THE ROLE OF INTERNATIONAL TECHNICAL COOPERATION BETWEEN UNIVERSITIES IN THE TRANSFER OF TECHNOLOGY, WITH SPECIAL REFERENCE TO AGRICULTURE

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What Is Transfer of Technology ?

Transfer of technology is a process by which knowledge and skill in the application of science in a specified disciplinary area are communicated. This process uses people as the medium of communication. Only human individuals are capable of sending and receiving messages and giving proper applicability to the transmitted message. Proper applicability means that the transferred knowledge and skill are made useful to meet a present demand. Communicating for results operates in a cybernetic system. The sender encodes his ideas for transmission and the receiver decodes them, adds meaning, responds and feeds them back to the sender. This cycling process repeats in order to define the necessary adjustments until it comes to the proper applicability of ideas. The feedback mechanism makes the transfer of technology an interactive process. It is not a one way flow of a packet of information from a sender to a receiver. It is a system of internal exchange and transformation of information about knowledge and skill which at the end benefits the participating parties. The receiver gains better knowledge and skill to cope with his tasks or problems, while the sender acquires an enriched experience.

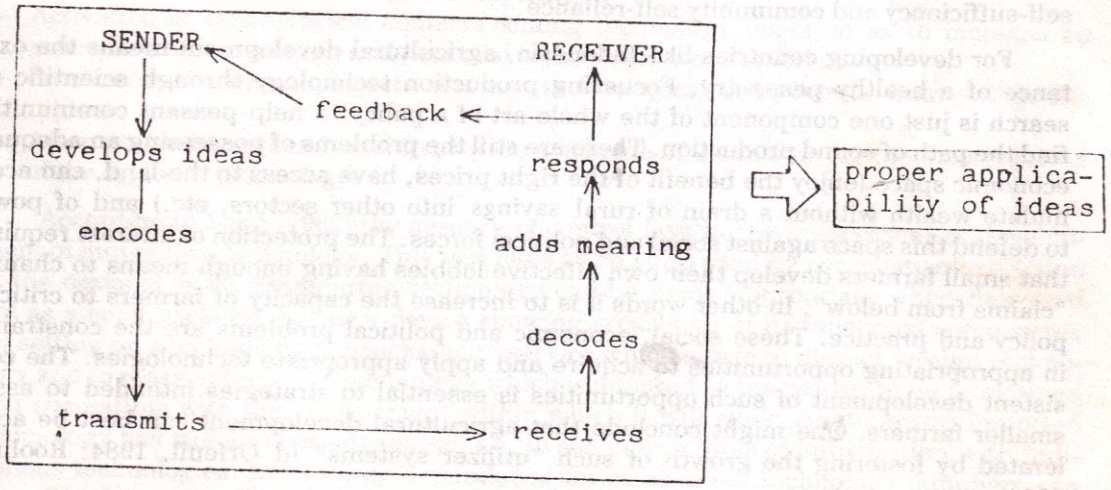

Fig. 1. A cybernetic model of the communicating process (adapted from Anastasi, Jr., 1972)

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Factors of Applicability of Technology

Many people still believe that the best solution to poor productivity is inputs of so-called quick yielding technologies. It is true that the breeding of high yielding plant varieties may lead to a green revolution. Putting high doses of fertilizers may quickly give dramatic crop returns. But sustainable agricultural production depends on much more factors than on single packages of technology alone. The many that are involved in determining the path ways of intensification of agricultural production include :

- Climate, land quality, hydrology and water resources
- Available technology (including roads, energy generation)
- Population pressure
- Government development policies and programmes
- Market opportunities and relative crop prices
- Sociopolitical and socioeconomic conditions (including farm size, land ownership, availability of labour)
- Cultural traditions and attitudes

These factors are time and location specific, and as such are recommendation criteria for the development of appropriate technology (Brammer, 1982; Röling, 1984).

According to Sen (1981) famines cannot be viewed merely as food crises. Famines can take place without a substantial failure in food availability. His so-called entitlement approach stipulates that a person starves because he does not have the ability to command enough food. Entitled to a bundle with enough food is one of the most primitive property rights, and in each society there are rules governing this right. The ability of a certain group of the population to establish command over food, using the entitlement relations operating in that society, depends on its legal, economic, political and social characteristics. Many cases of starvations are more the results of sociopolitical and socioeconomic disasters than caused by a real shortage in food supply. In a broader context Riddell (1981) advocates ecodevelopment action for human advancement in the poorer countries. This means national emphasis on economic equity, social harmony and environmental balance in the local pursuit of individual fulfilment, household self-sufficiency and community self-reliance.

For developing countries like Indonesia, agricultural development means the existence of a healthy peasantry. Focussing production technology through scientific research is just one component of the whole art of a policy to help peasant communities find the path of sound production. There are still the problems of possessing an adequate economic space (enjoy the benefit of the right prices, have access to the land, can accumulate wealth without a drain of rural savings into other sectors, etc.) and of power to defend this space against social and political forces. The protection of interest requires that small farmers develop their own effective lobbies having enough means to channel "claims from below". In other words it is to increase the capacity of farmers to criticise policy and practice. These social, economic and political problems are the constraints in appropriating opportunities to acquire and apply appropriate technologies. The consistent development of such opportunities is essential to strategies intended to assist smaller farmers. One might conclude that agricultural development can best be accelerated by fostering the growth of such "utilizer systems" (d'Orfeuil, 1984; Rooling, 1984).

The conditions of healthiness of the peasant community also concerns production method. To produce a good agricultural output it must possess appropriate technologies, either traditional or acquired, and it must have its own method of production adapted

to the natural and social environment (d'Orfeuil, 1984). Unlike commercial farms where optimization of production is the main objective of technological inputs, subsistent farming uses technology to minimize risk, meaning securing yields. Subsistent farmers cannot afford risk however small because they do not have the surplus to be carried over from one production period to the next. This carry over of surplus is basic to optimization of commercialized farming systems as it is the built-in mechanism to balance risk whenever it has been anticipated to occur.

How Appropriate A Transferred Technology Could Be ?

Following Harold Laswell's definition, technology is the ensemble of practices by which one uses available resources in order to achieve certain valued ends (Roling, 1984). As the achievement of technology is dictated by various social, economic and political determinants, a technology to be appropriate must be suited to local realities (Bessis, 1982) and uses available resources most efficiently (Sanchez & Salinas, 1981). Because realities which are created by human behaviour (social, economic and political) are changing with the change in man's perception about his existence and his adherence to certain social values, appropriateness implies a certain dynamics.
Thus it may be said that :

> "Appropriate technology is the ensemble of practices suited to local realities by which one uses available resources efficiently in order-to achieve certain time dependent valued ends"

Although science from which technology develops contains universal truth, technology is subjective in the sense that its veracity is location and time specific. A well proven technology for a certain environmental condition may be useless for or inapplicable in a different environmental setting. Condition changes with geographical locations or with time in the same location. Therefore Long (1982) calls for an effective policy for controlling the transfer of technology which would seem also to call for the promotion of an indigenous technological capability. This may include :

- Stimulation and rationalization of research and development (R & D) at the regional level to avoid unnecessary regional duplication
- Activation of technological contacts among technology users so as to increase an awareness of the existing and potential technological possibilities
- Promotion of regional projects that use technological components from within the region
- Attempts at the regional level to provide a scheme of incentives for the incorporation of the region's technology

According to Long (1982) the essence of control lays in the inducement of development of indigenous technology. This will have to be supported by complementary action at the national level. Transferred technology can be made appropriate when delivered not as a solid package, but as a device showing crearly all of its functional components. By setting up a technology "unpackaging" service which aim is to dissect foreign technology and to reassemble into a technology which is adapted to the matter to be intervened and compatible with the environment within which it will work. Anatomizing imported technology has still another advantage, i.e. to see possibilities of substitution with indigenous technologies. In this way dependence on established technology suppliers can be reduced.

There is no such thing like instant appropriate technology. It has to be prepared, and the maker is the system of transfer of technology.

A Look At International Cooperations

A technical cooperation is an interactive activity among cooperators aiming at the establishment of a productive linkage. In the case of cooperation in education, like those among universities, productivity is measured by the success in achieving improved teaching methods and facilities, increased research capability and capacity, and better quality and applicability of research outputs. Improved teaching should lead to increased student enrollment and better quality graduates at an adequate output level. Better quality and applicability of research means on the one hand the strengthening of teaching and on the other the promotion of extension services. Graduates will eventually become disseminators of improved technology.

A productive linkage will result in an equalized partnership and thus provides a strong ground for a continued communication. After this stage has been reached, and if a mutual need exists, the technical cooperation will not end with the termination of the official letter of agreement. It takes only a different form. Communication will continue as long as the need demands for exchange of ideas, information and/or people as bearer of thoughts or as media of the transfer of technology. One may conclude that there seems to be a great opportunity for international technical cooperations among universities to become the vehicle of the transfer of technology between developed and developing countries.

This will be especially true when by existing legalities government research institutions and extension services are placed under the bureaucracy of line departments. As they are bound by overhead policies they are less effective as channels of technology transfer. Unlike universities, they are not enjoying enough freedom of response, interpretation and initiative. Bureaucratized institutions and services may find themselves ill at ease with a dialogue whose script they do not control (Anon., 1983). In addition, they do not have and never will have the means to generate disseminators of technology. On the other hand, universities by their very existence are producers of disseminators of knowledge and skill by excellence. They offer also the best opportunity to pursue integrated knowledge which is fundamental of the creation of appropriate technology.

Even in the USA where freedom of the individual is among the highest esteemed human rights, organizational influences on science are still clearly reflected. While freedom of inquiry and speech is a well established tradition in the university structure, scientific activities within the governmental structure are seen as a hierarchical, bureaucratically controlled activity under government direction. How strong the bureaucratic control is may be comprehended from this statement that over the years the Forest Service has had great difficulty coping with research findings that conflicted with official policy. One comment of respondent scientists in a survey said that it is critical that support of basic research in agriculture have continuity and freedom from bureaucracy that prevents high quality and innovative research (Busch & Lacy, 1983).

There are reasons to believe that transfer of technology can be achieved better through international technical cooperation between universities. Several advantages of this system of transfer can be listed as follows :

- A minimum, if any, of bureaucratic and overhead policy influences on both sides.
- Communication if need be can be extended beyond the official time limit of cooperation through the established sense of fellowship of one academic society
- Enhanced dissemination of acquired technology along the secured paths of education

— Universities are born leaders of indigenous innovative capability geared by a holistic systems approach
— Self-propelling development based on the educational concept of human resource investment.

The technical cooperation between the Rijksuniversiteit te Gent and the Universitas Gadjah Mada, known as Project JTA-9A (44), is a good example of the product of an intelligent decision. Its basic theme of "Increasing Agricultural Productivity Through Research and Education" clearly reflects the strong conceptual foundation on which this Project operates. To educate people how to help themselves is the key to a successful transfer of technology, as it implies development of understanding of their own needs and desires, and of indigenous capability to meet them.

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