Promotion of Agricultural Innovation Systems Approach: Policy Implications for Maize Extension and Advisory Services in Tanzania

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Abstract

This paper is based on a study (Wambura et al., 2016) which assessed extension and advisory service delivery for maize production in Morogoro and Dodoma Regions of Tanzania using Agricultural Innovation Systems (AIS) Approach. Maize productivity in Tanzania is low in spite of its importance to the country's food security and economic well-being of farmers. New approaches to extension and advisory service delivery are needed that stimulate increased agricultural production and foster the emergency of agricultural innovation systems. The purpose of this paper is therefore to assess the state of maize innovation system in Tanzania and provide policy implications for the future extension and advisory services (EAS). The study used a mixed method research design to collect data using structured questionnaires, one-on-one interviews with key informants, focus group discussions (FGDs) and stakeholders' workshops. Content analyses of cases provided a context to understand policy implications for maize extension and advisory services in the study areas. It was found that the key aspects contributing to low maize productivity included weak institutional structures, often with little or no contact between other stakeholders. In most cases, lack of farmer organizations hampered farmers taking the initiative. Such problems were compounded by poorly developed markets, poor infrastructure and a lack of knowledge (especially of the maize production value chain), or by inadequate extension services often associated with inappropriate research. Consequently, use of unsuitable varieties and poor management practices with limited access to inputs or output markets resulted in low, often declining yields and low incomes for farmers. The paper concludes that policy makers should identify weak or missing components and linkages within the agricultural innovation systems and take measures accordingly to promote maize innovations; while extension and advisory services should be capacitated to address these gaps and develop technology packages to be disseminated to the farmers.

Keywords: Agricultural innovation system (AIS), Maize value chain actors, Extension and advisory services (AES), Tanzania.

Introduction

A number of different frameworks have been promoted, as the basis for investments in agriculture technology development worldwide (Wambura *et al.,* 2012; Swanson and Rajalahti, 2010; Birner *et al.,* 2009). In the 1950s and 1960s, the focus was on building public sector research departments and institutes and extension services. In the 1980s, the linear model was used to argue for the need to strengthen national agricultural research systems (NARS) and investments focused on strengthening research supply by providing infrastructure, capacity, management, and policy support at the national level. Since the 1990s, the agricultural knowledge and information system (AKIS) concept brought more attention to demand-side factors (Qamar, 2005; Rivera *et al.,* 2005; Agwu

et al., 2008).In recent years, many countries have reviewed their agricultural knowledge systems and moved away from supply-driven innovation towards a more interactive, demand-driven Agricultural Innovation Systems (AIS) approach, in response to concerns about: lack of adoption of innovation by farmers; the ability of AIS to meet emerging and pressing challenges; budget pressures; and issues related to the acceptance of innovation by consumer and civil society (Spielman and Birner, 2008; Christapolos, 2008).

According to Spielman and Birner (2008), Figure 1 provides a conceptual framework for a National Agricultural Innovation System that takes into account the innovation systems approach of AIS. It captures the essential elements of an innovation system, the linkages between its components, and the institutions and policies that constitute the enabling environment for innovation. Within this AIS framework, agricultural producers are understood as crucial actors in the value chain that are not just assisted

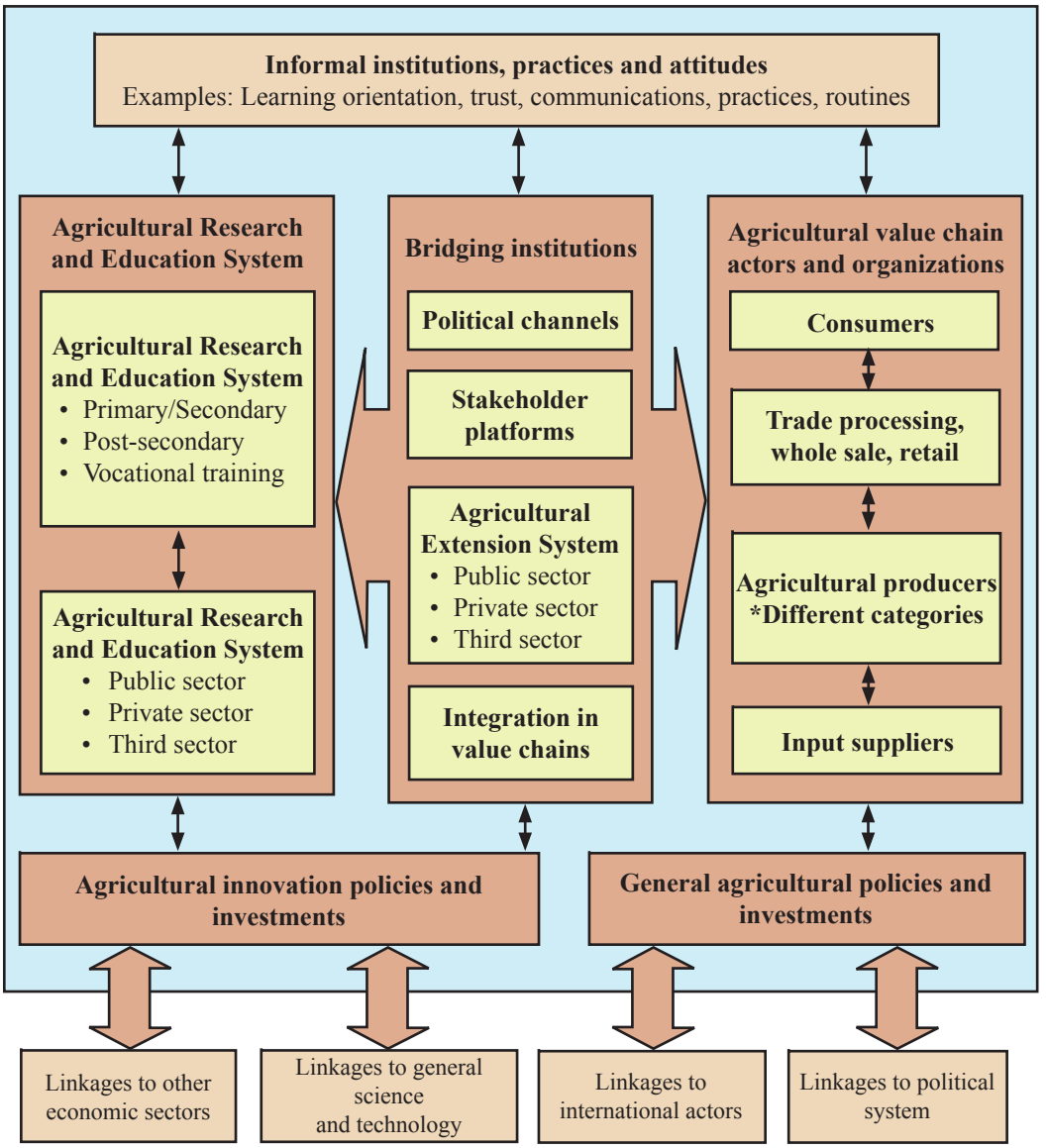

Figure 1: Agricultural Innovation Systems
Source: Spielman and Birner (2008)

by agricultural research and education systems via bridging institutions that build capacities for agricultural innovation. But also by other actors in the value chains such as the input suppliers and seed producers in agribusiness that provide valuable technical assistance, as well as retailers and their demands in order to comply with the standards of good agricultural practices. Consequently, innovation is not a one way street from research to users but can actually also be created by the users themselves. In fact, innovation primarily takes place within value chains and should subsequently be integrated into a responsive and demand-oriented agricultural education and research system (TAP, 2010).

Tanzania is home to 45 million people, whose economy depends heavily on agriculture, which accounts for more than one-quarter of GDP, provides 85% of exports, and employs about 80% of the workforce (URT, 2012). The country's economy is therefore dependent on rural based small-scale agriculture whose productivity is not increasing (in some cases, even declining) contributing towards household food insecurity, malnutrition and poverty. Maize ranks first among the major cereal grains grown in Tanzania and the main staple food for the entire population (URT, 2010). The crop is mainly grown by smallholder farmers on 1-3ha holdings accounting for about 85% of the total crop production (URT, 2012). Nearly two-thirds of Tanzanian farmers are engaged in maize production, so broad pro-poor growth can be achieved by targeting maize productivity. Although maize is the main staple crop, yield levels are still low (URT, 2007). According to Mwanga (2010) the national maize yield growth rate is 2.4% per annum that is 0.3% less than population growth rate. The average national production is approximately 1.25 ton/ha instead of 4.5 ton/ha expected under good management practices (FAOSTAT, 2014).

In spite of its great potential to produce a surplus, Tanzania has remained a net importer of maize over the last five decades. Several factors account for low yield in maize including: lack of appropriate technology or access to technology, inputs and credit. In addition, farmers' information and skills gap constraints the adoption of available technologies and management practices or reduces their technical efficiency when adopted (van Mele, 2007; Zhou, 2008). To address these weaknesses, this study assessed extension service delivery for maize production in Morogoro and Dodoma Regions of Tanzania using Agricultural Innovation Systems (AIS) Approach in order to guide the design and implementation of an effective extension service delivery. The specific project objectives were to: (i) identify maize value chain actors and institutional context, in which generation, diffusion, use and sustainability of maize innovations takes place; (ii) examine roles of the identified actors in maize production process and how these roles influence the effective delivery of extension services; (iii) determine the perceptions of key actors regarding performance of extension service delivery for maize production; and (iv) determine factors influencing the performance of extension service delivery for maize production. This paper is based on specific objective (i) above and its purpose is to assess the state of maize innovation system in the study areas and provide policy implications for the future extension and advisory services (EAS) in Tanzania.

Methodology

The study was carried out in Morogoro and Dodoma Regions because they are part of the target area of Global Hunger and Food Security Initiative (GHFSI) which was being implemented in Tanzania. These areas have high agricultural potential and serve as gateways to chronically food-insecure districts. However, both Morogoro and Dodoma regions face chronic food shortages despite greater potential for agricultural development (URT, 2012). The study involved 16 wards from 4 selected Districts (4 from each district) from the 2 study regions, namely: Mvomero and Kilosa Districts from Morogoro Region; and Kondoa and Kongwa Districts from Dodoma Region.

The study used a mixed method research design (Terrell, 2012) to collect data using structured questionnaires, one-on-one interviews with

key informants, focus group discussions (FGDs) and stakeholders' workshop. A total of 346 respondents were randomly selected and interviewed using a structured questionnaire. The participants were drawn from a population of various actors involved in the maize value chain including input suppliers, farmers, traders, processors, market intermediary, domestic wholesalers, government officials, technical specialists, financial institutions, farmer's organizations and transporters in the study area. Supplementary data were collected through FGDs organized in each of the four study districts, which involved a SWOT/L analysis of maize productivity and extension service delivery. In addition, 60 key informants were selected and interviewed using snowball sampling technique. Content analyses of cases provided a context to understand policy implications for maize extension and advisory services in the study areas.

Results and Discussion

Eleven maize value chain actors were identified as follows: input suppliers, farmers, buyers, processors, traders (for exports), domestic wholesalers and retailers, government officials, technical specialists, financial institutions, farming organizations and transporters (Table 1). This indicates that the system of actors and process not only include research and extension, but also technology users, private companies, NGOs and supportive structures such as markets and credit. It was found that maize innovation in the study areas was mainly based on conventional agricultural extension which has been considered as a 'linear model' of innovation, where agricultural innovations are developed by research centers which are assumed to be transferred to farmers by the public agricultural extension services. However, some elements of an agricultural innovation system perspective had been adopted, although usually implicitly. For example, the country provides a perspective on the modernization of agriculture that is substantially broader than the introduction of new technology only (URT, 2013).

Key aspects of maize innovation systems included weak institutional structures, often with little or no contact between stakeholders. In most cases a lack of farmer organizations hampered farmers to take the initiatives. Such problems were compounded by poorly developed markets, poor infrastructure and a lack of knowledge (especially of the maize production value chain), or by inadequate extension often associated with inappropriate research. Consequently, use of unsuitable varieties and poor management practices with limited access to input or output markets

Table 1: Distribution of all respondents involved in the study

Maize Value Chain Respondents	Male		Female	
	f	%	*f*	%
Input providers (n=20)	14	70	6	30
Farmers (n=135)	96	71	39	29
Market intermediary (n=17)	17	100	0	0.00
Processors (n=24)	20	83	4	17
Traders (for exports) (n=25)	20	80	5	20
Domestic Wholesalers & Retailers (n=11)	7	64	4	36
Government Officials (n=24)	21	87	3	13
Technical Specialists (n=36)	25	69	11	31
Financial Institutions (n=16)	9	56	7	44
Farmers organizations (n=7)	6	86	1	14
Transporters (n=31)	26	88	5	16
Total (n=346)	**261**	**76**	**85**	**24**

Table 2: Situational Analysis of Maize Innovation Systems in Tanzania

Situation	Excellent	Very Good	Good	Average	Poor
Institutional structures*				√	
Contact between stakeholders					√
Farmer organizations					√
Access to markets				√	
Infrastructure				√	
Level of knowledge				√	
Crop varieties				√	
Management practices					√
Access to inputs					√
Crop yields					√
Farmers incomes					√

**Issues discussed with and rated by key informants*

Table 3: The SWOT analysis for Tanzania's maize value chain

Strengths	***Weaknesses***
• A widespread and well-known crop • Well established national demand • Many different organizations already working on maize and supporting maize farmers' development • A vast amount of appropriate technology already available that could be applied in Tanzania • Significant interest and support from the international community and private sector in involvement in improved maize value chains	• Disorganized value chain with weak links • No agreed National Maize Development Strategy • Perceived as politically important crop for food security • Local millers inefficient, unregistered and unlicensed • Farmers' need to sellmaize immediately after harvest to meet cash needs • Limited use of market information • Too many inefficient and costly steps between producer and consumer in commercial market • Most maize farmers operating at subsistence rather than commercial level • Inadequate rural infrastructure, especially access roads and electricity
Opportunities	***Threats***
• Technology available to increase production • Huge potential for export • Some large-scale processors showing interest in reaching out to producers to improve linkages • New varieties to be introduced to be more productive and better adapted to conditions • Improved use of WRS, better local storage and market information systems • Increased use of simple on-farm water harvesting techniques	• The inability of the Government to implement changes to policies and regulations • The uncontrolled supply of counterfeit seeds and chemicals • Private sector decides to invest in other countries, not Tanzania • Unexpected impact of climate change • Negative environmental impact of increased maize production

resulted in low, often declining, yields and low incomes for farmers. Results summarized in Table 2 show that based on key informants and focus group discussions all aspects of the current situation examined ranged from average to poor. That is: institutional structures, access to markets, infrastructure, level of knowledge and crop varieties were considered to be on average category. Those considered under poor category included contact between stakeholders, farmer organizations, management practices, access to inputs, crop yields and farmers' incomes.

Considering that the study areas have huge comparative advantages in maize production because of their natural resource endowment, SWOT analysis was also conducted as indicated in Table 3. The table shows that there is less of an advantage in terms of current policies, the use of technology and the structure of maize markets. But these are areas where improvement is possible.

Conclusions

These findings imply that the idea of linear 'transfer of technology' has to give way to a dynamic understanding of the maize innovation system, in which new ideas and practices are again (and again) experimented on and adapted by farmers, researchers, (private and public) extensionists, input suppliers, traders and other actors in the system. Innovation system approach offers a more inclusive and holistic approach, emphasizing wider stakeholder participation, institutional context, and diverse knowledge source and linkage, and comparatively incorporates the mandates of reforms and new trends for maize development. Policy makers should therefore identify weak or missing components and linkages within the maize innovation systems and to take measures accordingly of innovations being promoted; while extension should built in such policy information into technology. In addition, the Government should encourage and promote farmers' and private sector innovation by enacting favorable policies (patenting, reward system), while extension administrators should build capabilities to facilitate, analyze and promote farmer innovations.

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