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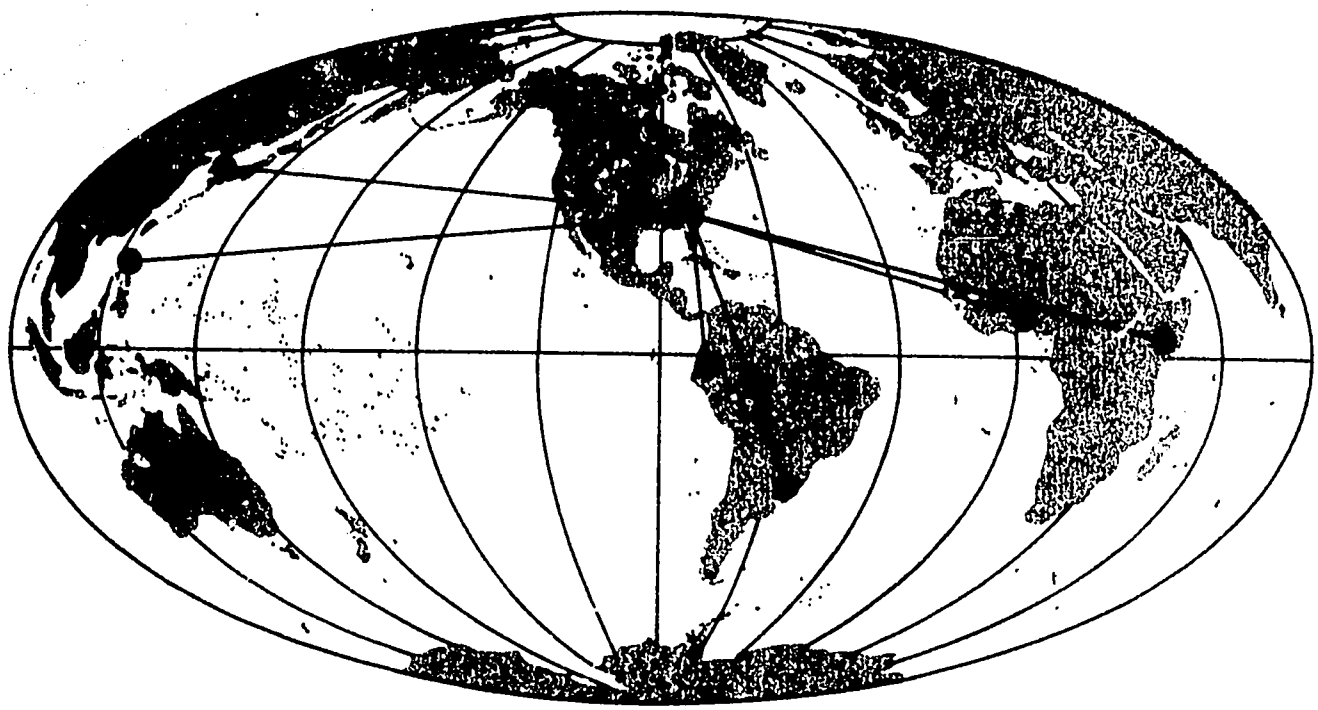

TECHNOLOGY TRANSFER SYSTEMS
FOR SMALL INDUSTRIES

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

# TECHNOLOGY TRANSFER SYSTEMS FOR SMALL INDUSTRIES

A Paper Presented by

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at the

Seminar on the Role of Small Scale Industries
in Transfer of Technology
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# TECHNOLOGY TRANSFER SYSTEMS FOR SMALL INDUSTRIES

BY

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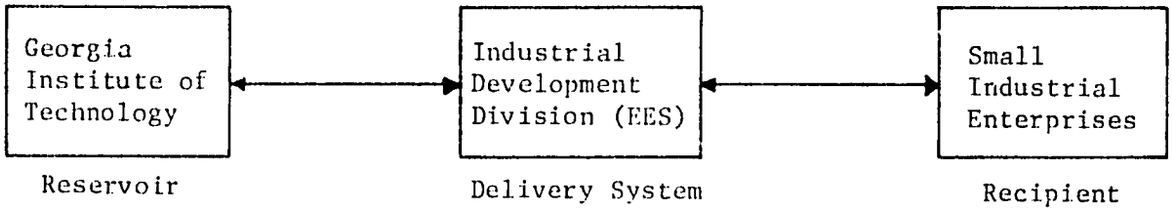
# TECHNOLOGY TRANSFER SYSTEMS FOR SMALL INDUSTRIES

It is a pleasure and a delight to be able to participate in this seminar and to present some information on technology delivery systems for small industries as practiced by Georgia Tech in the State of Georgia and elsewhere.

I do not wish to oversimplify, but it seems to me that a technology transfer system can be rather simply depicted, though it may be complicated in implementation. 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 5,000 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. The Industrial Development Division (IDD) 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

IDD is a source of technological information and a delivery system for that information through its industrial extension system.

The universe of users of technology in Georgia is some 6,500 manufacturing plants of various sorts, but averaging somewhat less than 100 employees each over the state. Hence, most of these plants are quite small, the operations are relatively unsophisticated, and they exhibit the usual spectrum of problems associated with small industries -- one-man domination, capital deficiencies, production or quality control problems, inventory procedures or lack of procedures, sales or distribution deficiencies, labor and training problems, deficiencies in accounting or bookkeeping, or in other management control systems, etc.

In such enterprises, the overworked managers are usually so concerned with each day's operating problems they do not have time to seek out the latest technological developments and to determine how these might be applied to help their enterprise expand, diversify, operate more efficiently, or improve its profit picture.

Probably these problems are familiar to you -- there is a remarkable and basic similarity of small industry problems in Georgia, in the United States, in Latin America, and elsewhere. There are different economic, social, cultural, and governmental environments for small business and industry operations obviously, but we find most of the small-scale industry problems are generally similar in nature although the specifics of each vary.

In 1959, IDD conducted a research analysis of the problems and needs of small manufacturers in Georgia. As a result of this study, the Division became interested in providing direct assistance to small manufacturers and has maintained such a program for the last 15 years. In this period, IDD has provided technical information and management and technical assistance to more than 3,500 small industries in Georgia, the Southeast, U.S., and in Latin America. These activities have been instrumental in many industrial expansions and diversifications and in the creation of thousands of new jobs.

It is obviously impossible in this paper to review what was done in all cases. I would like to mention some typical cases and perhaps these illustrations will provide you with an additional insight as to how this particular delivery system works.

The Industrial Development Division operates out of a main office in Atlanta and seven industrial extension (field) offices dispersed throughout the state. Each industrial extension office has responsibility to serve a portion of the state. The bulk of the staff in Atlanta serves as technical and manpower support to the field offices of the industrial extension system. One of the main responsibilities of the industrial extension personnel is to seek out and identify industrial problems and to provide solutions to these problems. More than 600 technical reports on economic development have been published by the Division.

In the period 1966 through 1970, broad programs of technical information transfer were conducted by IDD in Georgia.

One program involved direct mail contact with 3,000 companies in Georgia, telling them IDD would like them to participate in a technology transfer program. Of these, 1,200 indicated a desire to do so. Division industrial extension staff people then conducted interviews with the 1,200 companies to ascertain their short-term information needs (such as data on a new welding technique) and their long-term areas of technical interest (metalworking, for example). Staff personnel then proceeded to search for, analyze, and transfer the short-term information requirements to the interested industries. The transfer was achieved, frequently by mail, but more usually by a visit of industrial extension people to the industry to help in the explanation of the technical material and to provide assistance in the conversion of this data to a form understandable and usable by the manufacturer. (NASA's technical briefs, for example, were not immediately usable by the small unsophisticated Georgia manufacturer.) Some of these 1,200 companies had few technical information requests and were provided with few items of information. Others had frequently expressed needs and this resulted in many technology transfers over a period of years.

When it came to longer term areas of technical interest, IDD undertook a program of reproducing and distributing new information in a particular field to companies which were interested in the field. New information for the textile industry, for example, was distributed to appropriate companies. A quarterly metalworking bulletin with the latest technical information on products and processes was published and distributed to 250 metalworking companies in the state. Such an activity requires a strong technical and development library.

From 1970 on, this technical information program was merged with a long-existing program of management and technical assistance provided to Georgia business and industry by Georgia Tech. This is a problem-solving, pragmatic program aimed directly at overcoming industry problems which are standing in the way of company expansion and diversification. The program also involves saving jobs by helping companies in distress and assisting in creating new ventures. The problems encountered vary tremendously and may relate to any aspect of a company's business (i.e., finances, organization, management, production, sales, distribution, etc.). These activities are conducted by central office staff people and the industrial extension staff.

As some measure of the effectiveness, an analysis was made of 1972 operations of this program.

| No. of Companies Serviced | Direct Jobs Created or Saved | Project Costs | Cost per Job |
|---|---|---|---|
| 429 | 6,415 | US$251,580 | US$39.21 |

IDD cannot claim, of course, full responsibility for creating or saving all of these jobs, since the contribution of Division services varied with each company. Nevertheless, since the compilation does not include indirect jobs created or saved or multiplier factors of any sort, it is believed to represent a fair assessment of the effort in 1972.

What specifically was done? Here are a few examples.

A mobile home manufacturer in southwest Georgia requested information and assistance on plant layout and materials handling in its existing plant. During the initial visit by the IDD extension representative, it was disclosed that the company was also contemplating erecting a new plant, also for the manufacture of mobile homes. Over a period of time, the field services engineer provided the manufacturer with technical information and assistance. Partially as a result of this action, the company has increased employment at this plant by around 15 people. In addition, it has built a new plant, incorporating information provided by Georgia Tech, which will ultimately employ around 350 people. The dollar value of these expansions is estimated to amount to well over $2 million per year.

A compression molded silica brick manufacturer in Valdosta, Georgia, requested information and assistance from IDD. After a visit by a field services representative, it was disclosed that the plant had many problems involved in the production of its compression brick. Field services provided technical information on coloring brick and the process itself, as well as a general bibliography on brick making. Technical assistance was provided by an industrial extension engineer, as well as a faculty member from Georgia Tech. As a result of this information and assistance, over 30 jobs were created with resulting payrolls of over $200,000. In addition to these jobs, the company has plans for selling franchises for this process which will create approximately 650 new jobs in the Southeast. It is estimated that the eventual total value resulting from this project will be in excess of $2.5 million. The IDD technical and development library, built over a 16-year period, was the source of much of the information developed for the company.

A carpet manufacturer in Cartersville, Georgia, requested information and assistance from the industrial extension representative. This company's original problem was that it needed information on the accepted tolerances in the carpet industry, as well as information on processing wool yarn with low tensile strength. The company was not only provided information and assistance in these areas, but ultimately was provided assistance in determining standard costs of its manufacturing as well as in developing an effective plant layout. Partially as a result of the assistance provided to this company, it has expanded from a 30,000-sq. ft. building to a 120,000-sq. ft. building. When this expansion is complete, the firm will have hired an additional 50 people, which will mean an approximate $300,000 additional annual payroll for the area.

Sometimes the problems are mundane and not very technical. Not all of the Industrial Development Division's work with Georgia business and industry involves the transfer of technology or the development of new industrial operations. In fact, much of the effort is devoted to providing small, unsophisticated manufacturers with relatively nontechnical, very practical business advice and assistance. The story of Sam Spinks is a typical example. Mr. Spinks operates Legion Manufacturing Company in Dallas, Georgia, a small town of about 2,000 population. His company produces a line of plastic and cloth products made from scrap material which Mr. Spinks purchases from furniture manufacturers.

Legion Manufacturing was in trouble when Mr. Spinks contacted IDD. Although he did not know just what his trouble was, he knew that unless something was done and done immediately, the company would have to go out of business. At that time he employed 16 women only two days per week.

At the invitation of Mr. Spinks, marketing specialists from IDD visited the plant, checked the financial statements, inspected the products, discussed product styling and packaging, and before leaving this first meeting, recommended a change in manufacturing procedure.

After further study by other members of the IDD staff, it was recommended that the number of styles be reduced and restyled, that the packaging be redesigned, that the method of distribution be changed, and that a further refinement in the manufacturing process be made.

Mr. Spinks immediately put these recommendations into effect. Three months later, he called IDD to report that instead of 16 women working two days per week he was employing 60 women five days per week and that, instead of a lack of business, he was enjoying a backlog of orders totaling 800 dozen.

Another phase of IDD's technical services program is the provision of technical assistance to manufacturers who are too small to support their own engineering staffs. One such company is Southeastern Tread, a small but progressive manufacturer of tire retreading equipment in Ashburn, Georgia. The manager of this company recently sought IDD's assistance in evaluating new materials as a replacement for metal cases used on the equipment. These cases protect the mold and also insulate it during heating. Georgia Tech examined various materials and finally selected fiberglass as best for the intended use. A prototype was made. The new material offered superior protection against damage, provided better insulation, and improved the appearance of the equipment. Another unexpected benefit was the ease with which handling devices could be attached to the fiberglass. These devices cut handling time and reduced costs accordingly. With this technical assist from Georgia Tech, this small company in south Georgia is now producing an improved product line and is operating more efficiently.

The findings of a two-year research project in 1969 and 1970 in technology transfer to small industries may be of interest. This was an attempt to try various methods of technology transfer to two contrasting industries, a long

established and stable industry (upholstered furniture in North Carolina) and an emerging industry which was growing rapidly (mobile homes in Georgia). Part of the investigation concerned itself with the question of whether a rapidly growing emerging industry would be more receptive to technology transfer than an established stable industry.

The techniques tried were (1) group presentations by means of workshops, seminars, and demonstrations, (2) written materials by means of letters, copies of technical articles, circulars, or newsletters, and (3) direct personal visits and in-plant assistance. The technology transferred was a series of industry innovations (use of gangnails, urethane foam insulation, fluorocarbon resin coatings for wood cutting tools, etc.).

In this project Georgia Tech and North Carolina State University worked jointly, Georgia Tech with the mobile home industry, North Carolina State University with the upholstered furniture industry.

Some of the general findings are as follows:

(1) For various growth industry reasons, the emerging industry was no more receptive to technology transfer than the established industry. The rapidly expanding mobile home industry (25 plants in Georgia at the project beginning, 69 plants at the conclusion) was faced with more sales of an accepted product than could be produced. While quality of homes produced by some companies was questionable, the industry saw no need for innovation in techniques as long as the demand held up.

(2) There was a considerable time lag between demonstrations of a new technique and its acceptance by even a few companies. In the case of gangnails for mobile home roof trusses and other components, six months after the industry demonstrations, no companies had utilized the technique. In the next few months, seven companies began using the method.

(3) The Georgia Tech research team concluded that direct personal technology transfer and in-plant assistance was the most effective method of transferring technology to the mobile home industry. The same conclusion was reached by the North Carolina State University research team in working with the upholstered furniture industry.

(4) One of the more apparent difficulties is the determination of the individual or individuals in the industry itself to whom the technology transfer should be made. As initially perceived by the research team, the president of one company was considered an industry leader. However, he showed no predilection on his part to either seek or accept innovation. In such a case, another responsible individual in the company must be utilized for the technology transfer.

Beginning in 1964, international development activities were implemented at IDD. Initially, these activities consisted of training programs in economic development principles and techniques for Latin American development organization people. These 13-week programs were taught in Spanish or Portuguese depending on the native language of the participants. In turn, we were involved by some of the participants in the development of an applied technology unit at a university in Venezuela for a four-year period and for the last three years in Paraguay, on a rural industrial development program.

The Paraguayan project involves technology transfer in a relatively underdeveloped country and it merits some review by this group.

It began as a 20-week pilot project to generate new industry in five rural communities of Paraguay in an effort to balance the existing concentration of industry in the capital, Asuncion. Working with the Paraguayan Ministry of Commerce and Industry, it involved the organization of community development committees in each of the five communities, training of these committees and paid staff persons in a sequence of activities aimed at acceleration of industrialization in the communities.

The initial organization pilot project was followed by two years of activity. involving training programs and seminars, research on community needs, prefeasibility studies for various industrial opportunities, the identification of entrepreneurs, and the establishment of small industries during the third year of the project. It also involves utilizing the capabilities of the Productivity Center, the Ministry of Commerce and Industry, and other organizations in a coordinated effort with Georgia Tech personnel acting as catalysts.

In the last year, 21 small industries have come into being as a result of this program. These rural industries employ 890 persons and involved a total capital investment of US$2,940,000. The cost of this project at the time of the

evaluation was $87,861 (or a cost per job of $98.72). Twelve industry feasibility studies for which entrepreneurs and funding have been identified are now being completed (by Paraguayans trained by Georgia Tech) and a significant number of new plants are anticipated from these. These will considerably reduce the cost per job created of this project.

Technology transfer has been an integral part of each step of this program. It has been provided to the community development organization, to entrepreneurs in new enterprises, to existing enterprises, to national financing organizations, and to the Ministry of Commerce and Industry.

So as a result of some 14 years of technology transfer involving thousands of transfers in a micro-development effort of some magnitude, IDD has some successes to talk about. It also has some failures, naturally, and since the services and recommendations are usually free to the industry, they are sometimes ignored or not implemented. Sometimes it is too late to help a struggling company which is about to go out of business.

A.I.D. has recently provided Georgia Tech with a five-year grant to develop a center of excellence at the institution in "Employment Generation through Stimulation of Small-Scale Industry." This will include a broad program of research in small industry stimulation, a graduate program focused on the entrepreneur and small industry, the development of training programs, and a number of international conferences on the subject. It will involve a continuing relationship with at least four counterpart organizations in Asia, Africa, and South America interested in the development of small-scale industry, and we are in the process of identifying these counterparts. We also are planning to develop a comprehensive collection of case histories, small industries studies, and developing country experiences in this field for use of interested organizations.

We are obviously not theoreticians -- we are pragmatists interested in employment generation through industrialization.

In summary, based on our own limited experience, we would make these observations about the technology transfer process:

1. The needed technology is generally available for transfer. It frequently needs translation and adaptation.

2. The many small industries in every developed and developing country which need assistance constitute a sizeable market for technology.

3. The lacking ingredient is often a delivery system to effect the transfer of knowledge to the potential users.

4. We have not encountered many instances of small-scale industries being transfer agents in this process, although obviously these exist.

5. Successful technology transfer to small-scale industry is rarely an easy thing. It takes knowledge, communication, explanation, interpretation of information, implementation, continuity of program, considerable time and money, and a great deal of patience. However, where high unemployment exists, technology transfer to industry can be an important contributor to employment generation.