Research, Education, and Extension Linkages: An Analysis of Institutions in Developing Countries

Hassan Sadighi, Ph. D.

sadigh_h@modares.ac.ir
Assistant Professor and Head,
Agricultural Extension and Education,
Tarbiat Modarres University,
P.O. Box 14115-336, Tehran, Iran.
Tel. (+9821)4194911
Fax: (+9821)4196524

Abstract

A variety of theoretical models have been developed to show the interface between agricultural research and extension. The linkage between the parts of technology generation and technology transfer in a national agricultural system often involves more than two partners. It is desirable that these institutions would have a network of local influence through establishing research and extension stations and sub-stations, and defining the specific functions of research and extension to be conducted by these institutions. Farming systems research and extension and on-farm trials are considered the important techniques to link research and extension in these institutions. Partnerships, built on mutual trust and respect, are a key component in the development and delivery of successful research, education and extension programs. The linking of research, education and extension, along with input from producers, results in more relevant programs and more efficient utilization of resources. Research, education and extension agencies recognize that by working together their efforts result in win-win situations rather than win-lose situations. The purpose of the study was to examine the linkages between research and extension in agricultural higher education institutions in developing countries. Selected countries were chosen for the linkage analysis. An in-depth content analysis conducted on secondary data obtained from the selected countries. Qualitative method was used to make judgment and characterization on efficiencies and effectiveness of the institutional linkages. This paper has presented evidence from seven countries of the diversity of agricultural research–extension linkage systems prevalent around the world. This diversity is the result of contrasting sociocultural situations and the different development models adopted by different countries.
Introduction

Agricultural extension is widely regarded as playing an important role in improving agricultural systems worldwide and its provision has been seen for many years as a principle responsibility of the state. Large public administrations, hierarchically structured and staffed with permanent employees fulfilling various roles and functions were thought to maintain a broad impact and equity in treatment of clients, while also providing a firm regulatory system. However, the general feeling in developing countries now, is that they are inadequately addressing farmers’ needs, and these administrations are too inflexible, inefficient, and unresponsive to situation specifics (Cary, 1993; Beynon, 1996). Many of these problems arise from lack of organizational and operational cooperations; and linkage between research, extension, and educational institutions.

The concept of linkage implies the communication and working relationship established between two or more organizations pursuing commonly shared objectives in order to have regular contact and improved productivity. Havelock (1986) contends that linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. He argues that if the barriers between two systems are permeable enough for messages and responses to flow out of each to the other, then a link has been created between the two. From this viewpoint, agricultural research and extension services are two systems which are linked by information flow and feedback. For agro technologies to be relevant to local needs, researchers, extension workers and farmers must play important roles in identifying research problems, adapting the recommendations to local conditions and providing feedback to researchers about the innovations that have been developed.

Depending on the country, linkage activities are usually managed at varying administrative levels national, regional, state and local levels. The agricultural research and extension system identifies farm families as their target and the hub around which researchers and extensionists focus their actions. The constraints which hinder research–extension linkage potentially affect the agricultural output of farmers, whereas effective links will allow farmers to enhance their output through the availability of farming innovations.

A variety of mechanisms has been developed to link research and extension in the planning and implementation of various tasks in developing nations. Maintaining effective and sustainable links across institutional barriers, however, has proven to be a major challenge (Ewell, 1989). Thus, many countries in the developing world adopted the integrated system of teaching, research and extension in their agricultural higher education programs as a development strategy to combat these barriers. The United States Agency for International Development (USAID), reflecting the successful roles played by the Land-Grant Universities in the United States, supported the establishment of agricultural universities on the same model in many countries in Africa, Asia, and Latin America. Such agricultural universities were established in Ethiopia, Malawi, Morocco, and Nigeria, India, Indonesia, Thailand, Brazil, and Dominican Republic, Mexico (Wilson, 1993). This integrated system of teaching, research and extension has been successful particularly in the United States, however, many observers believe that it did not bring the required socio-economic changes in the rural communities of developing countries that adopted the system. The major constraints of the university research and extension system in
these countries include lack of sufficiently coherent research policies, inadequate research budget, and excessive turnover of academic staff (FAO, 1991).

A variety of theoretical models has been developed to show the interface between agricultural research and extension. Among the widely known models in the literature are those developed by Ruttan (1978) who identifies eight functions (elements) in the technology development and transfer process in consecutive stages of a simple linear model. These are: the world stock of knowledge, science, technology generation, testing, adaptation, integration, dissemination, and adoption/diffusion. Research organizations need to start with the world stock of knowledge and continue until the technology is fully integrated within a social system. Extension on the other hand, should start from the stage of technology testing and continue until the innovation has been adopted by the farmers. The common elements between research and extension organization are then, technology testing, adaptation, and integration which make up the interface between the two systems. A major problem, however, in the developing world are those where researchers and technology transfer workers are ignorant of each others’ activities. Also, in practice, research stops too early and extension starts too late in what should be a continuous process (Ewell, 1989).

Theoretical models in agriculture that support the process of technology generation and transfer include “the farmer-back-to-farmer model” developed by Rhoades, et al. (1985). This model assumes that research should start and end with the farmer. It involves such major activities as: diagnosis to define problems as perceived by farmers, extensionists and researchers; interdisciplinary team research; on-farm and experiment station testing; and farmer evaluation/adaptation of the technology. Farming systems research, and especially on-farm research can be promoted to develop appropriate technologies to help farmers in developing countries under the above circumstances.

The linkage between the parts of technology generation and technology transfer in a national agricultural system often involves more than the two partners. The model in Fig. 1 has been developed to identify and explain the factors involved in institutional research and extension activities, and to demonstrate the relationships between these factors. The model expresses two major categories of external and internal linkage factors.

The external linkage factors represent forces outside of the institutional environment. These include policy environment, technical assistance, public organizations, and the private sector/farmers. The internal linkage factors on the other hand explain conditions that can be manipulated by the institutions. These conditions are institutional factors and operational linkage strategies. Most of the factors are linked among each other through a shared interest in national technology generation and transfer programs.

Operational linkage strategies (as shown in Fig. 2) are of two categories. These are organizational and functional linkage strategies. Organizational linkage mechanisms explain the networking and functions of research extension in agricultural higher education institutions. The increasing orientation of agricultural research and extension efforts towards small farmers makes these activities focus more on regional problems at a grass-roots level. The location specific nature of research and extension activities makes the decentralization effort and thus, the networking of these activities more essential. Functional linkage strategies include technical linkage factors and the system of priority setting in research and extension. Technical linkage
factors that could possibly be included under this category are: on-farm research and extension techniques; and farming systems research and extension approaches. These techniques are neither mutually exclusive nor should they necessarily be adopted simultaneously. They should be utilized as conditions and situations allow. The on-farm research and extension technique is an important linkage strategy to promote applied or adaptive research. It allows direct contact between the researchers, and the farmers. It also permits the participation of extension staff in field level research through implementing research surveys, conducting trials and integrating extension programs with on-farm research.

Fig. 1-Linkage Model

Research and Extension Linkage Model for Institutions In Developing Countries

Purpose and Methodology of the Study

This study surveyed qualitative and quantitative studies to formulate a theoretical framework of agricultural research–extension linkages from a global perspective and identified the positions of various countries within the framework. Since the methods of forging links between research and extension organizations differ from one situation to another and from country to country, this paper presents five types of agricultural research–extension linkages, as found in seven countries: Indonesia, Japan, Republic of Korea, Mexico, Nigeria, Tanzania, and Thailand. Secondary data, and surveys were then studied in these seven countries to collect information to elaborate and substantiate the linkage types in the theoretical framework.
Results and Conclusion

Forms of research–extension linkage:

The type of research–extension linkage in a given country can be determined by using the theoretical framework embodied in the five forms of linkage (Table, 1). The overall criteria used in the theoretical classification of linkage forms are: (1) the status of agricultural research and extension organizations relative to one another, and (2) the transfer methods of sourcing research problems, deciding on research themes, and research results.

Table 1. Theoretical framework embodied in the five forms of linkage.

<table>
<thead>
<tr>
<th>Type</th>
<th>Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form A:</td>
<td>Research and extension organizations operate at the same status in a country, using a bottom up approach in decision-making on linkage activities.</td>
</tr>
<tr>
<td>Form B:</td>
<td>Both organizations have the same operative status, using a top-down approach to manage the links.</td>
</tr>
<tr>
<td>Form C:</td>
<td>Research and extension organizations have unequal status, and the linkage system operates according to a bottom-up management approach.</td>
</tr>
<tr>
<td>Form D:</td>
<td>Both organizations are unequal in status, and the linkages operate according to a top-down management approach.</td>
</tr>
<tr>
<td>Form E:</td>
<td>There is no organized linkage system between agricultural research and extension organizations.</td>
</tr>
</tbody>
</table>

These forms of linkage are classified as either top-down or bottom-up approaches. The bottom-up method of sourcing research problems and decision-making in linkage forms A and C presume that these forms of linkage work more efficiently if prefectural, provincial or state governments possess their own independent agricultural research stations and extension agencies.

Factors and indicators of linkage forms:

The study considered five factors in identifying the forms of linkage: the size of the national research system; size of the extension service; level of adult literacy; the organization of agricultural administration; and agricultural policy in terms of the importance attached to
research and extension. The five indicators used to measure the five factors were: (i) number of research institutes/experiment stations at national and state levels; (ii) ratio of extension workers to farm families; (iii) percentage of adults with basic education; (iv) the organizational nature of agricultural administration; (v) research and extension budgets as a percentage of the national agriculture budget, together with the existence of laws and regulations for agricultural policy. The indicators of research–extension linkage factors as they apply to Indonesia, Japan, Mexico, Nigeria, South Korea, Tanzania, and Thailand are shown in Table 2.
Table 2. The indicators of research–extension linkage factors as they apply to the specific countries.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Indonesia</th>
<th>Japan</th>
<th>Mexico</th>
<th>Nigeria</th>
<th>South Korea</th>
<th>Tanzania</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of national research institutes</td>
<td>16</td>
<td>19</td>
<td>15</td>
<td>19</td>
<td>13</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Number of research institutes/experimental station operating at state level</td>
<td>-</td>
<td>255</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ratio of extension workers to farm families</td>
<td>1:1200</td>
<td>1:252</td>
<td>1:800</td>
<td>1:1615</td>
<td>1:500</td>
<td>1:1000</td>
<td>1:1000</td>
</tr>
<tr>
<td>Adult literacy (percentage of total population with basic education)</td>
<td>83.2%</td>
<td>99.0%</td>
<td>89.2%</td>
<td>55.6%</td>
<td>98.0%</td>
<td>66.8%</td>
<td>93.5%</td>
</tr>
<tr>
<td>Nature of agricultural administration</td>
<td>Webbed¹</td>
<td>Decentralised²</td>
<td>Complex³</td>
<td>Under two tiers⁴</td>
<td>A central system⁵</td>
<td>Simple⁶</td>
<td>Semi autonomous⁷</td>
</tr>
<tr>
<td>Number of Breaux, department, agencies in agricultural ministry</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Research Budget as percentage of national agricultural budget</td>
<td>8.0%</td>
<td>1.8%</td>
<td>7.7%</td>
<td>3.0%</td>
<td>2.2%</td>
<td>1.4%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Extension budget as percentage of national agricultural budget</td>
<td>6.0%</td>
<td>1.0%</td>
<td>10.0%</td>
<td>2.1%</td>
<td>1.5%</td>
<td>1.2%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Existence of policy laws and regulations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1: …with local leadership in a centralized system;
2: …and many roles given to prefectures;
3: …and decentralized with more roles to states;
4: …of government structure with a measure of federal control;
5: …with huge command structure;
6: …organizational arrangement with regional and provincial structure; and
7: …departments in Ministry of Agriculture and Cooperatives.

Japan’s research–extension linkage system offers a range of opportunities for farmers’ participation in joint decision-making on research themes at the prefecture level. The strong research–extension linkage in Japan can partly be attributed to the exchange of staff between agricultural research and extension organizations, enabling personnel to work for a specified time in each other’s establishment.

In Indonesia, Nigeria and Korea the research–extension system is such that decision-making power is concentrated at the top, in the hands of national research officers. It is recommended that Nigeria should change its agricultural research policy to allow state governments to control agricultural research stations and conduct research appropriate to the distinctive characteristics of each state. In the Republic of Korea, the placement of research and
extension in one institution is commendable but greater power would be desirable. In Tanzania and Thailand, bold institutional reforms will be required to improve the linkages between agricultural research and extension. In Mexico, the gap in status between extension and research needs to be narrowed for greater linkage between the two systems.

**Educational Importance**

In the absence of positive external pressure from national policy makers, foreign agencies, farmers and the private sector, the dynamics of an institution tend to be dictated by internal processes, resulting in poor performance. This situation is found in many low-income countries, and is a result of historical factors, and current political and social structures. The findings of this study show that policy changes, institutional reorganization, and the strengthening of organizations are required to enhance research–extension linkages in developing countries. This paper has provided a theoretical framework through which global agricultural research–extension systems can be analyzed in order to highlight specific ways in which research–extension linkages can be improved.

**References**


Commission on Behavioral and Social Sciences and Education, National Research Council.


