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OF TECHNOLOGY TRANSFER**

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POLITICAL AND ECONOMIC DIMENSIONS OF TECHNOLOGY TRANSFER.

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ABSTRACT

This brief paper attempts to provide a general overview of the political and economic dimension vis-a-vis technology transfer. It suggests a broad agenda for understanding some of the inter-relationships between agricultural extension and how it is affected by economic and public policy. Over the years this has become increasingly evident and it is essential to redefine our role as scientists and/or policy makers if we are to improve the understanding of the complexity of dimensions relating to agricultural development. It provides and suggests an interlinking conceptual framework and thus might improve our role as researchers, agricultural specialists, policy makers or persons interested in agricultural development issues.

In making this brief presentation the expectation is that it will accelerate establishment of the basis for enhancing and developing the dialogue between the technical community and policy-makers. It outlines the dimensions of this interaction as a conceptual foundation to build upon.

1. INTRODUCTION

This brief paper attempts to provide a general overview of the political and economic dimension vis-a-vis technology transfer. It suggests a broad agenda for understanding some of the inter-relationships between agricultural extension and how it is affected by economic and public policy. Over the years this has become increasingly evident and it is essential to redefine our role as scientists and/or policy makers if we are to improve the understanding of the complexity of dimensions relating to agricultural development. It provides and suggests an interlinking conceptual framework and thus might improve our role as researchers, agricultural specialists, policy makers or persons interested in agricultural development issues.

In making this brief presentation the expectation is that it will accelerate the creation of basis for enhancing and developing the dialogue between the technical community and policy-makers. It outlines the dimensions of this interaction as a conceptual foundation to build upon. Thus, comments on the ideas would be welcome.

II. THE CONTEXT

The context from which to derive these dimensions requires outlining. In general, agriculture in most developing countries is both traditional and commercial. Some of the most outstanding features of traditional and/or peasant agriculture are:

- small scale operations
- use of local inputs
- low degree of mechanization
- diversified production
- low yields
- risk aversion
- deficient soils
- scarce resources

The list is not all inclusive and conclusive, but it provides sufficient elements to allow an overview of the scope of problems to be addressed in order to improve traditional farming in developing countries. While there is a limited understanding as to the small farm systems prevailing in traditional agriculture, there is also inadequate knowledge as to which crop and/or animal husbandry system can guarantee a regular and increasing supply of foodstuffs, fiber, firewood, and cash income. However, many problems to be confronted are not necessarily technical but economic, political and social in nature, and thus policy measures should be offered to address these. There is no need to emphasize that this limited understanding and knowledge of small farm systems is a challenge for all researchers, extensionists and policy makers involved in agricultural development.

On the other hand, commercial agriculture is distinguished by some of the following features:

- medium to large scale operations
- high degree of mechanization

- *monoculture*
- *intensive cultivation*
- *high yields*
- *risk prone*
- *energy intensive*
- *use of external and non-renewable inputs*
- *capital intensive.*

With rapid industrialization and scientific development in the developed countries, agricultural research and extension and economic systems emerged, and thus, commercial agriculture.

This has had major consequences for agricultural development *per se*, i.e. knowledge of plant nutrients, photosynthesis, plant breeding, bio-technology, engineering; and petrochemical industries have changed the biological potential in agriculture. In the medium and long term however, the positive impact of these technologies is countered by second and third generation problems, among them resistant bacteria, viruses and insects, soil and water degradation, salinity of irrigated soils, pesticide residues, etc.

The above mentioned problems ought now not only to be examined and analyzed specifically at the levels they occur, but also within the political and economic power structures and policies as well.

The general description of "traditional" and "commercial" agricultural systems indicates their inadequacy to respond to developing countries' needs for foodstuffs, raw materials, and agricultural exports, in a sustainable way.

Indeed, the development of sustainable agricultural systems within dynamic ecological and socio-economic conditions is yet to be achieved in practice. The efforts towards their development must be guided by a systems approach sustained within a multi-disciplinary analytical perspective. For indeed, inadequate knowledge and short-sighted policies, together with accelerated environmental degradation of these agricultural systems, compromise agricultural development.

III. POINTS OF DEPARTURE

A useful definition of "institutions" would be that they are organizations, whether they are organizational sets, single or part of an organization like a research or extension department, division or unit. Similarly, institutional development and strengthening is to be understood as a dynamic process to provide relevant answers for improving endogenous capacities within a changing

institutional environment.

The economic crisis, the decline of agriculture and low priority for agriculture in policy circles, have influenced the technology institutions in Jamaica over the past decade. This is reflected in the difficulties experienced and gradual dismantlement of the research and extension services at the Ministry of Agriculture.

Recently a view emphasizing the more positive contribution of agriculture to growth has emerged, and with it the need to revitalize technology institutions. A Rural Agricultural Development Authority (RADA), with responsibility for extension and rural development was created in 1990, and the establishment of a National Agricultural Research Institute (NARI) is currently in train and is to be completed in 1991.

This new institutional setting of RADA and NARI faces a unique set of opportunities and problems. And there is the potential for developing new flexible arrangements and for breaking the inertia and constraints faced by previous institutions. With regard to the former, it has the potential of enhanced delivery and capability for the various stake holders in agricultural technology transfer.

Despite all this, problems and constraints still remain. National funding for the new agencies will most likely prove limited and insufficient in relation to their agenda. The possibility of renewing, expanding and strengthening their staff appears quite limited. They will also face expanded and competing demands (food crops, traditional and non-traditional exports, raw materials, etc.) in structuring their mandate. The previous decline of the existing Ministry of Agriculture's capabilities in research and extension inevitably entails an inherited constraint for the new institutions.

Unless careful attention is given to their mandate and to the design and implementation of organization and management arrangements for these new institutions, the potential they hold for making a substantial contribution to agriculture, may not be attained. Major areas of need will include program development, inter-organizational linkages, organizational design, planning and programming, human resource development and training, information systems, and other areas.

Although RADA is established and NARI may be said to be in the pipeline, these organizations will require time to mature and develop fully. Indeed, there are certain constraints which ought to be addressed, as most of these technological institutions revealed prob-

lems which are listed briefly:

- *budgetary constraints and underfunding: The economic crisis of the 80s and its after effects have forced the government to cut its expenditure on research and extension, despite the already existing insufficiency of resources allocated to technological institutions.*
- *Low political status: Not only is the influence of agriculturalists limited with regard to agricultural policy, but the staff salary structure is poor. Thus agriculture in general is, in monetary and/or political terms, unattractive as a professional career.*
- *Limited professional mobility: Restricted opportunities for professional mobility within the public service system.*
- *Inadequate institutional infrastructure: The programming and operational aspects require upgrading from the conceptual aspects to project design, operations and institutional functioning.*

From the above it is evident that institutional infrastructure requires expansion and improvement, but the concerns in this brief document refer not to the issues of institutional development and strengthening *per se*, but focus on the proposition that a growing realization of the political and economic dimensions of technology transfer must be encouraged.

IV. POLITICAL AND ECONOMIC DIMENSIONS

The importance of agricultural development for the economies of developing countries is becoming increasingly recognized. Thus, with the increased importance of agriculture, it has become evident that technological change is an important source of growth for the agricultural sector. In this regard, new dimensions have to be incorporated into the institutional and scientific framework of research and technology transfer.

The discussion of new developments, to which the technological systems in agriculture have been subjected, is outside the scope of this paper. What is suggested is that without elaborating on the analysis of factors affecting namely-

- i. *present and future supply and demand for agricultural technology, and*
- ii. *the changing scientific and institutional framework for technology generation and transfer,*

the technology potential to be tapped for contributing to agricultural development and economic growth merits incorporation in a new analytical perspective, that is the political and economic dimension of technology transfer.

Technology transfer contributes to increased agricultural productivity, reduces production costs and leads to lower consumer prices. Among some examples of technology transfer in agriculture are:

- i. *New crop varieties (high yielding and/or disease resistant strains and these are often genetically engineered).*
- ii. *Manufactured inputs (pesticides, fertilizers, agricultural chemicals).*
- iii. *Machinery (tractors, cultivators, harvesting equipment, drying equipment)*
- iv. *Farm management (tillage practices, computers, economic and financial management techniques)*
- v. *Research and training (biotechnologies, training for scientists and farmers).*

The impact of these examples of technology transfer is related to the clientele (whether it be traditional and/or modern agriculture), which in turn conditions how the technology is transferred, its adoption rate, and the degree of government intervention.

In most developing countries the commonest channel for agricultural technology transfer has been through public sector institutions, such as governments and, to a lesser degree, universities and international organizations. However, private firms are becoming more important in this area.

The technology transfer by the public sector is reduced to:

- *government extension services*
- *direct aid programs*
- *university extension*
- *international agricultural programs*

On the other hand, private sector technological transfer is manifested through:

- *national and multinational enterprises*
- *sales of technologically advanced products (inputs)*
- *joint ventures*
- *licensing products and production*

1. Political Dimension

Governmental policies, specifically those legislative and judicial policies are intended to influence technology transfer. Their effect on either the public and/or private sector technology transfer agent differs and thus their impact on the transfer process. Granted, the targeted "type" of agriculture would ultimately be affected negatively, and/or positively by these government policies.

It is often forgotten how public policy affects agricultural technology transfer, and that it will likely continue to create incentives for and restrictions to either of the two most common agents in the technology transfer process.

The political dimension of public policy, primarily fiscal and legislative, can be recognised in public sector institutions in terms of:

- *public funding (decline in public sector funding)*
- *taxation (public agricultural extension institution budgets are financed out of general taxation, levy of taxes on producers, imposition of royalties on technology-based exports)*
- *political priorities (policies which encourage technological transfers, specifically farm-size, regions, products)*
- *agricultural policies (addressing equity issues regarding technological transfer costs and benefits).*

The political dimension of public policy in relation to the private sector agent of technology transfer is reflected in:

- *joint ventures (joint agreements between the public and private sector, marketing, production, technology)*
- *patents and licences (patent protection and licensing; public policy is crucial for technology transfer, innovation, marketing)*
- *standards and regulations (might restrict and/or facilitate technology transfer under general agreements and legislation)*
- *plant and animal health (health and environmental considerations might restrict type and rate of technology transfer)*
- *agricultural policies (price support, land development schemes, etc.)*

2. Economic Dimension

The economic environment whether through government policies and/or market conditions affect technology transfer regardless of the institutional channels for this transfer process.

With reference to the public sector as an agricultural technology transfer agent, the economic dimensions are seen in:

- *agricultural demand (increased demand for agricultural products at the domestic and foreign markets)*
- *multinational enterprises (subsidiaries, joint ventures and the multinational modus operandi of technology transfer)*
- *economic development (specific and/or general economic development which supports specific crops and/or regions can create incentives and/or adopt, develop, or transfer technology i.e. prices, land, etc)*
- *economic policies (as related to subsidies for adopting production methods)*
- *fiscal regulations (with reference to foreign investment and multinationals)*

As the private sector becomes more important in agricultural technology transfer, the economic dimension of the process merits being highlighted with reference to government economic policies and market considerations such as:

- *industry profitability (attractive financial returns. (specifically when dealing with patentable products or processes, and exclusive marketing)*
- *market conditions (competitiveness within the market. Also increased demand for technology based manufactured inputs and capital inputs such as chemicals and machinery)*
- *multinational activity (the multinational activity is common in machinery, seed and chemical industries related to agriculture)*
- *fiscal policies (tax credits and subsidies for crops and/or inputs)*
- *monetary policies (interest rates and foreign exchange rate, foreign investment, movement of capital, etc.)*
- *trade policies (export expansion and/or import substitution policy measures, quotas and tariffs)*

The political and economic dimensions of technology transfer are present in agricultural development issues. And indeed governments will likely retain their influential role in the agricultural transfer process by way of public policy and less government direct intervention, within an economic setting which is increasingly moving towards free market considerations.

An analytical perspective which incorporates the political and economic dimensions of agricultural technology transfer, derived from public policies and/or the market considerations, would enhance the understanding of this complex process, and would contribute to accelerated agricultural development and growth.



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