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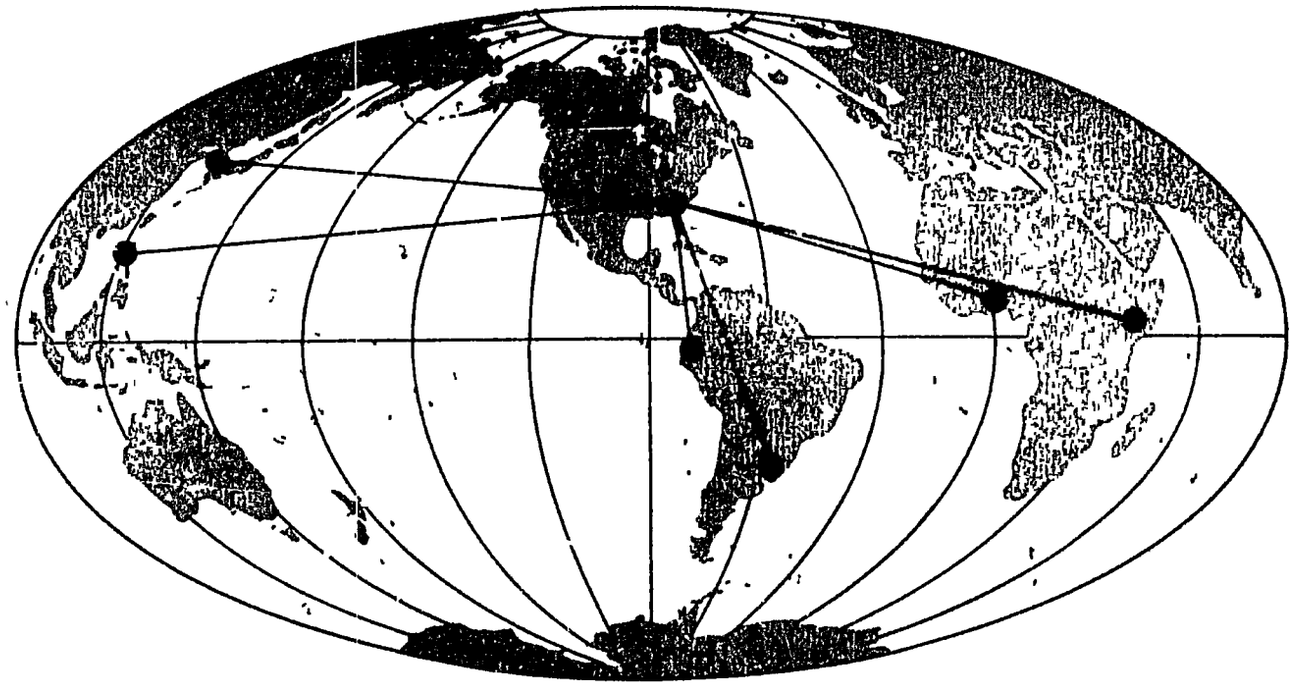

SOME ISSUES RELATED TO THE IMPACT OF MICRO–DEVELOPMENT PROJECTS

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GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA

A COMPARATIVE VIEW OF TECHNOLOGY TRANSFER: DOMESTIC AND OVERSEAS

Ross W. Hammond, IDD, Georgia Tech

Presented at
Iowa State University, Ames, Iowa
May 8, 1974

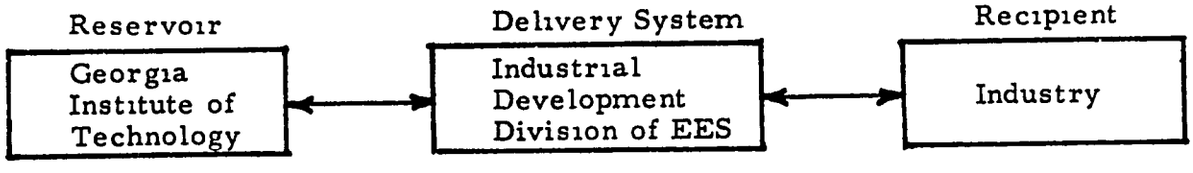
One of the delightful aspects of working in economic development, both at home and abroad, is that one frequently has the opportunity to renew acquaintances with highly stimulating old friends and to meet new friends with whom a mutually enriching exchange of views can take place. This meeting is such an occasion and I am honored to be a part of it. So I am particularly pleased once again to see Norman Dahl, Hugh Miller, my colleague from Georgia Tech, Melvin Kranzberg, and others and I look forward to the opportunity to talk with everybody.

My plans are to tell you some of the basic differences we at Georgia Tech have encountered in technology transfer in developing countries as opposed to Georgia and the southeastern region of the U.S. Then we will review a slide presentation in which we will try to highlight some of the differences.

Technology transfer is a fascinating and frustrating process. In concept it is rather simple -- in practice it is extremely difficult.

I do not wish to oversimplify, but it seems to me that a technology transfer system can be simply depicted. It may be thought of as having three principal elements -- a reservoir of technological information, a delivery system, and a recipient.

In Georgia, one such technology transfer system takes this form.



Let me briefly describe the elements:

Georgia Tech is a considerable reservoir of technological information, for it is one of the largest engineering institutions in the U.S., with 7,000

engineering students, along with an associated faculty and facilities, including one of the larger technological libraries in the country.

It has a feature unique in the United States. The Engineering Experiment Station associated with Georgia Tech is an applied research activity, employing 500 persons, which has as its stated mission the acceleration of economic growth in Georgia. One unit of the Engineering Experiment Station is the Industrial Development Division (IDD). The Industrial Development Division has a broad program of research, service, training, and technology transfer activities in:

Employment generation
Community development
Area development (industrial extension)
Management and technical assistance
Market analysis
Manpower resources
Technical services
Economic development training
Housing, transportation, and industrial economics
Industrial development
International development
Development library expansion

This program has operated at IDD since 1956, and the present staff numbers 65 persons. It has involved continuing technology transfer activities both domestically and abroad. It is from this 18-year base of problem-solving work experiences that the following observations are drawn. I would like to generalize a bit, knowing very well the danger in doing so. Many people here could bring up a specific example which appears to refute whatever generalization I make. So bear with me -- if you don't agree with what I say, feel free to do so. I will admit freely that our experience is limited in a geographical sense and in an absolute sense.

Let me quickly draw comparisons between the U.S. environment with which we are all familiar and the developing country scene.

First, let's discuss the nature of the LDC economy compared to the Georgia economy (which is to say the U.S. economy).

In Georgia, 30% of the labor force is engaged in manufacturing, only 5% in agriculture. In developing countries, the situation generally is the reverse with as high as 80% to 90% of the labor force involved in agricultural employment.

Hence, in LDCs, people do not know much about manufacturing. It is not a common thing and they tend to think only in agricultural-related terms.

Unemployment and underemployment vary widely in LDCs, but it is generally in the order of three to six times the U. S. average. Such massive unemployment introduces elements of political instability which has contributed to the frequent toppling of governments (Chile is a recent example). Hence, employment generation has become a prime government objective in many less developed countries.

In the U. S., we find relatively high per capita income levels and a large middle class. In LDCs, we find low per capita income levels ($100 to $200 per year in many countries) and usually the absence of a large middle class. Hence, the middle class as a source of capital is relatively non-existent.

While in developed economies capital sources are varied and relatively plentiful, the LDCs characteristically do not exhibit either a large or accessible capital financing structure.

Compared to many LDCs, Georgia's education picture, while among the lowest in the U. S., nevertheless seems excellent in terms of average years of schooling and other indicators. Literacy is high, while in many LDCs it is low. Development, parenthetically, is often linked to education and literacy, but one can exist without the other. In the Philippines, literacy is high but development is relatively slow, especially when compared with South Korea where similar high literacy prevails.

In the U. S., a high proportion of industry, large or small, is U. S. - owned or operated, or partially owned. In the developing countries the large companies are frequently foreign owned or managed. The smaller industries tend to be indigenously owned and operated.

As recognition of this pervades nationalistically-oriented LDC governments, we can expect a greater interest in stimulating the small industrial section, for this is the home-owned sector of the economy.

Now let us mention briefly some questions about industrial management and operations. Management problems are quite similar in nature in developed and developing countries, varying in degree with the different orders of scale found in the developing countries.

However, management advice and assistance is available from many sources, public and private, in the developed economies. In the developing countries, it is much more difficult to obtain and beyond the financial capabilities of most of the companies.

Capital is more available in developed countries, less so in the less developed countries. A reservoir of skilled labor exists in many advanced countries -- such a labor supply is rarely present in the less advanced countries.

Developed countries, with high per capita incomes, represent good domestic consumer markets. LDCs, with low per capita income pictures, represent inadequate domestic markets.

Developed countries generally have advanced multi-modal transportation complexes which facilitate the movement of goods and people. Such complexes are unheard of in the developing countries (with few exceptions).

Now let us discuss technology and make brief comparisons for each type of country, developed and developing.

In developed countries like the U.S., we find a broad range of industrial sophistication, from low technology to extremely high technology. In developing countries, the range is low to medium technology, with occasionally some high imported technology (oil in Nigeria, for example).

The average size of industrial enterprise is much larger in developed countries. In the U.S., small industry has an upper limit of 500 employees; in Korea, 100; and in the Philippines, 50, to use one measure of size. With smaller industries characteristic of developing economies, there are fewer internal problem-solving staff positions in industry, and a corresponding greater need for technical assistance from outside the concerns.

However, technical assistance is available in the U.S. from educational institutions, state and Federal government units, research institutes, consultants, etc. This multiplicity of technical assistance sources is not common to or existent in many less developed countries.

There is a large number of technology alternatives available from many sources in the developed countries. It is a mistake to think that all of these

technological alternatives are equally available to the entrepreneur in rural Brazil, or Kenya, or Indonesia. There are inadequate systems of information transfer which make the delivery of technology difficult and/or non-existent. The LDC entrepreneur really has relatively few technology alternatives to consider.

In the U.S., there are numerous institutional change elements at work, both in the public and private sector. In the LDCs, relatively few organizations are working at change and where they exist, they are thinly staffed with good people, and even these frequently are inadequate in their experience.

Finally, let us talk about some of the techniques of technology transfer.

The simplest, most used, and perhaps least effective way of transferring technology is to mail the printed word describing the technology. We have done a lot of this with little success -- mailings had to be followed by other techniques.

Even so, in many of the developing countries, the mails are notoriously bad and the probability of such mail arriving may be on the order of 50%. This reduces the already low probability that the technology will be utilized by the industrial recipient.

The basic problem is that most technological information is written for a scientific or engineering audience. I happen to be one who believes there are many beneficial spin-offs from the space program. However, the NASA briefs, as an example, were extremely technical documents. We found them completely unusable by the unsophisticated Georgia manufacturer. It wasn't that they didn't contain good information -- they were just unreadable in many cases by someone devoid of a technical background.

Now that took place in an economy where technical publications are easily available and technology is a fact of everyday life. Imagine the difficulty of technology transfer in the developing countries where technical publications are not prevalent and few people exist who can understand and interpret or adapt them.

There also are problems of language. Most developing country technological libraries I have been in have few books in the native tongue and many

books in English. This has forced the students to study a second language which, no doubt, does them much good in the long run, however painful it may be during the education process.

Parenthetically, the abundance of English texts has resulted in the U. S. becoming a unilingual country by and large. It is difficult to find much emphasis on learning other languages in most scientific or technical educational institutions today. I recently heard one multi-national company executive say they preferred to hire Europeans for international jobs. One of the reasons advanced was that Europeans had greater language learning capability due to being bilingual or multi-lingual.

Another mode of technology transfer is by product or process demonstration. It is a frequent thing in the U. S. to organize for a group of industrialists such a demonstration. It is a relatively effective transfer element.

Such demonstrations are less frequent in most developing countries and non-existent in some.

The same general observation can be made about seminars and short courses, adult education if you will, another vehicle for technology transfer.

Our people have come to the conclusion, after 14 years of trying technology transfer with about 3,500 companies, that the best single technique is eyeball-to-eyeball technology transfer.

Simple bookkeeping and accounting, for example, is one of the most prevalent needs of developing country industries. Seminars and short courses are widely used to disseminate knowledge about these subjects to groups of people. The general knowledge derived from this type of instruction is helpful. However, even more helpful to the individual entrepreneur is for someone to sit down with that entrepreneur to advise him how to set up a specific set of books and accounts adapted to his company's particular needs. The success of this type of transfer is many times those of other modes discussed previously.

Now to illustrate some of these points, permit me to show you a short slide presentation. It is made up of small industry shots from five countries where we have counterpart organizations (under an AID grant). These counterparts are all involved in small-scale industry stimulation through various programs.

Slide Presentation

* * *

In summary, let me reiterate some of the differences in approach that a U.S. institution must use in working overseas in technology transfer.

First, we are capital-intensive and automation-oriented in the U.S. The developing country orientation is largely labor-intensive. Hence, a different approach to the work is needed -- full automation of an existing plant is undesirable in many cases, since it tends to reduce employment in an environment where employment generation is critical.

Second, the level of technology is generally lower in the developing countries. Hence, academic course work in the higher mathematics, operations research, computer programming, etc., have little practical application in many LDCs. What we need to generate are approaches which are pragmatic and problem-solving. In educating LDC students, we have to somehow provide them with work experience in addition to academic backgrounds. LDC students need laboratory courses and design courses which are problem-solving in nature.

Third, in operating in the developing countries, one must recognize that differing political, social, cultural, and economic constraints exist in each country. It is difficult to generalize about these. Each country becomes a specific situation. A prime requirement of individuals from the U.S. who seek to work with the developing countries is flexibility, a willingness to try alternative solutions best suited to the country. We have found that what works well in one country may fall flat in another. Hence, we discourage in our people preconceived notions about how things should be done overseas. We suggest rather that they gather the facts, analyze the facts and arrive at conclusions and solutions based on the on-site information.