Later maturity in a variety increased the probability that a farmer would plant improved maize by about 22%. Extension increased the probability of allocating land to improved maize by about 14% and increased the probability of using fertilizer by 115%. Several issues require closer attention from research, extension, and policy makers. Research and extension efforts need to be linked and strengthened to increase the flow of information to farmers. In developing improved maize varieties, researchers must consider yield as well as other important traits: drought resistance/tolerance, resistance to storage pests, shelling quality, and taste. For this to occur, farmers must participate in the research process. The formal credit system needs to be altered to address the credit problems faced by small-scale farmers. A more efficient marketing system for inputs and outputs would benefit farmers by providing higher maize prices and reducing fertilizer costs. Such a system would require supporting policies from the government. Studies of the economics of seed and fertilizer use should be undertaken, especially now that input and output markets have been liberalized.

In addition, Ryoba (1996) conducted field research using personal interviews, structured questionnaires, employed SPSS and content analysis technique to assess the use of indigenous soil and water management technologies in semi-arid areas in Mwanza District, Tanzania, and found that smallholder farmers were aware of the detrimental effects of soil erosion and loss of water as well as indigenous soil conservation and water harvesting technologies, however, the majority of the farmers were not taking measures to control soil erosion and conserve moisture. It was therefore concluded that the

use of soil water management technologies was low. The research gaps under this area include: original extension approaches to be developed within specific extension context; role of extension and innovation in spurring value chain development; use of ICT (particularly smart phones) by farmers and advisory service personnel to optimize efficiency in extension system; and extension in the era of climate change; linking extension messages with local indigenous knowledge; and impact of ICT use in extension services on agricultural productivity.

Monitoring, evaluation and impact assessment

Researchers must have frequent feedback about what is and is not working in terms of farmers. Rural household members and extension agents can not only provide confirmation but after the best source of ideas on how to adopt a technology to local conditions. Mwasyeté's (2012) study used a structured questionnaire to collect primary data from 270 randomly selected respondents consisting of 180 FFS participating and 90 non-FFS participating farmers, focus group discussions and key informant interview on (FFS) and rural livelihoods in Mbinga and Mbeya Rural Districts, Tanzania. Data were analyzed using statistical package for social sciences (SPSS) computer program. The results revealed that there is a statistically significant difference in productivity between Farmer Field Schools (FFS) participating and non-participating farmers. It was therefore concluded that FFS approach is effective and should be used as an extension approach in Tanzania. The research gaps under this area include: the actors and institutional context in which the generation, diffusion and use of new knowledge takes place; extension systems models used in Tanzania and how do they affect agricultural productivity; and extension systems models appropriate in Tanzanian situation.

Impact assessment and institutional linkages

In order to enable the effective processes of technology generation and access to technology, smallholders are required to seek diverse sources of information, evaluate what they receive, and as users of technologies this demand greater knowledge about their ecosystem. Establishing

systematic linkages between research, extension and rural households is an effective means of generating technologies appropriate for these conditions. Linkages involving rural households to set the research agenda helps ensure that new technologies are not only technology viable but indeed address priority problems perceived by the rural households who are the ultimate users of technology solutions. Kulindwa's (2008) study on linking small farmers to market through evaluation of agricultural marketing system development program in Arumeru District, Tanzania, also used personal interviews and structured questionnaires to collect data which were analyzed by means of SPSS and content analysis techniques. The study found that the distance to the market and the age of the head of household were negatively and significantly associated with the probability of smallholder farmers participating to the market, and the size of the farm cultivated, road condition and household size were positively related to household participation to the market. It was thus concluded that the education obtained by farmers from extension officers significantly influenced the probability of household participation to the market. The research gaps under this area include: institutional arrangement for agricultural extension; formulation of national extension policy in order to ensure political and financial commitment; and operational linkages between extension and research and other key relevant institutions.

Pluralism

Pluralistic extension system includes potential provision of extension services from the public sector, the private non-profit sector and the private for-profit sector. The key issue of creating a pluralistic service is a need to find an appropriate 'mix' of public and private funding and delivery mechanisms for extension, which will achieve differing agricultural goals and serve diverse target populations. A mature extension system is characterized by a pluralistic system of extension funders and service providers. However, the public sector must continue to be a major player, both in funding and coordinating operations. Extension policies and strategies need to define effective

division of labor between public extension and other providers, and identify overall objectives for public sector involvement in extension. There was no any micro-study available for review under this area. However, the following research topics need to be addressed: challenges and opportunities of private sector participation as providers of extension services; separation between extension financing and extension service delivery functions; effectiveness of public and private extension service providers including farmers' associations, community organizations, and NGOs; and the role of Government in co-ordination among extension service providers, control of quality of extension services, capacity-enhancement of non-public extension service providers, and impact.

Location and purpose-specific original extension methodologies

New approaches such as Farmer Field Schools (FFS) and the Agricultural Knowledge and Information System (AKIS) have been developed. Direct farm level links are stressed between researchers and farmers. More recently, the notion of extension as part of a wider system has emerged. For example, Suleiman *et al.* (2006) noted that the 'innovation systems framework' offer more inclusive ways of thinking about the actors and the institutional context in which the generation, diffusion and use of new knowledge takes place. The system of actors and process not only includes research and extension, but also technology users, private companies, NGOs and supportive structures such as markets and credit. There was no any micro-study available for review under this area. However, the following research topics need to be addressed: linking stakeholders in the AKIS or AIS for results driven processes; examining the innovations systems approach to extension; and methodologies for training extension staff and farmers; and the impact of farmer to farmer extension approaches on agricultural productivity; and extension methodologies used by extension system to communicate with farmers.

Broader technical mandate of extension in line with global development

A broader conceptualization of agricultural extension (either to embrace the agricultural innovation system concept and/or to link it with other sectors, such as: health, formal education, micro-credit, etc.) need to be given more emphasis. Currently in most developing countries research and extension is top down, scientists decide research priorities rather than farmers. Scientists' have limited exposure to field realities, involvement of extension and farmers is passive, and the feedback system is weak. This affects development of appropriate technology. Technology recommendations are general, effectively ignoring the multiple farming situations available within a district and even within a farm. There was no any micro-study available for review under this area. However, the following research topics need to be addressed: broadening the technical mandate of extension to aim at broader development of rural human resources.

The reviewed micro-studies conducted in Tanzania revealed that even with one-time cross-sectional studies, with some care it is possible to collect data in such a way that comparisons are possible across study sites and through time. To keep open this possibility, however, it is important to exercise considerable forethought in the design of the surveys. If concepts are defined in similar ways and data are recorded in comparable fashion, the data from disparate micro-studies can be combined for various types of meta-analysis. This can be particularly useful for analyzing the "big issues" that cannot be addressed within a single micro-study. For example, no single micro-study can effectively address the impact of government policies or institutions on technology adoption. But a coordinated set of comparable studies might yield information of this kind. If the studies are not designed to be compatible, however, no amount of ex post analysis will be able to get at the larger questions.

Leading International Academic Articles on Agricultural Extension

Agalamu (2000) noted that based on a study of seven countries – Indonesia, Japan, Republic of Korea (South Korea), Mexico, Nigeria, Tanzania

and Thailand – forms of research–extension linkage were identified. The institutional arrangements governing agricultural research–extension linkages in each country, the procedures through which farmers' problems are identified and research themes decided, and the administrative levels at which linkages operate. Agalamu observes how the procedures for linking research systems and extension services are managed and highlights the key weaknesses of each linkage type, and concludes that policy changes, institutional reorganization, and the strengthening of institutions are required to enhance agricultural research–extension linkages in developing countries.

van Mele (2007) noted that international agricultural research increasingly has to justify its relevance in reducing rural poverty in a sustainable way. Uptake and impacts have become more important than outputs (technologies and methodologies). With societal accountability on the rise, research centers are forced to reposition themselves in the innovation system. Although various Consultative Group on International Agricultural Research (CGIAR) centers contributed to the development of new organizational models in research and extension, multiple challenges and opportunities to reach the rural poor remain unaddressed. van Mele (2007) further observed that when the focus is on how the way of doing things (practices) change over time, we tend to talk about the 'innovation process'. When the focus is on the way people relate to each other (in terms of knowledge, power, function), we tend to talk about the 'innovation system' or the 'innovation network'. Some use the terms as synonyms, but others consider them very different. By referring to innovation systems there tends to be more attention to the character of the relations and functions between the different actors or institutions that are the 'components' making up the system. By referring to innovation networks it is often more important to consider 'who are the actors' and 'who links to whom'.

According to Spielman and Birner (2008), the concept of agricultural innovation systems evolved as a result of the perceived narrowness

of scope of the concept of Agricultural Knowledge and Information Systems (AKIS). AKIS was generally viewed as a set of relationships between and among agricultural research, extension and training (Rivera *et al.*, 2005). The concept of an agricultural innovation system (AIS) encompasses the three main actors in AKIS plus policy makers, organizations in the value chain (including the private sector processors and distributors), linkages to other scientific sectors, as well as consumers. An extension system that fits within AIS would be designed quite differently, with specific attention paid to its ability to engage with a broader set of actors (Anderson, 1994).

World Bank (2007) observed that African agricultural development depends on well-trained farmers and well-trained personnel who staff the institutions that support agriculture. In particular, World Bank (2007) argues for the political will to invest in this area, better integration of agricultural education institutions into the broader agricultural innovation system, and a rebalancing of the enrollment profiles to increase the number of students pursuing more highly technical training at diploma, bachelor and master levels. On training of future agricultural extension staff, Maguire (2011) argues that curriculum needs to be revised and modernized to focus on the new priorities within agricultural extension. Maguire points out that many formal agricultural education programs are focused on preparing graduates destined for government service at a time when governments are cutting back on their extension workforce. In order to accomplish these curricular improvements new public private partnerships are needed, both for financial support but also to insure that the curriculum is relevant to today's needs. Acker and Gasperini (2009) emphasize that education in all its forms has the potential to empower people, by increasing their self-confidence, their capacity to improve their livelihoods and their participation in wider processes of social and economic change. Acker and Gasperini further note that different dimensions of education and training for rural people have proven useful in developing peoples' capacity to enhance food security.

According to Zhou (2008), in recent years, many countries have realized the need to revive agricultural extension services to promote pro-poor growth, reach poor marginalized smallholder farmers and address new challenges on sustainability, environmental degradation and climate change. Zhou further notes that new approaches to extension emphasize three elements: strategies to develop Agricultural Innovation Systems; pluralism of service providers; and extension services should be demand-driven. Swanson and Rajalahti (2010) agree, arguing that empowerment of farmer groups with a strong voice in the extension agenda is vital to a healthy extension system. Advancing agricultural innovation building institutionally sustainable innovation systems, which can be gauged by growing interrelations between the participants in the innovation system, an intensive communication between all stakeholders and a strong 'social embedding'. Zhou suggests the need for a pluralistic extension system, which includes potential provision of extension services from the public sector, the private non-profit sector and the private for-profit sector. The key issue of creating a pluralistic service is a need to find an appropriate 'mix' of public and private funding and delivery mechanisms for extension, which will achieve differing agricultural goals and serve diverse target populations (Mdemu, 2000).

Swanson and Rajalahti (2010) provide information on how to transform and strengthen pluralistic agricultural extension and advisory systems in moving toward the broader goal of increasing farm income and improving rural livelihoods. The focus is primarily on the technical knowledge, management skills, and information services that small-scale farm households will need to improve their livelihoods in the rapidly changing global economy. In addition, there is a need for information on how extension should help all types of farmers in dealing with escalating natural resource problems, including climate change; and comparative analysis of different extension strategies, organizational models, institutional innovations, and resource constraints and how an extension system might

be transformed and strengthened through specific policy and organizational changes as well as needed investments.

Major reform trends around the world include decentralization, contracting, cost-recovery, privatization and the involvement of NGOs and farmer-based organizations. Emphasis is also placed on making extension services demand-driven. The concept of demand-driven extension emphasizes the need to provide services that meet needs and priorities of farmers in the context of changing domestic and international environments for agriculture (Ashby and Sperling 1995). It is linked to a paradigm shift in public sector reform towards responsive governance. However, it remains a major challenge to identify the options for extension reform that are likely to make extension more demand driven, especially given the situation that market failures in agricultural services are widespread (Zhou, 2008).

Labarthea and Moumounib (2008) highlighted the consequences of the privatization of extension services on the collective procedures for the accumulation of technical knowledge in the agricultural sector and concluded that it is important to take the social context specific to each country into consideration. Chapman and Tripp (2003) observed that the private extension delivery is subject to a range of interpretations. A number of experiences in both industrialized and developing countries provide opportunities for examining the advantages and limitations of a privatization strategy for extension. Examples include instances of purely market based extension service, extension service linked to private provision of inputs or purchase of outputs, cost recovery public programs that provide a partial subsidy for private extension providers. No single model is adequate to describe private extension, and range of experience regarding the adequacy of private providers, the privatized system and the capacity of governments to manage the transition.

van den Ban (2000) provides alternative means of financing agricultural extension and the ways in which different financial mechanisms

may influence the type of extension support offered to farmers. van den Ban notes the motives of different organizations for investing in agricultural extension and analyzes the implications of alternative funding mechanisms and offers some hypotheses regarding alternative funding mechanisms in relation to the flow of knowledge to, in and from extension organizations; the management of these knowledge flows; the goals of the extension organization; the choice of extension messages; extension methods and approaches; the target groups; and the management of the extension organization. In addition, van den Ban states that in many countries a pluriform extension system is developing in which different organizations are financed in different ways. Whether or not the privatization of extension is desirable depends on factors such as labor productivity, the extent to which there are surpluses or shortages in the production of food, and the impact of extension on consumer food prices.

Emerging technologies are starting to show potential. Martin and Abbott (2010), for example, examined the diffusion and perceived impact of agricultural-based mobile phone use among small- to medium-size limited-resource farm holders in Uganda. They found that 42% of farm households owned and used mobile phones. More than half of the farmers used their phone for arranging inputs, obtaining market information, and monitoring financial transactions. Nearly 50% were using their phones to consult with experts on production issues. They concluded that diffusion of mobile phones is now in a take-off stage and the technology provides one means of reaching farmers with needed agricultural and market information.

Proposal of a research agenda on extension systems for iAGRI

The above Tanzania and international literature have indicated the importance of research on extension systems in contributing to the objectives of Feed the Future, and especially iAGRI. Knowledge gaps in research were generally identified from Tanzania and global literature on agricultural extension. The research

agenda was organized in the form of five major themes and 32 research sub-topics/research questions that would serve as a useful guide to researchers writing grant proposals for iAGRI and to students and advisors planning Masters thesis and PhD dissertation research (Table 1).

Table1: Research agenda

Major Research Theme	Research Sub-Topics / Questions
1. Farmer-led: empowerment of farmer groups to share control the extension agenda and to provide input on the evaluation of extension staff effectiveness	1.1 How could farmers be organized for empowerment and group extension approach?
	1.2 How could grassroots extension program planning, monitoring and evaluation of extension activities be improved?
	1.3 What types of farmers whose extension needs are to be addressed with tailor-made extension strategies, methodologies and materials?
	1.4 What methodologies should be used by extension system to communicate with farmers?
	1.5 What methodologies should be used for training extension staff and farmers?
	1.6 What is the impact of farmer to farmer extension approaches on agricultural productivity
	1.7 How should economic and social impact assessment of extension interventions be conducted?
	1.8 How should women participate in value chain development, savings, micro-credit and wealth management?
	1.9 Linking gender and extension services: How do cultural barriers affect access to extension services?
2. Pluralistic: models of pluralistic extension (promotion of pluralism in extension by involving public, private and civil society institutions)	2.1 What are the challenges and opportunities of private sector participation as providers of extension services?
	2.2 How could separation between extension financing and extension service delivery functions be done?
	2.3 How could effectiveness of public and private extension service providers including farmers' associations, community organizations, and NGOs be identified?
	2.4 What is the role of government in co-ordination among extension service providers, control of quality of extension services, capacity-enhancement of non-public extension service providers, and impact assessment of services provided?
3. Market Driven: the role of extension in value chain development and market access	3.1 What is the extent to which extension services are adopting the value-chain approach and market oriented?
	3.2 How could farm-to-market chain links be established?
	3.3 What are the effects of globalization and market liberalization on farmers?
	3.4 How do private traders, processors and retailers contracted extension services ensure a reliable and timely supply of quality agricultural products?

Major Research Theme	Research Sub-Topics / Questions	Major Research Theme	Research Sub-Topics / Questions
4. Innovation Driven: effective models for linking all stakeholders in the AKIS or AIS for results driven processes	4.1 How could stakeholders in the AKIS or AIS be linked for results driven processes? 4.2 How is the innovations systems approach to extension? 4.3 How could extension messages be linked with local indigenous knowledge. 4.4 What is the extent of farmers utilization of different extension messages? 4.5 What is the role of extension and innovation in spurring value chain development? 4.6 How are the actors and institutional context in which the generation, diffusion and use of new knowledge takes place? 4.7 How could ICT (particularly smart phones) be used by farmers and advisory service personnel to optimize efficiency in extension system? 4.8 What is the impact of ICT use in extension services on agricultural productivity? 4.9 What is the role of extension in an era of climate change?		5.5 What extension systems models are used in Tanzania and how do they affect agricultural productivity? 5.6 Which extension systems models are appropriate in Tanzanian situation?
5. Policy Environment: The communication link between farmers (and front-line extension staff) and policy makers are vital if farmer friendly policies and budgeting are to take place.	5.1 How is the institutional arrangement for agricultural extension? 5.2 How could national extension policy be formulated in order to ensure political and financial commitment? 5.3 What are the operational linkages between extension and research and other key relevant institutions? 5.4 How could the technical mandate of extension be broadened to aim at broader development of rural human resources?		

Conclusion

The environment of agricultural extension system research has been changing in Tanzania with more focus on food and nutrition security, poverty alleviation, entry of new actors such as the private sector and NGOs in the delivery of extension services, changed extension systems research paradigms and bottom-up approaches for end user involvement in decision-making. However, while the public spending on extension has been shrinking, the role of government in extension services delivery is also being examined, sometimes separating the financing of extension programs from the delivery of extension services. Alongside a new approach has been emerging: considering extension as facilitation and producers (farmers) as clients, sponsors and stakeholders rather than beneficiaries. The identified knowledge gaps in research on extension system need to be addressed, in order to contribute to objectives of Feed the Future, and especially iAGRI in Tanzania.

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