Employment Generation Through Simulation
of Small Industry

Volume 2

Contents:

1. Curricula Research and Development

2. Guide to International Statistical Sources and National Development Plans at the International Development Data Center

3. Guidelines for Industrial Extension Personnel

4. An International Compilation of Small-Scale Industry Definitions

5. Directory of Consultants to Small Rural Industries

6. Testing and Evaluation of Dow Chemical's Solar Stills

7. Processes, Mechanisms and Agents of Transfer to Support Technological Development

8. Analysis of Small Industry Development: Methods and Techniques
CURRICULA RESEARCH AND DEVELOPMENT

Soong Jun University
Seoul, Korea
April 21-June 8, 1974

Prepared for the
Agency for International Development

by
Herbert Eller

Georgia Institute of Technology
Atlanta, Georgia 30332
July 1974
A large number are providing the leadership and effort required for curricula improvement. They include:

- Dr. Hahn Beom
- Dr. Yoon Baek
- Dr. Kyung Chae
- Dr. Clarence
- Professor in the Engineering Department
- Professor Young-ho Lim, Mechanical Engineering Department
- Professor In Suk Choi, Economics Department
- Mr. Jang Choon Lee, Assistant Director, Integrated Development Center

These people, as well as others, provided invaluable leadership and cooperation during the author's stay in Korea.
INTRODUCTION

As part of its program of research and guidance to counterpart institutions in developing countries under the auspices of an institutional grant from the U. S. Agency for International Development, the Georgia Institute of Technology sent the author to the Republic of Korea April 21-June 8, 1974. One of his activities was to determine the need for an industrial engineering curriculum at Soong Jun University and to advise the faculty on its development.

Meetings were held with the engineering college faculty, the president and his staff, and individual educators in various departments and areas of activity. The purposes of these discussions were as follows:

1. To evaluate the status of technical education in Korea by means of conversations with personnel from the Technical Education Panel of the Ministry of Education.

2. To aid in identifying weaknesses in technical education regarding curricula, textbooks, apparatus, evaluation techniques, and teaching aids.

3. To assist individual members of the academic staff in identifying sources of information concerning the latest developments in their areas of specialization.

4. To discuss with administrators the type of technical assistance required to implement technical education improvement projects.

Curricula research activities at Soong Jun University had received impetus from two sources. First, the university president, Dr. Hahn Been Lee, is committed to the idea of making technical education at the university relevant to the real needs of urban and rural industries in Korea. The result has been the creation of an innovative spirit at the institution. In addition, the Korean Ministry of Education had requested a reduction in the number of semester hours required to earn a bachelor's degree from 200 to 146 under its experimental curriculum revision policy.

As a member of the research committee organized by Dr. Kyung-Gap Yang, Dean of the College of Engineering, to develop tentative new and revised degree programs, the author submitted a suggested industrial engineering program which would lead to a bachelor's degree. This proposed curriculum incorporated guidelines provided by Dr. Yang and Dr. Clarence E. Prince, Jr., Associate Dean of
the Engineering College, regarding core courses, humanities, science electives, and engineering electives. It is shown in this report as Exhibit A.

Based upon the suggested industrial engineering program, Dr. Yang, Dr. Prince, and the author prepared an engineering curriculum study guide for the engineering faculty to aid them in revising their respective engineering programs. In addition to a general pattern of course and credit distributions applicable to all engineering departments (Exhibit B), a detailed curriculum for an industrial engineering department, with course descriptions, was provided by the author as a sample (Exhibit C). This model was accepted by the various department heads.

At the time the author's stay at Soong Jun University was concluded, a formal request was being prepared for submission to the Ministry of Education in June for establishment of a degree program in industrial engineering. Notification of approval of new programs by the Ministry is made in December. Therefore, if approval is granted, Soong Jun University will be in a position to admit students to the new industrial engineering program for the fall semester, 1975.
STATUS OF ENGINEERING EDUCATION AT SOONG JUN UNIVERSITY

Physical Plant. The physical facilities of Soong Jun University are adequate, with few exceptions. As with most engineering departments, more equipment is desired, but good use is being made of the laboratory equipment now in place. The laboratories are very neat and the equipment is well maintained. Laboratory problems are designed to provide "hands-on" experience for the students.

Textbooks are available in Korean, Asian, and/or other editions. It is customary for students to purchase textbooks for each subject scheduled. Library facilities are available. However, there is a shortage of up-to-date reference books, handbooks, journals, and other related publications.

Research work is limited. The laboratories, in general, are not adequately equipped for sophisticated research. However, the university does not have doctorate programs, which usually require elaborate apparatus for research activities.

Curriculum. Bachelor of Engineering degrees are offered in electrical, electronics, chemical, mechanical, and textile engineering. An industrial education program has been approved. A formal request is being prepared to be submitted to the Ministry of Education for a degree program in industrial engineering. The quota of new students that can be admitted each year is fixed by the Ministry of Education.

Entrance Requirements. To qualify for entrance to the university, students must have graduated from high school, pass the national college entrance examination, and pass an entrance examination administered by Soong Jun University. Final selection is made on the basis of competitive entrance examinations and a personal interview.

Faculty. A number of the faculty members have either a master's degree or Ph.D. in their respective teaching fields. A number of them have received their training in universities in the United States and Seoul National University. Efforts are being made to involve more faculty members in industrial activities for the purpose of gaining practical experience.
SOONG JUN UNIVERSITY'S OPPORTUNITY TO MEET
TECHNICAL EDUCATION NEEDS IN KOREA TODAY

It is a fact recognized by officials of the Korean Government who are concerned with technical education, by governmental employers of engineering graduates, by private employers, and by outside observers that Korea needs a large number of engineers and technologists of the type that should be trained in applied programs. However, technical education presently consists primarily of high-level theoretical programs or of substandard programs with too little emphasis on laboratory training. The training now being given often does not equip the students to assume their proper role in meaningful employment after receiving their degree or diploma. Therefore, economic inputs into improving technical education could yield positive returns to the Korean economy.

It is believed that Soong Jun University could provide an extremely useful service to the Seoul community by making selected programs available during the evening to persons who are working but would like to further their education and training. Technician training programs as well as degree programs should be considered. These programs could make an initial impact and have a continuing impetus toward improving technical education to help meet Korea's needs for engineers and technicians.

The curricula research activities being performed at Soong Jun University can play an important part in bringing about a reemphasis upon technical education. Since Ministry of Education approval is required for new degree programs, it seems desirable that Soong Jun University work closely with any organization which advises the Ministry of Education on technical education improvement programs. It is felt that an organization comprising responsible Korean educators should make the final decision regarding the priority of technical education improvement programs. Different organizations or committees might be named for various disciplines, i.e., science, engineering, and technology.

Educational improvements at Soong Jun University would provide a standard of excellence that could serve as a guide to many other educational institutions at various levels in future efforts to upgrade their quality of training. Obviously, these institutions also would need a great deal of financial assistance and expert advice; in order to provide this assistance, Soong Jun University would need funding. Since many proposals for technical education programs are
submitted annually for approval, it might be advisable to convene a panel to
review and approve worthy projects. Panel members might be selected from vari-
ous existing organizations, such as societies for technical educators and coun-
cils for technical education. The selection of a proposal by such a panel
should be tantamount to receiving budget support by the budgeting agency of the
central government.

In the field of industrial engineering specifically, the establishment of
such a program at Soong Jun University would, through applied training, provide
the type of technological graduates needed in Korea's growing industrial sector.
The number of industrial engineering graduates in Korea is very small. Thus
far, the universities now offering industrial engineering programs have gradu-
ated only a few students.

There are a number of problems facing Korea's managers today. Graduate
students at the Korean Advanced Institute of Science enumerated and evaluated
some of the more urgent problems in a survey conducted by Professor John Frost,
invited lecturer. A report of the survey results is reproduced as Exhibit D
and summarized as follows:

When asked what problems management will be required to face during the
next five to ten years in Korea, the students gave responses which fell into
seven subject areas.

(1) Higher wage demands through union pressure
(2) Shortage of management and technical skills
(3) Increased domestic and foreign competition
(4) Shortage of natural resources
(5) Social and political constraints
(6) Ecological restraints -- air and water pollution
(7) Financial constraints.

Analysis of these problems serves to reinforce the need for an applied
industrial engineering program such as the one planned at Soong Jun University.
The study of this discipline emphasizes development of the student's abilities
to analyze, design, and implement systems that integrate technical, economic,
and social behavior factors in industrial, service, social, and government
organizations. Thus, trained industrial engineers can render vital assistance
to the country in coping with these problems.
A further need is for increased practical assistance to industry from academe. At Soong Jun, the establishment of the Integrated Development Center has provided the various departments of the university with a technical assistance delivery system potential which should be encouraged, financially supported, and implemented.
Exhibit A
SUGGESTED INDUSTRIAL ENGINEERING PROGRAM
INTRODUCTION

Industrial Engineering provides both a basic engineering foundation and a grounding in the interactions between technology and management. Students in the program are usually interested in obtaining a fundamental engineering background as the basis for professional specialization in activities associated with the field -- work methods and standards, management control systems, management science, organization, planning -- or as a preparation for other endeavors such as management. The study of industrial engineering places emphasis upon developing the students' abilities to analyze, design, and implement systems that integrate technical, economic, and social-behavior factors in industrial, service, social, and governmental organizations.
### INDUSTRIAL ENGINEERING COURSE OUTLINE

#### First Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>Korean</td>
<td>3</td>
</tr>
<tr>
<td>First Semester English</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science</td>
<td>4</td>
</tr>
<tr>
<td>Graphics</td>
<td>2</td>
</tr>
<tr>
<td>M.T. &amp; P.E.</td>
<td>2</td>
</tr>
</tbody>
</table>

19

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics</td>
<td>2</td>
</tr>
<tr>
<td>Korean</td>
<td>3</td>
</tr>
<tr>
<td>Second Semester English</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science</td>
<td>4</td>
</tr>
<tr>
<td>Engineering Computations</td>
<td>2</td>
</tr>
<tr>
<td>M.T. &amp; P.E.</td>
<td>2</td>
</tr>
</tbody>
</table>

19

#### Second Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>First Semester Engineering Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>2</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
</tbody>
</table>

17

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Measurement</td>
<td>3</td>
</tr>
<tr>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>Second Semester Thermodynamics</td>
<td>2</td>
</tr>
<tr>
<td>Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Economy</td>
<td>2</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
</tbody>
</table>

16
### Third Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>Strength of Materials</td>
<td>2</td>
</tr>
<tr>
<td>Wage and Salary Administration</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Elective</td>
<td>3</td>
</tr>
<tr>
<td>Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

| Accounting and Cost Accounting      | 3            |
| Bible                               | 2            |
| Engineering Elective                | 3            |
| Manufacturing Processes             | 3            |
| Science Elective                    | 3            |
| Humanities Elective                 | 3            |
| M.T.                                | 1            |
|                                     | **18**       |

### Fourth Year

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental Elective</td>
<td>3</td>
</tr>
<tr>
<td>Project Planning and Control</td>
<td>3</td>
</tr>
<tr>
<td>Production and Inventory Control</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Elective</td>
<td>3</td>
</tr>
<tr>
<td>Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

| Plant Layout and Materials Handling    | 3            |
| Industrial Safety                     | 3            |
| Management Decision Making            | 3            |
| Engineering Elective                  | 3            |
| Seminar                                | 2            |
| Humanities Elective                    | 3            |
| Free Elective                          | 3            |
|                                       | **20**       |

| Total                                  | **146**      |

**Note:** Core courses are underlined.
Note: An industrial engineering student wishing to minor in another field would use the engineering and science electives to schedule at least 21 credit hours in the other department.

SUGGESTED ENGINEERING ELECTIVES FOR INDUSTRIAL ENGINEERING MAJORS

Finance
Marketing
Human Factors in Engineering
Statistics II
Personnel and Labor Relations
Modern Trends in Management
Synthetic Work Measurement
Dynamics of Machinery
Industrial Machinery
Machine Design
Fluid Mechanics

CORE COURSES

Engineering Economy
Engineering Mechanics
Strength of Materials
Computer Science
Thermodynamics

INDUSTRIAL ENGINEERING COURSES REQUIRED FOR INDUSTRIAL ENGINEERING MINOR

<table>
<thead>
<tr>
<th>Course</th>
<th>Class</th>
<th>Lab</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Industrial Engineering</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Work Measurement</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Statistical Quality Control</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Plant Layout and Materials Handling</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Economy</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Management and Decision Making</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Project Planning and Control</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Students desiring to double major in Industrial Engineering should satisfy the course content of the Industrial Engineering curriculum.
ABSTRACT

A general pattern of course and credit distributions for engineering departments has been formulated. It should be possible for each department to fit its requirements into this pattern.

Included is a sample curriculum worked out for an industrial engineering department.

Under this plan, engineering students will not have to decide on a major until the end of the freshman year. With wise planning and guidance, it may be possible in some cases to delay final choice of major or minor until the end of the sophomore year.

Total credits are 140-146. This curriculum would meet Engineering Council for Professional Development requirements in the USA. Slightly more humanities courses are in this curriculum at Soong Jun due to various special needs.

An important feature is the elective freedom offered to the student. He may or may not have a minor, which could be in any University department. Double-degrees would be possible only with 1-2 more semesters, however.
### GENERAL COURSE STRUCTURE

#### Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>Korean</td>
<td>3</td>
</tr>
<tr>
<td>English</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science</td>
<td>4</td>
</tr>
<tr>
<td>Graphics</td>
<td>2</td>
</tr>
<tr>
<td>P.E./M.T.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics</td>
<td>2</td>
</tr>
<tr>
<td>Korean</td>
<td>3</td>
</tr>
<tr>
<td>English</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science</td>
<td>4</td>
</tr>
<tr>
<td>Engr. Computations</td>
<td>2</td>
</tr>
<tr>
<td>P.E./M.T.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

#### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Core</td>
<td>2</td>
</tr>
<tr>
<td>Engr. Core</td>
<td>2</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Math Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Core</td>
<td>2</td>
</tr>
<tr>
<td>Engr. Core</td>
<td>2</td>
</tr>
<tr>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

#### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>LAB</td>
<td>1</td>
</tr>
<tr>
<td>Engr. Core</td>
<td>2</td>
</tr>
<tr>
<td>Phys. Sc. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elective</td>
<td>3</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>LAB</td>
<td>1</td>
</tr>
<tr>
<td>Dept. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective (Optional)</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elec.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

#### Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>LAB</td>
<td>1</td>
</tr>
<tr>
<td>Dept. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elec.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>Dept. Course</td>
<td>3</td>
</tr>
<tr>
<td>LAB</td>
<td>1</td>
</tr>
<tr>
<td>Dept. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engr. Elective</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Elec.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

-15-
# GENERAL COURSE AND CREDIT DISTRIBUTIONS

<table>
<thead>
<tr>
<th>Area</th>
<th>Year</th>
<th>Subtotal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Liberal Arts and Religion:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bible</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>b. English 1, 2</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>c. Korean 1, 2</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>d. Ethics</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>e. Math 1, 2</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>f. Humanities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>9</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>g. P.E./M.T.</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>II. Free Electives (Any Dept. - Optional):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FE-1</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>b. FE-2</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>III. Required Engineering Sciences:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Physics</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>b. Chemistry</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>c. Phys. Sc.</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>d. Phys. Sc.</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>e. Math</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>f. Math Elective</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>g. Graphics</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>h. Engr. Computations</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>IV. Engineering Core Courses:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. EC-1</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>b. EC-2</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>c. EC-3</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>d. EC-4</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>e. EC-5</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>f. EC-6</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

-16-
## GENERAL COURSE AND CREDIT DISTRIBUTIONS (continued)

<table>
<thead>
<tr>
<th>Area</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Subtotal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Required Electives: (Major or Minor Dept.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. RE-1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>b. RE-2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. RE-3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. RE-4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| VI. Dept. Required Courses: |   |   |   |   |         |       |
| a. D-1 | 3 |   |   |   |         | 12    |
| b. D-2 | 3 |   |   |   |         |       |
| c. D-3 | 3 |   |   |   |         |       |
| d. D-4 | 3 |   |   |   |         |       |
| e. D-5 | 3 |   |   |   |         |       |
| f. D-6 | 3 |   |   |   |         |       |
| g. D-7 | 3 |   |   |   |         |       |
| h. D-8 | 3 |   |   |   |         |       |
| i. D-9 | 3 |   |   |   |         |       |
| j. D-10 | 3 |   |   |   |         |       |
| k. Lab-Seminar-Independent Study | 2 | 2 |   |   |         | 34    |

| VII. Required Departmental Electives: |   |   |   |   |         |       |
| a. DE-1 | 3 |   |   |   |         | 6     |
| b. DE-2 | 3 |   |   |   |         |       |

**Totals**

- Liberal Arts/Religion: 52
- Free Electives: 6
- Required Engineering Sciences: 24
- Engineering Core: 12
- Required Electives (major/minor): 12
- Department Required: 34
- Department Electives: 6
- **Total: 146**
GENERAL NOTES

I. By the end of the Junior year, a student must have taken:
   a. 6 out of 8 Engineering Core Courses (see list below)
   b. 2 Physical Science Electives
   c. 1 Mathematics Elective

II. Free Electives may be taken in any department or omitted entirely by the student.

III. Required Electives may be taken from any university department.

IV. For a Minor, plan as follows:
   a. Required Electives - 4 for 12 credits
   b. Free Electives - 2 for 6 credits
   c. Department Electives - 1 for 3 credits

   21 credits*

V. A Second Major should be possible in an extra semester or two by satisfying the requirements of the two departments on an individual basis as courses can be scheduled. An Advisor from each department will be needed.

VI. It is suggested that no more than 4 Humanities Electives be taken in any single department. A list of approved Humanities Electives will be prepared.

VII. Each Engineering Department should fit its own curriculum requirements to this general pattern and make recommendations on sequence of courses and suggest engineering core and physical science courses.

   A typical course pattern would be developed for each department, but be flexible.

VIII. This curriculum pattern makes possible an Engineering Technology (4-year) option.

   The required electives, etc., can be devoted to this. (It would, however, be more demanding than usual due to course overlap with the 4-year engineering students.)

* The department heads are recommending that non-IE students use these 21 credit hours of engineering electives to obtain a "Minor" in Industrial Engineering.
Exhibit C
THE INDUSTRIAL ENGINEERING DEPARTMENT
(Sample Curriculum)
INTRODUCTION

Industrial Engineering provides both a basic engineering foundation and a grounding in the interactions between technology and management. Students in the program are usually interested in obtaining a fundamental engineering background as the basis for professional specialization in activities associated with the field -- work methods and standards, management control systems, management science, organization, planning -- or as a preparation for other endeavors such as management. The study of industrial engineering places emphasis upon developing the students' abilities to analyze, design, and implement systems that integrate technical, economic, and social-behavioral factors in industrial, service, social, and governmental organizations.
## INDUSTRIAL ENGINEERING DEPARTMENT
(140-146 Credits)

### Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bible</td>
<td>2</td>
<td>Ethics</td>
<td>2</td>
</tr>
<tr>
<td>Korean</td>
<td>3</td>
<td>Korean</td>
<td>3</td>
</tr>
<tr>
<td>English</td>
<td>3</td>
<td>English</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
<td>Math</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>4</td>
<td>Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Graphics</td>
<td>2</td>
<td>Engr. Computations</td>
<td>2</td>
</tr>
<tr>
<td>P.E./M.T.</td>
<td>1</td>
<td>P.E./M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D-1) Introduction to I.E.</td>
<td>3</td>
<td>(D-2) Work Measurement</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
<td>(Math E.) Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>(EC-1) Dynamics</td>
<td>2</td>
<td>(EC-3) Thermodynamics</td>
<td>2</td>
</tr>
<tr>
<td>(EC-2) Computer Science</td>
<td>2</td>
<td>(EC-4) Engr. Economics</td>
<td>2</td>
</tr>
<tr>
<td>(H.E.) Principles of Economics</td>
<td>3</td>
<td>H.E.</td>
<td>3</td>
</tr>
<tr>
<td>H.E.</td>
<td>3</td>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>M.T.</td>
<td></td>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D-3) Quality Control</td>
<td>3</td>
<td>(D-5) Accounting &amp; Costs</td>
<td>3</td>
</tr>
<tr>
<td>(D-4) Wage/Salary Admin.</td>
<td>3</td>
<td>(D-6) Manufacturing Processes</td>
<td>3</td>
</tr>
<tr>
<td>(EC-5) Strength of Mat'ls.</td>
<td>2</td>
<td>(EC-6) Electric Circuits</td>
<td>2</td>
</tr>
<tr>
<td>(RE-1) Engr. Elec.</td>
<td>3</td>
<td>(RE-2) Engr. Elec.</td>
<td>3</td>
</tr>
<tr>
<td>H.E.</td>
<td>3</td>
<td>Bible</td>
<td>2</td>
</tr>
<tr>
<td>M.T.</td>
<td>1</td>
<td>M.T.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>
## Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D-7) Project Planning/</td>
<td>3</td>
<td>(D-9) Plant Layout-Mat'ls.</td>
<td>3</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>Handling</td>
<td></td>
</tr>
<tr>
<td>(D-8) Production/Inventory</td>
<td>3</td>
<td>(D-10) Management Decision</td>
<td>3</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>Making</td>
<td></td>
</tr>
<tr>
<td>(DE-1) Dept. Elec.</td>
<td>3</td>
<td>(DE-2) Dept. Elec.</td>
<td>3</td>
</tr>
<tr>
<td>(RE-3) Engr. Elec.</td>
<td>3</td>
<td>(RE-4) Engr. Elec.</td>
<td>3</td>
</tr>
<tr>
<td>Free Elec.</td>
<td>3</td>
<td>Free Elec.</td>
<td>3</td>
</tr>
<tr>
<td>LAB Seminar</td>
<td>2</td>
<td>LAB Seminar</td>
<td>2</td>
</tr>
<tr>
<td>H.E.</td>
<td>3</td>
<td>H.E.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>20 (17)</td>
<td></td>
<td>20 (17)</td>
</tr>
</tbody>
</table>
I. Suggested Engineering Electives for I.E. Majors (not in priority):
   a. Finance
   b. Marketing
   c. Human Factors in Engineering
   d. Statistics II
   e. Personnel and Labor Relations
   f. Modern Trends in Management
   g. Synthetic Work Measurement
   h. Dynamics of Machinery
   i. Industrial Machinery
   j. Machine Design
   k. Fluid Mechanics
   l. Industrial Safety

II. Suggested Engineering Core Courses:
   a. Engineering Economics
   b. Engineering Mechanics (Dynamics)
   c. Strength of Materials
   d. Computer Science
   e. Thermodynamics
   f. Electric Circuits

III. An I.E. student wishing to minor in another field would use the engineering, free, and other electives to schedule at least 21 hours in the other department.

IV. Industrial Engineering courses required for an I.E. Minor:

<table>
<thead>
<tr>
<th>Course</th>
<th>Class</th>
<th>Lab</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to I.E.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Work Measurement</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Statistical Quality Control</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Plant Layout/Materials Handling</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Economics</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Management and Decision Making</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Project Planning/Control</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>6</td>
<td>21 credits</td>
</tr>
</tbody>
</table>

V. Students desiring to double major in I.E. should satisfy the course content of the I.E. curriculum.
# Industrial Engineering

A List of Course Titles and Suggested Textbooks

(Equivalent substitutes should be chosen if suggested text is not available)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Titles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting and Cost Accounting</td>
<td>Grant and Bell, <em>Basic Accounting and Cost Accounting</em></td>
</tr>
<tr>
<td>Business Law</td>
<td>Lusk, <em>Business Law, Principles and Cases</em>, Irwin</td>
</tr>
<tr>
<td>Finance</td>
<td>Weston and Brigham, <em>Essentials of Managerial Finance</em>, Holt, Rinehart, and Winston</td>
</tr>
<tr>
<td>Industrial Safety</td>
<td>Simonds and Grimaldi, <em>Safety Management</em>, (Richard D. Irwin, Inc.)</td>
</tr>
<tr>
<td>Management Decision Making</td>
<td>Thieraut, <em>Decision Making Through Operations Research</em></td>
</tr>
<tr>
<td>Motion and Time Study</td>
<td>Niebel, <em>Motion and Time Study</em></td>
</tr>
<tr>
<td>Personnel and Labor Relations</td>
<td>Strauss and Savies, <em>Personnel, The Human Problems of Management</em></td>
</tr>
</tbody>
</table>
James M. Apple, Lab Manual for Plant Layout, (Ronald Press)

Hailstone and Brennan, Economics

Grant, E. L., and W. Grant Ireson: Principles of Engineering Economy


Sartain: Psychology: Understanding Human Behavior

William Voris, Production Control, 3rd Edition

Hughes and Grawoig, Linear Programming, Vol. No. 1


Broom and Longenecker, Small Business Management, Southwestern, 1966

Juran and Gryna, Quality Planning and Analysis


Patton, Littlefield, and Self: Job Evaluation

Karger and Bayha, Engineered Work Measurement
TOPIC OUTLINES

Topic outlines are provided for reference for the following courses:

1. Principles of Psychology
2. Principles of Management
3. An Introduction to Industrial Engineering Technology
4. Motion and Time Study
5. Accounting and Cost Accounting
6. Data Processing
7. Finance
8. Marketing
9. Engineering Psychology (Human Factors Engineering)
10. Wage and Salary Administration
11. Statistics I
12. Personnel and Labor Relations
13. Production and Inventory Control
14. Statistical Quality Control
15. Business Law
16. Project Planning and Control
17. Modern Trends in Management
18. Principles of Engineering Economy
19. Statistics II
20. Plant Layout and Material Handling
21. Small Business Management
22. Management Decision Making
23. Industrial Safety
24. Work Measurement
25. Principles of Economics

In cases where the recommended text is not available, the topic outline should be helpful in selecting a substitute text.
Text: Sartain: Psychology: Understanding Human Behavior

Objectives: By developing personality theories, the psycho-physiological system, theories of perception and learning, and the social and cultural factors which help to determine the above, the student should be prepared to use this knowledge in areas of human relations, child rearing, and Industrial applications such as psychological testing.
TOPIC

Introduction to Psychology
Psychology and the other Sciences
Introduction to Personality Theories
Type Theories
Learning Theory
Holistic Approach
First Quiz
Psychoanalytic Theory
Psycho-Sexual Development
Oral Character
Anal Character
Phallic Character
The Mental Structure
Id and Ego
Super-Ego and Ego Ideal
Personal Defense
Reaction Formation
Neurotic Reactions
Psychotic Reactions
Second Quiz
Motivation
Subjective Needs and Drives
Objective Incantives
Theories of Motivation
Emotions
Attitudes, Beliefs, and Prejudice
Ideology and Propaganda
Personality and Society
Personality and Culture
Cultural Differences
The American Personality
Third Quiz
Heredity
Chromosomal Errors
Mutations
Genetic Models
Dominance and Recessive Traits
The Environment
Physiological Factors and Behavior
The Central Nervous System
The Glandular System
The Senses
Vision and Cutaneous
Other Senses
Perception
Conditioning
Association
Personality Tests
Aptitude Tests
Last Test
IM Principles of Management


An introduction to the principles of organization for non-industrial engineering technology students. The basic factors involved in the organization and operation of a business enterprise are studied.

SUBJECT UNDER DISCUSSION

Introduction
Case Usage
Management Defined
Development of Management Concepts
Objectives and Ethics

Planning
Planning for Profit
Planning for Sales
Planning for Production
Management Information Systems
Decision Making

Organization Theory
Organization Structure
Organization Relationships
Organizational Processes
Committees
Organizational Analysis

Leadership Patterns
Communications
Motivation
The Supervisor
Personnel Planning and Policies
The Basis of Control
Budgetary Control
Nonbudgetary Control
Comprehensive Case Example
Conclusion and Review of the Course
SUBJECT

IE An Introduction to Industrial Engineering Technology

A study of the relationships of the industrial engineering technician with the profit-making enterprise. Emphasis is placed on organizational principles, the functions of the major departments of an enterprise, and practices in manufacturing processes and production methods.

OBJECTIVE

To acquaint the student with the field of Industrial Engineering Technology and its relationship with the profit-making enterprise and the field of Industrial Engineering.

TEXT

Richard C. Vaughn, *Introduction to Industrial Engineering* (Iowa State University Press)
SUBJECT UNDER DISCUSSION

Introduction
The Engineering Technician
Curriculum Orientation
Founders of Industrial Engineering
Forms of Business Enterprise
Industrial Organization
The Role of the I.E. Technician
Plant Location
Manufacturing Engineering
Plant Layout
Material Handling
Packaging
Law
Accounting
Value Engineering
Engineering Economy
Statistics
Properties of Data
The Normal Curve
Probability
Statistical Quality Control
Production Control
Project Control
Purchasing
Inventory Control
Job Evaluation
Motion Study
Time Study
Industrial Relations
Sales Engineering
The IET and Industry
Job Opportunities
IET Student Development
Review
SUBJECT

IE     Motion and Time Study

An introduction to the field of Motion and Time Study. The preparation and use of process charts. Micromotion study and the principles of motion economy are studied. MTM-2 is covered as a means of synthetic time study and as a tool for methods improvement. Time study is covered in sufficient detail to allow the student to become productive in this area with minimum training from his employer.

OBJECTIVES

To acquaint the students with the mechanics of motion and time study.
To give an understanding of the human relations problems involved.

TEXT

Niebel, Motion and Time study.
TEXT: Niebel, *Motion and Time Study* (A) required
       Barnes, *Motion and Time Study* (B) reserve
       IE Handbook (C) reserve
       Krick, *Methods Engineering* (D) reserve

TOPIC

Introduction
Definition
Process Charts
Operation Analysis
LH-RH Charts
Man-machine Charts
Multiple Activity
Term Project Explanation
Therbligs-Motion Study
Therblig Application
Motion Economy
Micromotion Study
And in Return
Time Study
Rating
Allowances
Making a Time Study
Standard Time
Introduction to MTM
Term Project Work Time
Work Sampling
Turn In Term Project
<table>
<thead>
<tr>
<th>Week</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Process Charts</td>
</tr>
<tr>
<td>2</td>
<td>LH-RH Charts</td>
</tr>
<tr>
<td></td>
<td>Multiple Activity Charts</td>
</tr>
<tr>
<td>3</td>
<td>Man-Machine Charts</td>
</tr>
<tr>
<td>4</td>
<td>Therblig Application-Micromotion</td>
</tr>
<tr>
<td>5</td>
<td>Time Study-Rating</td>
</tr>
<tr>
<td>6</td>
<td>Time Study-Data Collection</td>
</tr>
<tr>
<td>7</td>
<td>MTM Lab</td>
</tr>
<tr>
<td>8</td>
<td>Work Sampling</td>
</tr>
<tr>
<td>9</td>
<td>Final Report</td>
</tr>
</tbody>
</table>
I.M. Accounting and Cost Accounting

Basic concepts of accounting, including problems concerning: expense and income accounts; accounting periods adjustments regarding periodic costing of goods, handling of promissory notes and accruals, deferred charges and credits including the cognizance of handling each of the prementioned charges and credits: the basic understanding of financial statements (actual exhibits), cost accounting including the following: (a) basic objectives; (b) job order costing; process order costing; IME's; and the using of Lifo, Fifo and average costing with problems using the aforementioned.

OBJECTIVES

To bring a non-accounting major to a working knowledge, in a brief period of time, to the working principles of the handling of basic concepts, in the field, with the ability to adapt to the workings of all major acceptions for understanding and principles of the given material in any time Industrial Industry.

TEXT

Grant and Bell, Basic Accounting and Cost Accounting.
COURSE OUTLINE

BASIC ACCOUNTING AND COST ACCOUNTING

IET

1. Introduction: Definitions and Reasons for Subject Matter
2. Basic Concepts: Balance Sheet Viewpoints, owner's equity
3. Basic Concepts: Balance Sheet Viewpoints, Corporation Foundation
4. Limitations of Accounting Valuations--asset valuations
5. Debits and Credits--including illustrations
6. Accounting Terminology--Accural Accounting, Changes in ownership
7. Asset and Expense--timing aspect
8. Trial Balance and determining profit or loss for accounting period
9. Expense and Income Accounts--perpetual inventory
10. Expense and Income Accounts--Cost of goods
11. Closing of the books for an Accounting Period: Problem 3-1
12. Problems 3-5, 3-6, individual student assistance
13. Introduction of end of period adjustments
14. Extension of end of period adjustments, periodic inventory--cost of goods
15. Extension of end of period adjustments accrued aspect--sales returns and allowances
16. Extension of end of period adjustments ten-column worksheet illustration
17. Deferred charges and credits
18. Bad debts and sales discounts, depreciation
19. Problems 7-1, 7-2
20. Problem 7-3
21. Review of Quiz
22. Study of Financial Statement-Actual company reports
23. Study of Financial Statement--Actual company reports, par and no par stock; use of ratios and comparisons

24. Study of Financial Statement--Actual company reports, conservatism and disclosure; consistency in reporting

25. Objectives of Cost Accounting--Basic principles

26. Objectives of Cost Accounting--cost control-effects and methods

27. Cost Accounting--conflicts between objectives; distinction between selling and using manufacturers costs

28. Cost Accounting--methods of applying burden for IME's; inventory accounts

29. Job Order Costing--techniques and illustrations

30. Job Order Costing--techniques and illustrations

31. Problem 10-4 Review for quiz

32. Theory section of material on Chapters 8-9-10

33. Problem section of material on Job Order

34. Review of Quiz

35. Process costing introduction--distinction between job order and process cost

36. Illustration of Process Costing

37. Illustration of Process Costing

38. Disposition of overhead variance--departmental use

39. Treatment in cost accounting of partly completed work units

40. Material costs--Average cost; Lifo, Fifo-advantages and disadvantages

41. Material costs--Illustrations using various methods

42. Standard costs--unit variation analysis

43. Review for Final

44. Final Examination
SUBJECT

IE DATA PROCESSING

The study of industrial data processing methods. Emphasis is placed on equipment used, equipment selection, and the development of preferred methods of data processing.

OBJECTIVE

To give the student a survey of punched card and electronic data processing equipment and methods, with emphasis on the systems approach to developing methods, the factors that influence the selection of methods and equipment and the problems associated with the installation of new methods and equipment.

TEXT

Computers in Business, Donald H. Sanders

The following books are on reserve in the library:

(LA) Data Communication in Business, Edgar C. Gentle
(LC) Business Information Processing Systems, Elliott and Wasley

Introduction and Information
Data Processing and Evolution

Information Revolution
Introduction to Computers

Input/Output Media and Devices
Input/Output Media and Devices

Data Transmission
Central Processing Unit
Numbering Systems

Storage Devices
Multi-machine Configurations

Programming Analysis
Flow Charts
Program Preparation

Computer Languages
Program Coding
Program Controls

Management and Computers
Systems Study

Organization
Staffing and Control
Tomorrow's Outlook

Records Retention Studies
Vital Records Studies
A study of the finance function of the firm, with attention directed to the corporate tax environment, financial planning of the firm, and capital budgeting. Also included in the study will be the long investment decisions of the enterprise, and how the concept of present worth and internal rate of return will influence financial decisions. A thorough treatment of the financial structure of the firm and the use of leverage as related to the cost of capital will serve to demonstrate to the student how the concept of debt can be used to increase the value of the firm. Working capital management and the various forms of long term financing, such as common and preferred stock, will also be discussed.

It is a survey of the whole field of finance, both private and public. Emphasis is placed on current problems in the field as well as on basic principles developed from past experiences.

Weston and Brigham, Essentials of Managerial Finance, Holt, Rinehart, and Winston
TOPICS

The Finance Function
Role of Financial Decisions
Tax and Expenditure Patterns
Corporate Income Taxes
Personal Income Taxes
Types of Financial Ratios
Break-Even Analysis
Source and Use of Funds
Budgeting
Cash Budgeting
Quiz
Compound Value
Present Value
Appropriate Interest Rate
Choosing Among Alternative Proposals
Ranking Investment Proposals
Theory of Financial Leverage
Factors Influencing Financial Structure
Capitalization of Income
Definitions of Value
Debt Capital
Preferred Stock
Cost of Equity
Marginal Cost of Capital
Quiz
Working Capital Management
Security Markets
Nature of Investment Banking
Common Stock Financing
Nature of Preferred Stock
Convertible Preferred Stock
Quiz
SUBJECT

Marketing

This course is an introduction to the individual and the business firm as customers; their needs, and methods of arriving at needs, satisfying decisions, and an introduction to the marketing function, also its organization, decision areas, and control techniques.

OBJECTIVES

The student should become acquainted with the organization of the marketing function, the tasks it performs, the decisions it makes, and the psychological and organizational nature of the customer and methods of stimulating and satisfying customer needs.

TEXT

McCarthy, Basic Marketing: A Managerial Approach (Irwin)
TOPICS

The Marketing System
The Management Job in Marketing
Legal Environment of Marketing
Marketing Research
Developing Industry Sales Forecasts
Forecasting Sales for Established Products
Consumer Spending Patterns
Consumer Behavior is Multidimensional
Consumers--The International Market
Consumers--A Behavioral Science View
Methods of Industrial Buying
The Farm Market
The Government Market
Product Situations
What is Packaging?
The Development of Branding
Conditions Favorable to Branding
Consumer Goods
Industrial Goods
Product Planning
Product Life Cycles
Style and Fashion Cycles
Channels of Distribution
The Transporting Function
The Storing Function
Basic Promotion Methods
Typical Promotion Blends
Price and Price Objectives
SUBJECT

IE Engineering Psychology (Human Factors Engineering)

An Introduction to Human Factors Engineering covering man's physical (mechanical) operation, as well as the best way to design man-machine systems to take advantage of man's capabilities and limitations. This includes the study of seating, controls, displays, and industrial applications of human factors data.

OBJECTIVE

To enhance the effectiveness of the use of the physical objects and facilities people use and to maintain or enhance certain desirable human values in the process.

TEXT

McCormick, Human Factors Engineering, 3rd Edition
TOPIC

Introduction
Man Machine Systems
Human Sensory Processes
Information Input
Information Mediation
Methods of Investigation
Arrangement of Space
Anthropometry
Work Capacity of Females
Environmental Factors
Physiological Measures
Heat Stress
Displays
Controls
Review
SUBJECT

IE    Wage and Salary Administration

An Introduction to Wage and Salary. Subject matter emphasized includes principles and policies, job evaluation, pricing jobs, methods of wage payment and special compensation devices.

OBJECTIVES

To enable the student to acquire a general knowledge of compensation theory and compensation practice. To develop proficiency in analysis and evaluation of wages and salary compensation, theory, and practices insofar as they relate to individual employees, unions, employing organizations, governments - in fact, our entire economy.

TEXT

Patton, Littlefield, and Self: Job Evaluation
TOPIC

Introduction
Purpose of Evaluation
Planning a Program
Union Relations
Job Analysis
Job Description
Ranking
Factor Comparison
Point Rating
Executive Position
Selection of a Method
Evaluation Process
Catch-Up Day
Surveys
Wage Curves
Committees
Administration
Coordination (Projects Due)
Coordination
Review and Catch-up
SUBJECT

IE Statistics I
Prerequisites: Analytic Geometry and Calculus, Computer Programming

An introduction to descriptive and inductive statistics with emphasis placed on inductive statistics. Frequency distributions, measures of location and variation, probability, estimation, and tests of hypothesis are covered.

OBJECTIVES

To introduce the student to the fundamentals of statistics, particularly basic inductive and deductive techniques, and the basic tools of statistical analysis.

TEXT


**TOPIC**

Sets and Functions
Probability Theory

Probability Distributions
Special Distributions

Freq. and Sampling Distri.

Estimation

Hypothesis Testing

Bayesian Inference
SUBJECT: IM - Personnel and Labor Relations

OBJECTIVES:

To suggest to the student systematic and scientific approaches to management in areas of personnel and labor relations.

TEXT:

Personnel, The Human Problems of Management, Strauss and Savies
IMT Personnel and Labor Relations

SUBJECT

Collective Bargaining in America
The Organized Labor Movement
Negotiating the Labor Agreement
Technology and Job Satisfaction
Motivating People to Work
The Exercise of Authority
Developing Group Participation
Why Communications Break Down
Overcoming Barriers to Communication
Types of Discipline
The Role of the Union in Discipline
Specialization and Job Satisfaction

The Internal Organization of the Union
The Organization of Credit Unions
The Organization of Industrial Unions
Specialization and Job Satisfaction
Basic Patterns of Lateral Relations
Organizational Implications of Increased Specialization
Specialization and the Foreman's Role
Building Integrated Work Teams
Improving Coordination Between Groups
The Meaning of Decentralization
Personality and Organization Structure
Power Levels of Supervision

Aspects of Wage and Salary Administration
Job Evaluation
The Point System
Wage and Salary Policy Problems
Merit Rating
The Impact of Incentive Systems
Auxiliary Incentive Plans
The Future for Incentives
Group Piece-work
Profit-Sharing
Suggestion Systems
The Scanion Plan
The Contemporary Scene: How Much Human Relations?
SUBJECT

IE Production and Inventory Control

The traditional functions and responsibility of production control are covered during the first part of the course. A review of matrix algebra is covered in order to give the student a background for Linear Programming. Twelve class periods are used to introduce the student to the Simplex technique of Linear Programming. The basic concepts of Inventory Control are presented.

The class is assigned the problem of designing a production control system for an actual plant to determine the problems that exist. The students then design a production control system to fit the conditions of that plant. When such a problem is available it is used in lieu of Linear Programming. During the past quarter, Fall, 1972, a production control system was designed for Marvend, Inc., Marietta Georgia.

OBJECTIVES

The student becomes acquainted with the functions and techniques of production control. The student is introduced to Linear Programming and the basic models of Inventory Control.

TEXT

A. William Voris, Production Control, 3rd Edition

B. Hughes and Grawoig, Linear Programming, Vol. No. 1
TEXT: (A) Voris, William: Production Control, 3rd Edition
(B) Hughes and Grawoig: Linear Programming, Vol. No. 1

TOPIC

Introduction to Production Control
Objectives and Applications
Functions of Management
Control Functions
Forecasts
Intermittent Manufacturing
Scheduling

Continuous Manufacturing
Matrix Algebra
Linear Programming
Graphical Approach
Simplex Algorithm
The Initial Tableau
Pivoting the Tableau
Interpreting the Tableau
The Final Tableau
Exercises
Economic Order Quantity
Quality Discounts
The Re-Order Problem
SUBJECT

IE Statistical Quality Control

An introduction to statistical quality control covering control charts for attributes, acceptance sampling, and development of these tools.

OBJECTIVE

To introduce the student to the techniques of SOC while stressing the statistical development of these techniques and their applications in Industry.

TEXT

Juran and Gryna, Quality Planning and Analysis
TEXT: Juran and Gryna, Quality Management and Analysis (A) 
Aft, Notes on reserve in the library

TOPIC

Introduction
Acceptance Sampling
Single Sampling
OC Curves
Double Sampling
AOQ
ASN
ATI
Review
Problems Due

Frequency Distributions
Graphical Representation
Parameters
Normal Distribution
Chi Square
Problems

Limits and Tolerances
Control Charts for
Averages and Ranges
Variation
Control limits and tolerances
Other Control Charts
Problems

"Quality Management"
Review
SUBJECT

IM    Business Law

Topics covered consist of Torts and Criminal Law, Contracts, Estates and Bankruptcy, Agency and Employment. Other topics covered at the election of the professor are Insurance, Commercial Paper, Personal Property and Bailments, Sales, Security Devices, Partnerships, Corporations, and Real Property.

OBJECTIVES

Business Law presents a carefully documented presentation of the legal framework of business for beginning students with special meaning for engineers, managers, and citizens. To attain this objective emphasis is placed upon the purpose and logic of the law as well as principles and rules. The student is given the opportunity to analyze factual case problems to apply general principles of law, with special emphasis upon cases dealing with problems related to engineering and industry.

TEXT

Lusk, Business Law, Principles and Cases, Irwin
IM Business Law

TOPIC

The Development of Law in America
Enforcement of the Law
Criminal Law
Torts
Nature of Contracts
Nature and Forms of Offer
Requirements for Acceptance
Misrepresentation and Fraud
Consideration
Capacity of Parties
Illegality
Statute of Frauds
Rights of Third Parties
Performance and Remedies
Introduction to Agency
Relation of Principal and Third Person
Relation of Agent to Third Person
Relation of Principal to Agent
Creation of Partnership
Relation of Partners between Themselves
Relation of Partners to Third Persons
Definition and Effect of Dissolution
Introduction to Commercial Paper
Requirements for Negotiability
Negotiation and Holder in Due Cause
Liability of Parties and Discharge
Checks and Documents of Title
SUBJECT

IE: Project Planning and Control
Prerequisites: IE 227, Computer Programming

The use of critical path methods in planning, scheduling, and control of projects is introduced. The concepts of both Critical Path Method and Program Evaluation and Review Technique (CPM and PERT) will be presented.

OBJECTIVES

To acquaint the student with current techniques in project management particularly, CPM, PERT, SIS, AND GERT. Some reference to other scheduling techniques is also made, e.g., Gantt charts. The use of EDP equipment is a part of the course.

TEXT

IET  Project Planning and Control
Prerequisites:  IET 227, Math 215  

(3-0-3)

TOPICS

Introduction
Networks
Networks and Time Estimation
Scheduling Techniques, Arrow
Scheduling Techniques, Precedence
Computers and CPM
Short Interval Scheduling
Resource Allocation
Time-Cost Trade-Off

Cost Controls
PERT
GERT
TBA
Projects Due
SUBJECT

IM Modern Trends in Management
Prerequisites --Fourth Year standing, IMT or IET Major.

The impact of modern technical developments and systems analysis on management. Current thinking in environmental technology management, industrial organization, project and process management.

OBJECTIVE

To give the student the opportunity to become familiar with management concepts and techniques beyond the scope of the standard curriculum. The student group is allowed to help in the organization of the course, in the scheduling and presentations in it, and in the review of what was covered.

TEXT

IMT -- Modern Trends in Management
Prerequisites: Fourth-year standing, IET or IMT major.

The impact of modern technical developments and systems analysis on management. Current thinking in environmental technology management, industrial organization, project and process management.

SCHEDULE

Since this is a senior elective course, it is taught in a much less rigid format than other required courses. The instructor uses the first two or three weeks to refresh the students on industrial organization and management, and introduces them to some modern concepts. A quiz is used to complete this portion of the course.

During these first few weeks, the instructor allows a portion of each meeting to be used for determination of the rest of the schedule. The students participate in this determination. When the schedule is decided, it is typed and distributed to all students and then the responsible students for each segment of the schedule must carry it out.

The schedule is distributed throughout this document, immediately preceding the handouts and written reports for each section.
SUBJECT

IE Principles of Engineering Economy
Prerequisites - Computer Programming, a calculus course

Output and Life of Equipment, operation costs, depreciation rates, economic selection of equipment, determination of economic lot sizes, and cost studies on representative problems.

OBJECTIVES

To acquaint the student with methods used to make quantitative decisions between alternatives involving engineering and the time value of money. To teach an appreciation for the costs and benefits of various projects as viewed by different parties. To teach the need for seeking expert advice so that good solutions are not overlooked. To teach the importance of cash flow and of irreducible data.

TEXT:

TOPICS

Introduction, definition of engineering economy

Alternatives

Equivalence, Interest, interest rates and compound interest

Equivalence, present worth, present worth tables

Compound amount computation from principle

Find principle from compound amount

Find uniform series from compound amount

Find compound amount from uniform series

Find uniform series from principle

Find principle from uniform series

Relationship between factors-reciprocals-tables

Nominal and effective interest

Problem solutions using formulas and tables

Interest necessity and possibility

Concealed costs of borrowed money

Minimum attractive rate of return

Annual cost - no salvage

Annual cost - salvage

Annual Cost and variable annual disbursements - perpetual life

Annual Cost - straight line depreciation

Annual Cost - Interest on first cost plus amortization

Annual Cost and advantages of straight line plus average interest

Present worth - effect on salvage value

Present worth - effect on difference in lives

Present worth - capitalized cost

Present worth - perpetuity

Capitalized Cost - compare methods

Valuation of property-compound amount

Valuation of bonds
SUBJECT

IE    Statistics II

A continuation of Statistics I, with all subject matter being built upon the knowledge learned in the first course. Applications of the statistics in the course is emphasized.

OBJECTIVES

To acquaint the student with the tools of statistical analysis, particularly regression and correlation analysis, sampling techniques, experiment design, analysis of variance, and some nonparametric techniques. The course is problem solving, as opposed to theoretical, in its orientation.

TEXT

Topics:

Introduction
Type I and II errors
Power Functions
Two Tail Tests
One Tail Tests
Mean and Sigma Tests
Regression and Correlation
Sampling and Experimental Design
Nonparametric Methods
Subject

IE Plant Layout and Material Handling

A study of the principles of plant layout and material handling, the use of process and flow charts, the use of tools and aids for effective plant layout, the determination of material handling plans, the construction techniques of plant layout, and the cost, presentation, and installation of a plant layout.

Objectives

To present to the student the procedures and techniques used in planning efficient production facilities by the student actually designing a complete layout for a small plant.

Text

James M. Apple, Plant Layout and Materials Handling, (Ronald Press)
James M. Apple, Lab Manual for Plant Layout, (Ronald Press)
IET Plant Layout and Material Handling

**TOPIC**

Introduction
Operation Process Chart
Production Planning
Production Calculations
Receiving and Shipping
Receiving and Shipping Requirements
Office and Plant Services
Service Area Planning
Planning Material Flow
Organization and Activity Relationship
Planning and Allocating Space
Area Allocation Diagram
Material Handling
Equipment Selection
Material Handling Problem
Operation Planning
Work Area Planning
Accumulation of Cost Data
Material Handling at Work Place
Begin Layout
Making the Plant Layout
Work on Layout
Determination of Operation Costs
Material and Manpower Costs
Determination of Costs
Equipment and Facilities Costs
Determination of Costs
Cost Schedules
Report to Management
Presenting the Layout
Presentation of Student Layouts
Installing the Layout
SUBJECT

IM Small Business Management

Small business in a free enterprise economy, the role of the small business manager or entrepreneur, the factors in failure and success, and the legal and economic problems of small business.

OBJECTIVES

To provide for the student, through study and discussion, an opportunity to analyze and appreciate the environment of the small enterprise, and to prepare for problems in the financial and operating controls in the small business.

TEXT

IM Small Business Management

TOPIC

Introduction
Small Business
Management Functions
The Entrepreneur, Business Initiation
Planning and Organizing
Retail Stores and Service Firms
Case Analysis
Capital and Credit
Business Records and Reports
Business Risk
Case Analysis
Location and Facilities
Production
Procurement
Machine Usage
Human Relations
Marketing and Sales
Market Research and Credit
Business Law
Legal Aspects and Government
Review and Conclusion

OBJECTIVES

The student should acquire a thorough understanding of the information required to establish quantitative models in the basic decision areas and an acquaintance of the areas of application of quantitative analysis.
IM Management Decision Making


TOPIC

Introduction
History of Operations Research
Goals of Operations Research
Introduction to Model Building
Types of Models
Operations research in the Firm
Introduction to Probability
Marginal, Joint, and Conditional Probabilities
Statistical Dependence and Independence
Combinations and Permutations
Revision of Prior Probabilities
Decision Trees
Mathematical Expectation
Discrete Distribution and Expected Profit
Continuous Distribution and Expected Profits
Uncertainty and Decisions
Introduction to Mathematical Maximization
Differential Calculus
Demand, Prices, and Profit Maximization
Review of Integral Calculus
Equation of Marginal Earnings and Marginal Cost
Equipment Selection
The LaGrange Multiplier and Maximization
Inventory Control
The Saw-Toothed Model
Algebraic minimization
Differential Minimization
Reorder Point and Safety Stock
Production Run Problems
Introduction to Linear Programming
Graphic Solution
The Simplex Solution
Simplex Maximization
Simplex Minimization
Matrix Explanations
The Transportation Problem
Game Theory
Arithmetic and Algebraic Solutions
Graphic and Dominance Solution
Matrix Solutions
Simplex Solution
Market Analysis
Market Movement and Probabilities
One Period Market Equilibrium
Multi-Market Equilibrium
Long Run Equilibrium
SUBJECT

IE Industrial Safety

The role management must play in industrial safety, the information must have to insure an efficient, well-managed safety program with particular emphasis on fire prevention, industrial hygiene, accident costs, compensation, insurance, and safety organization.

OBJECTIVES

To acquaint the student with the role management must play in the prevention of industrial accidents, with emphasis on new methods of determining and reporting costs of accidents in industry; the value of motivation; the psychological aspects of accident prevention and auxiliary functions of a safety department.

TEXT

Simonds and Grimaida, Safety Management, (Richard D. Irwin, Inc.)
IE Industrial Safety

TOPIC

Introduction
Problems
Objectives
Responsibility
Organization
Costs
Motivation
Accident Sources
Layout and Design
Machinery Guards
Electrical Hazards
Industrial Hygiene
Personal Protective Equipment
Automotive Safety
Training
Psychological Aspects
Fire Prevention
Product Development
Ecology and Safety
Safety Legislation
OSHA
OSHA (Projects Due)
SUBJECT

IE Work Measurement

The use of pre-determined time standards to determine work standards.

OBJECTIVE

To acquaint the student with standard time systems, most noticeably the Methods Time Measurement (MTM) System of pre-determined times. At the completion of the course the student will be able to apply MTM to set standards.

TEXT

Karger and Bayha, Engineered Work Measurement

PROCEDURES AND CREDITS

On the following pages.
The ANET Self-Study Program

The IE Self-Study Program is a new approach designed to replace the conventional lecture-recitation system.

In the conventional approach, the instructor aims the level and pace of the course at the average student. The superior student is apt to be bored. He certainly is not helped in gaining knowledge beyond that designed for the ability of the average student. The slow student is really discriminated against. He finds that he cannot keep up and soon realizes that falling behind usually results in failure in a course such as physical science.

The course will be scheduled for a regular hour. The instructor will be available at this time to assist you individually. Except for the first orientation session, there will be no schedule and no required homework.

The minimum amount of material to be covered is divided into 14 units. These units must be covered in order.

For each unit, you will be given text assignments, problems, and material to assist you in learning the required subject matter. If you run into a snag, the instructor will be available to help you at the regularly scheduled class time and during his office hours.

When you feel that you have mastered the subject matter, you may take a quiz on that unit. The quiz procedure will be as follows:

1. Sign up for the quiz you wish to take at least 15 minutes before class starts. This sign up list will be on your instructor's office door.

2. Your quiz will be graded immediately on a pass/fail basis. Each question is also graded on a pass/fail basis. When problems appear on a test, they are weighted 50% of the total test. Students are urged to stay and watch their papers be graded.

3. If you pass, you may go on to the next unit, and take that test the next day, if you wish.

4. If you fail, it does not count against you. As soon as you feel that you are ready, you may take another quiz over the same material. You may make as many attempts as necessary to pass. The only rule is that if you fail a quiz, you must wait at least one class day before attempting another quiz on that unit.

When you have passed all 14 quizzes, you will have earned a minimum course grade of C. At this point, you may take your C and retire from the course.

If you complete fewer than ten units during the quarter, your course grade will be F. If you complete ten, eleven, twelve, or thirteen units, your grade will be Incomplete. In this case, you may convert this to a grade of C by completing the balance of the 14 units during the next quarter. If the 14 units are not completed within this period, the grade becomes an F.

If you wish to try to raise your grade to a B or an A, you must take additional work. (Extra work must be completed during the regular quarter.)
To earn a B, an M&M film analysis is required, completed to the instructor's satisfaction. To earn an A, an additional project is required, as specified by the instructor.

**TOPIC**

Introduction  
Work Measurement  
Reach  
Move  
Turn  
Crank  
Apply Pressure  
Grasp  
Release  
Position  
Disengage  
Eye Motions  
Body, Leg, Foot Motions  
Motion Combinations
SUBJECT: Econ Principles of Economics

An introduction to the economizing problem related to need satisfaction and resource allocation in a mixed market economy. Both product market and resource market principles and operations are covered at both the micro and macro levels, with a discussion of criteria of optimum resource allocation and income distribution.

OBJECTIVES

The student acquires an understanding of the major economic goals of the individual, firm, and community; the criteria used in determining the best desirable goals, and the effect of varying market conditions on the attainment of these goals. He should also acquire a proficiency in stating economic relations in graphical and algebraic models.

TEXT:

Hailstone and Brennan, Economics

SUPPLEMENTARY READINGS:

(a) Wykstra - Introductory Economics - Chapter 11, Monetary Policy
(b) Miernyk - Economics - Chapter 16 - Banking System
(c) Spencer, Contemporary Economics - Chapter 3, Economic Systems
Econ Principles of Economics

TOPIC

Introduction
The Economic System
Scopes and Methods
Work on Projects
Government and Circular Flow
Prices, Supply and Demand
Production, Cost, Profit
  Pure Competition
Agriculture, Monopoly
Work on Projects
Oligopoly and Public Policy
Labor Economics
Rent, Interest, Profits
Human Capital
Work on Projects
GNP
Employment and Income
Money
Work on Projects
Banking
Stabilization
Stabilization and Fiscal Policy
Public Budget (Projects Due)
Taxation
Consumers and Businesses
Exhibit D

EVALUATION OF FUTURE MANAGEMENT PROBLEMS IN KOREA

(From a survey conducted by Professor John Frost at the Korean Advanced Institute of Science)
WHAT PROBLEMS WILL MANAGEMENT BE REQUIRED TO FACE DURING THE NEXT 5-10 YEARS IN KOREA?

(From response to the question by the graduate students in industrial science at the Korean Advanced Institute of Science)

1. Higher Wage Demands through Union Pressure

As it has in all developed countries, and some developing countries, the labor market will change. As industries increase, the need for skills will increase and labor will become competitive. In addition, they will learn, as all labor has learned, that in numbers there is strength and unions will grow stronger. There will also exist a wide generation gap between the workers of today and those of 10 years from now.

All this means higher and higher wages -- more social welfare and reform--the cost of which must largely be borne by industry.

2. Shortage of Management and Technical Skills

To meet the problems of tomorrow, a highly trained top and middle management force will be required. Costs will have to be reduced even with the increase in the costs of labor and materials, and, at the same time, product quality, reliability, and function will have to be improved in order to obtain consumer acceptance and compete in the world market.

This means that good industrial engineers and technicians must be trained in Korea who know how to solve these problems. Korea must become independent of foreign assistance.

To provide these skills, education and industry must work closely together -- industry must tell education what it needs and provide opportunities for the students to utilize and apply their skills, and education must design its curricula to meet these needs.

3. Increased Domestic and Foreign Competition

Innovation, initiative, and the utilization of special skills will be needed to make products more functional and improve both quality and reliability. Value analysis must be applied at all levels of the manufacturing process from product design to the design of management systems to insure that the right methods are used and to bring all phases of the process under control.
4. **Shortage of Natural Resources**

Policies must be directed toward the fullest development of natural resources. The riches of the earth and the oceans have scarcely been touched. We must look harder and dig deeper to find them. Existing resources must be developed to their full potential.

5. **Social and Political Constraints**

At the international level, there will be changes in tariffs and trade barriers to cut off or limit a uniform flow of exports and imports. Worldwide inflation may adversely affect foreign exchange rates.

At the local level, industry must become independent of government subsidy and restrictions. There should be more and more separation of management and ownership. Money invested in stocks provides a greater incentive for industrial growth than compulsory savings.

The successful transition from an agrarian to an industrial economy will require changes in deeply rooted cultures.

The increase in social and welfare requirements must be borne jointly by government and industry.

6. **Ecological Restraints -- Air and Water Pollution**

In any industrialized economy, the factor of pollution cannot long remain unchecked and uncontrolled.

7. **Financial Constraints**

The necessary amortization of foreign loans without foreign exchange dollars will increase industry taxes unless a bigger share of the foreign market can be captured. The ratio of foreign investment to domestic investment is too high -- another reason for encouraging public stock ownership in industry.

All of these problems pose difficulties, but they can be solved. Their solution, however, will require a very close working relationship, cooperation, and understanding between industry, education, and government. The students suggest that a governmental agency, composed largely of representatives from industry and education, should be formed to study the long-term needs of industry so that curricula can be best designed to meet these needs.
GUIDE TO INTERNATIONAL STATISTICAL SOURCES
AND NATIONAL DEVELOPMENT PLANS
AT THE INTERNATIONAL DEVELOPMENT DATA CENTER

Compiled by
International Development Data Center

This information document was prepared under
funding provided by the U. S. Agency for
International Development under a 211(d) grant.

Industrial Development Division
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
Atlanta, Georgia
October 1974
INTRODUCTION

The Guide to International Statistical Sources and National Development Plans at the International Development Data Center provides an index to and brief descriptions of specific statistical sources at IDDC concerning the countries of the Georgia Tech 211(d) counterpart organizations, a project funded by the U. S. Agency for International Development. It should be a useful starting point for researchers seeking such information.

The Guide is the result of an inventory of publications to determine gaps in the collection of the International Development Data Center (IDDC). The results provide two major benefits. The first is the development of a guide to the present statistical resources in the IDDC collection. The second is the creation of a checklist for future acquisitions in areas where gaps are apparent.

Since this Guide is the first effort at an inventory of the IDDC collection, it should be updated as soon as enough time has elapsed for obvious gaps to be filled.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>i</td>
</tr>
<tr>
<td>INSTRUCTIONS FOR USE</td>
<td>iii</td>
</tr>
<tr>
<td>Subject Classifications and Their Scope</td>
<td>iv</td>
</tr>
<tr>
<td>PART I: CLASSIFIED INDEX</td>
<td>1</td>
</tr>
<tr>
<td>PART II: ABSTRACTS</td>
<td>11</td>
</tr>
<tr>
<td>Serials</td>
<td>13</td>
</tr>
<tr>
<td>Pamphlets</td>
<td>24</td>
</tr>
</tbody>
</table>
INSTRUCTIONS FOR USE

The Guide to International Statistical Sources and National Development Plans at the International Development Data Center is divided into two main sections. Part I is an index to sources classified by subject and geographic scope. Part II lists the actual sources under "Serials" and "Pamphlets" by call number. Each entry consists of a call number, title, author or issuing agency, frequency of publication in the case of serials, date of publication in the case of pamphlets, and a brief abstract indicating scope and nature of the information provided. There are no evaluative statements nor a rating system of any kind.

Users of the Guide can locate information using the following procedure:

1. Look under the subject of interest in "Part I: Classified Index." Entries are arranged under the subject by geographic scope, listing world, then regional, and then country-specific sources. Note the call numbers listed under the subject/geographic area entry you are interested in.
2. Turn to "Part II: Abstracts" and locate the appropriate call numbers for full citations and abstracts to determine the scope and appropriateness of the actual documents.
3. Once the desired sources are selected, they can be located in the IDDC collection by call number.

Certain considerations should be kept in mind when using the Guide. The geographical classifications are mutually exclusive, i.e., sources noted under "World Sources" will not be noted in the "Regional Sources" or "Country Sources." Likewise, a source dealing only with Brazil will be listed under "Brazil" in the "Country" section and not under "Latin America" in the "Regional" section. The user interested in statistics on Brazil would do well to look under "Brazil," "Latin America," and "World" for complete information.

Further, only present or prospective counterpart country statistics have been indexed in the case of country-specific sources. The user interested in obtaining statistics on another country should be able to find them among either the "Regional" or "World" sources listed.

Finally, the user should scan the scope descriptions of the subjects used to ensure a fruitful search in the subject of concern if it is not otherwise easily recognizable in the basic list of subject headings. Following is the list of subjects used, arranged as they are throughout the Guide, with the appropriate scope descriptions.

-iini-
Subject Classifications and Their Scope

1. AGRICULTURE

Farm Population, Farms; Farm Characteristics; Farmer Cooperatives; Commercial Farms, Land Use; Irrigation, Fertilizers; Assets, Liabilities, Income and Expenses; Farm Equipment; Output, Input, Labor; Crop Summaries; Crop Production; Livestock and Products.

2. BANKING, FINANCE, AND INSURANCE

Stock Prices; Flow of Funds Account; Banks, Public and Private Owned; Other Financial Institutions; Mortgages, Debt; Uses and Sources of Funds; Deposit Accounts; Consumer Credit; Money; Securities; Life Insurance; Health Insurance; Property Insurance, Fires.

3. BUSINESS ENTERPRISE

Business Firms; Cooperatives; Domestic Investment; Expenditures, Inventories, Sales; Corporate Assets, Liabilities, Receipts and Profits; Mergers and Acquisitions; Business Failures; Bankruptcies.

4. COMMUNICATIONS

Postal Service; Telephone and Telegraph; Radio and Television; Newspapers and Periodicals; Copyrights; Mail Received; Communications Revenues.

5. CONSTRUCTION AND HOUSING

Value of New Construction; Construction Industries; Construction Contracts, Expenditures; Home Sales; Low-Rent Housing Programs; Mortgages.

6. DISTRIBUTION AND SERVICES

Retail Store Sales; Distribution and Services Summary, Wholesale and Retail Trade; Hotels and Motels; Advertising; Selected Service Industries.

7. ECONOMIC DEVELOPMENT POLICY AND PLANNING

Development Plans.

8. EDUCATION AND SCIENCE

Schools, Enrollment; Illiteracy, Elementary and Secondary Schools; Classroom Teachers; Public School Finances; Graduates; Higher Education; Degrees Earned; Libraries; Government Grants; Books; Research and Development; Scientists and Engineers, Patents and Trademarks.

1/ The subject classifications used in this Guide and their scope were largely adapted from those used in the Statistical Abstract of the United States.
9. FISHERIES

Quantity and Value of Catch; Fisheries Industry; Catch by Species; Fishery Products.

10. FOREIGN COMMERCE, AID, AND INVESTMENT

Balance of Payments, Exports and Imports (Indexes) by Commodity and by Country; Foreign Assistance Received; International Investments; Foreign Exchange Rates.

11. FORESTS AND FOREST PRODUCTS

Forest Land Area, Tree Distribution, Fires; Lumber Production; Pulpwood, Woodpulp; Newsprint.

12. GEOGRAPHY AND ENVIRONMENT

Land and Water Areas; Pollution; Temperature, Precipitation, Humidity, Sun and Wind.

13. GOVERNMENT FINANCES, EMPLOYMENT, AND ELECTIONS

Federal Budget; Budget Receipts, Outlays, Debt; Federal Property; Subsidy Programs; Tax Collections; Individual Income Tax; Corporate Taxes Paid; Public Debt; Government Employment and Payrolls; Vote Cast, National Elections; Elected Officials; Voter Registration and Participation.

14. HEALTH AND NUTRITION

Health Expenditures; Health Employment, Services; Hospitals, Nursing Homes; Patient Characteristics; Injury, Illness, Disability; Nutrition, Food Products.

15. IMMIGRATION AND NATURALIZATION

Immigrants; Foreign Laborers; Alien Movements, Naturalization.

16. INCOME, EXPENDITURES, AND WEALTH

GNP and Personal Consumption Expenditures; National Product and Income; Economic Growth, Gross Product; Personal Expenditures; National and Personal Income; Family and Individual Income; Wealth, Fixed Capital; Gold, Reserves.

17. LABOR FORCE, EMPLOYMENT, AND EARNINGS

Employment Status; Labor Force Characteristics; Unemployment, Employment; Industry, Occupation; Output Indexes; Hours and Earnings; Injury Rates, Farm Employment; Labor Unions, Work Stoppages.
18. LAW ENFORCEMENT, FEDERAL COURTS, AND PRISONS
Homicides, Suicides; Persons Charged with Crimes; Crime; Offenses and Arrests; Law Enforcement Expenditures; Court Cases.

19. MANUFACTURING
Industrial Production Indexes; Summaries; Shipments and Inventories; Capital, Expenditures, Employment; General Data for Principal Industries.

20. MINING AND MINERAL PRODUCTS
Mineral Production and Value; Mineral Industries; Specific Minerals.

21. NATIONAL DEFENSE
Expenditures; Military Forces, Personnel, Wages; Veterans.

22. POPULATION AND VITAL STATISTICS
Population and Area; Projections; Metropolitan, Urban, Rural; Sex, Race, Residence, Age; Nativity and Parentage; Mobility and Migration; Marital Status; Households and Families; Religious Bodies; Vital Statistics Summary; Birth, Rates, Fertility; Life Expectancy; Death, Rates, Causes.

23. POWER AND UTILITIES
Horsepower of Prime Movers; Mineral and Electric Energy; Electric and Gas Utilities.

24. PRICES
Wholesale Prices and Consumer Price Indexes; Market Price Indexes; Export and Import Prices; Living Costs; Retail Prices and Indexes.

25. PUBLIC LANDS, PARKS, RECREATION, AND TRAVEL
Federally Owned Land; Recreation Area Characteristics, Tourists; Travel, Passports; Sports; Museums, Performing Arts; Parks and Forests.

26. TRANSPORTATION (LAND, AIR, WATER)
Freight Traffic; Passenger Traffic; Transport Revenues; Transport Companies, Employment; Motor Fuel, Motor Vehicles; Transit Industry; Railroads; Air Carriers; Civil Aviation; Airports; Aircraft Industries; Airborne Trade; Waterborne Trade; Merchant Marine, Vessels; Employment.

27. MISCELLANEOUS
Anything not included in 1-26 should be looked for under this heading.
AGRICULTURE

World Sources: C7340, G8840(v.2), 09600, S4640, S7980, W9260, W9273, 50438, 50732

Regional Sources
Africa: A2570, B2440, E1950, E2050, F7152, 50632, 50831, 50960, 51051, 51052
Asia: A8310, E2060, S7985, 50237, 50630, 50961, 50963
Latin America: B6875, E1940, E2000, E3000, S7975, 50629, 50962

Country Sources
Brazil: S6150, 50024
Ecuador: 50091, 50861
Kenya: K3700, K3750
Korea: A2775(001, 005), K8395, K8435, N2775, Y3890, 51047
Philippines: 50633, 50643

BANKING, FINANCE, AND INSURANCE

World Sources: B1710, F7140, I3250, I6144a, I6156a, I6158, M7890, 09600, S7980, W9273, Y3950, 50334, 50628, 50732

Regional Sources
Africa: A2570, B2440, E2050, 50632, 50960
Asia: A8310, E1960, S7985, 50630, 50961, 50963
Latin America: E1940, E3000, I6100a, S7975, 50374, 50375, 50629, 50962

Country Sources
Brazil: S6150
Ecuador: I4400, 50861
Kenya: K3750
Korea: K8435, M7892, N2775, Q2000, Q2050

BUSINESS ENTERPRISE

World Sources: G8840(v.1), 09600

Country Sources
Ecuador: 50861
Korea: F4915, K8395, K8435, R4253, Y3960, 51044, 51053
Nigeria: 50248, 50697, 50698
Philippines: 50645

COMMUNICATIONS

World Sources: 09600, S7980, 50216, 50217, 51058

Regional Sources
Africa: E2050, 50632
Asia: S7985, 50630
Latin America: 50629

Country Sources
Brazil: S6150
Kenya: K3750
Korea: K8395, K8435, N2775

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
CONSTRUCTION AND HOUSING

**World Sources:** M7890, S7980, 50216, 50217, 51058

**Regional Sources**
- Africa: E2050, 50658
- Asia: E1960, S7985
- Latin America: E3000, S7975

**Country Sources**
- Brazil: S6150
- Ecuador: 50861
- Korea: K8395, K8435, N2775, P8305(001, 002, 007), 51047

DISTRIBUTION AND SERVICES

**World Sources:** M7890, S7980

**Regional Sources**
- Africa: E2050
- Asia: S7985
- Latin America: E1940, 50657

**Country Sources**
- Brazil: S6150
- Ecuador: 50861
- Kenya: K3750
- Korea: K8435, N2775, 51044

ECONOMIC DEVELOPMENT POLICY AND PLANNING

**World Sources:** I3250, I4150, 09600, P9240, P9640, 50239, 50322

**Regional Sources**
- Africa: A2570, B2440, E1950, E2050, 50657
- Asia: A8310, E1960, E2060
- Latin America: E1940, E2000, I6100a, 50291

**Country Sources**
- Brazil: 51050
- Colombia: 50134
- Ecuador: 50091
- Kenya: 50664
- Korea: 50443, 51046, 51047, 51048, 51049, 51055
- Nigeria: 50661, 50736, 50737
- Philippines: 50136, 50792

EDUCATION AND SCIENCE

**World Sources:** 09600, S4640, S7980, 50216, 50217, 50334, 50734, 51042, 51058

**Regional Sources**
- Africa: E1950, E2050, 50632, 50960
- Asia: A8325, A8330, S7985, 50630, 50961, 50963
- Latin America: E1940, 50629, 50962

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.*
EDUCATION AND SCIENCE (continued)

Country Sources
Brazil: S6150
Kenya: K3750
Korea: K8395, KB400a, KB435, P8305(001), S7988, 51055

FISHERIES

World Sources: G8840(v.2), S7980
Regional Sources
Africa: E2050, F7152
Asia: E2060, S7985
Latin America: S7975
Country Sources
Brazil: S6150
Ecuador: 50861
Korea: K8395, KB435, N2775, Y3890 51047

FOREIGN COMMERCE, AID, AND INVESTMENT

World Sources: B1710, C7340, C7345, D4880, D5970, D5970a, F7140, I3250, I4150, I6144a, I6156a, I6158, M7890, O6100, 09600, S4640, S7980, US580, US585, W9260, W9273, Y3900, Y3950, 50216, 50217, 50273, 50303, 50334, 50627, 50628, 50882, 50959, 51043, 51045, 51057, 51058
Regional Sources
Africa: A2570, B2440, E1950, E2050, F7151, F7152, 50632, 50657, 50658, 50960, 51052
Asia: A2210, A8310, E1960, E2060, F7154, F7155, S7985, 50237, 50630, 50961, 50963
Latin America: B2180, B6875, C3220, E1940, E2000, E3000, I1800, I6100a, L3552, P1870a, S7975, 50374, 50375, 50629, 50962
Country Sources
Brazil: S6150, 50024, 50910
Colombia: C7260
Ecuador: 50091, 50861, 50911
Kenya: K3700, K3750, 50912
Korea: K8435, KB448, M7892, M7894, Q2000, Q2050, S7989, Y3890, 50913, 51046, 51047
Nigeria: 50914
Philippines: 50633, 50636, 50642, 50643, 50644, 50645

FORESTS AND FOREST PRODUCTS

World Sources: G8840(v.2), M7890, 09600, S7980
Regional Sources
Africa: A2570, E2050, F7152, 50658
Asia: A8310, E2060, S7985, 50237
Latin America: S7975

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
FORESTS AND FOREST PRODUCTS (continued)

Country Sources
Brazil: S6150
Ecuador: 50861
Kenya: K3750
Korea: K8395, K8435, N2775, Y3890, 51047

GEOGRAPHY AND ENVIRONMENT

World Sources: 09600, S4640
Regional Sources
Africa: B2440, 50657, 50831
Asia: A8310
Country Sources
Brazil: S6150
Colombia: C7260
Kenya: K3750
Korea: K8395, K8435, Y3890

GOVERNMENT FINANCES, EMPLOYMENT, AND ELECTION

World Sources: B1710, I6158, S7980, Y3950
Regional Sources
Africa: 50960
Asia: S7985, 50961, 50963
Latin America: E1940, E3000, I5990, 50962
Country Sources
Brazil: S6150
Ecuador: 50861
Kenya: K3750
Korea: K8395, K8435, N2775, S7990, 51046, 51047

HEALTH AND NUTRITION

World Sources: S4640, S7980, 50216, 50217, 50334, 50734, 51058
Regional Sources
Africa: E2050, 50632
Asia: S7985, 50630
Latin America: 50629
Country Sources
Brazil: S6150
Korea: K8435

IMMIGRATION AND NATURALIZATION

Country Sources
Brazil: S6150

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
INCOME, EXPENDITURES, AND WEALTH

World Sources: D4880, F7140, G8840(v.1), I3250, I4150, I6158, M7890, 09600, S4640, S7980, W2973, Y3940, Y3950, 50216, 50217, 50333, 50334, 50732, 50734, 50876, 51058

Regional Sources
Africa: A2570, E1950, E2050, 50632, 50635, 50657, 50658, 50831, 50960
Asia: A8310, E1960, E2060, S7985, 50630, 50961, 50963
Latin America: B2180, E1940, E2000, E3000, S7975, 50374, 50375, 50629, 50962

Country Sources
Brasil: S6150
Colombia: C7260
Ecuador: I4400, 50861
Kenya: K3750
Korea: K8435, K8448, M7892, N2775, Q2000, Q2050, 51046, 51047

LABOR FORCE, EMPLOYMENT, AND EARNINGS

World Sources: G8840(v.1), I4150, M7890, 09600, S4640, S7980, Y3940, 50216, 50217, 50334, 51042, 51058

Regional Sources
Africa: E1950, E2050, 50657, 50960
Asia: A8310, E1960, E2060, S7985, 50961, 50963
Latin America: E1940, E2000, E3000, 50962

Country Sources
Brasil: S6150, 50024
Ecuador: 50091, 50861
Kenya: K3750
Korea: A6150, K8435, K8448, M7892, R4253, Y3890, Y3960, 51044, 51046, 51047, 51055, 51059
Philippines: 50136

LAW ENFORCEMENT, FEDERAL COURTS, AND PRISONS

World Sources: 09600

Country Sources
Korea: K8435

MANUFACTURING

World Sources: F7140, G8840(v.1, 2), I4150, I6158, M7890, 09600, S7980, 50216, 50217, 50732, 51058

Regional Sources
Africa: A2570, B2440, E1950, E2050, F7152, 50632, 50657, 50658, 50831, 50960
Asia: A8310, E2060, S7985, 50237, 50630, 50961, 50963
Latin America: B2180, B6875, E1940, E2000, E3000, L3552, S7975, 50629, 50962

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
MANUFACTURING (continued)

Country Sources
Brazil: 56150, 50024
Colombia: C7260
Ecuador: 50861
Kenya: K3700, K3750
Korea: A6150, KB395, KB435, M7892, N2775, Q2000, Q2050, 51044, 51046, 51047, 51053
Philippines: 50633, 50644, 50645

MINING AND MINERAL PRODUCTS

World Sources: C7340, G8840(v.2), M7890, 09600, S7980, 50250, 50273

Regional Sources
Africa: B2440, E1950, E2050, F7152, 50657, 50658, 50960
Asia: A8310, S7985, 50219, 50220, 50237, 50961, 50963
Latin America: I6140, L3552, S7975, 50962

Country Sources
Brazil: S6150
Ecuador: 50861
Kenya: K3700, K3750
Korea: A6150, KB395, KB435, N2775, R4253, 51047
Philippines: 50642

NATIONAL DEFENSE

Country Sources
Korea: K8395

POPULATION AND VITAL STATISTICS

World Sources: D3830, D4880, M7890, 09600, S4640, S7980, Y3940, 50216, 50217, 50333, 50334, 50732, 50734, 50876, 51058

Regional Sources
Africa: E1950, E2050, 50632, 50657, 50831, 50960
Asia: S7985, 50630, 50961, 50963
Latin America: B2180, E1940, E2000, S7975, 50629, 50770

Country Sources
Brazil: 56150, 51054
Colombia: C7260
Ecuador: 50091, 50861
Kenya: K3750
Korea: KB395, KB435, P8305(001, 002, 007), 51046, 51047
Nigeria: 50696

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
POWER AND UTILITIES

World Sources: G8840(v.1), M7890, 09600, S4640, S7980, 50216, 50217, 51058

Regional Sources
Africa: E2050, 50632, 50960
Asia: A8310, S7985, 50222, 50630, 50961, 50963
Latin America: S7975, 50629, 50770

Country Sources
Brazil: S6150, 50024
Colombia: C7260
Ecuador: 50861
Kenya: K3750
Korea: KB395, KB435, N2775, 51047

PRICES

World Sources: C7340, F7140, I6158, M7890, 09600, S7980, W9273, Y3940, Y3950, 50334, 50627

Regional Sources
Africa: A2570, 50632, 50960
Asia: E1960, E2060, S7985, 50630, 50961, 50963
Latin America: B2180, B6875, C3220, E2000, E3000, S7975, 50629, 50770

Country Sources
Colombia: C7260
Ecuador: 50861
Korea: KB395, KB435, M7892, Q2000, Q2050, Y3890
Philippines: 50633

PUBLIC LANDS, PARKS, RECREATION, AND TRAVEL

Country Sources
Kenya: K3750
Korea: KB395

TRANSPORTATION

World Sources: M7890, 09600, S7980, 50216, 50217, 51058

Regional Sources
Africa: E2050, 50632
Asia: S7985, 50630
Latin America: S7975, 50629

Country Sources
Brazil: S6150
Kenya: K3750
Korea: KB395, KB435, M7892, N2775, Y3960, 51047

MISCELLANEOUS

--FAMILY PLANNING

World Sources: 50734

* Four-digit numbers preceded by a letter denote serials; five-digit numbers denote pamphlets.
PART II
ABSTRACTS

Provides up-to-date information on development projects funded fully or in part by the Asian Development Bank. Information includes location and description of projects as well as financial arrangements made in each case. No statistical tables are given.


Briefly describes each African country in terms of political situation, economy, production, transport and communications, finance, and foreign trade. Statistical information covers gross domestic product, industrial production, agricultural output, money supply, price indices, foreign trade, balance of payments, exchange, and mining.


Statistics cover farm households, population, land, crops, and irrigation facilities as of 1970 in the City of Seoul, Busan City, and Jeju Do.


Statistics cover farm households, population, land, crops, and irrigation facilities as of 1970 in the Province of Chungcheong Nam Do.


An aggregate index of industrial production, shipment and inventory, and wage statistics. Gives a full description of the base year shift and the past time series according to the new base year.


Provides descriptive information on development plans for ECAFE countries and statistical information on indices of industrial production, employment, productivity, and GDP; fertilizer production, consumption, and prices; production of chemicals (soda ash, caustic soda, sulphuric acid); production of minerals (copper, lead, tin, pig iron, steel); textile industries (production and consumption of cotton yarn, wool, rayon); and paper and paper products. Publications vary in content. Statistics are mainly on industrial production and agriculture.

RESEARCH SUMMARY. Asian Institute of Technology, Bangkok, Thailand. Irregular.

Lists and describes reports of research in progress, as well as of projects completed since 1959, at the Asian Institute of Technology. Presented in six sections: water science and engineering, transportation engineering, structural engineering and mechanics, environmental
engineering, geotechnical engineering, systems engineering, and management.

AS30


Provides information on recently completed and currently in progress doctoral dissertations dealing with diverse aspects of Asia. (Gives student's name, title of dissertation, university attending.)

B1710

BALANCE OF PAYMENTS YEARBOOK. International Monetary Fund. Annual, composed of monthly issues.

The standard presentation for each country includes:
(a) Goods, services, and unrequited transfers: merchandise, non-monetary gold freight, and insurance on merchandise, travel, investment income.
(b) Capital: long-term and short-term investment, government investment, money banks.
(c) Allocation of SDR's.
(d) Reserves and related items: assets and liabilities.

B2180


Descriptive, up-to-date information (political, social, economical) is given in summary form for each country in South America. Statistical information covers cost of living indices, exchange rates, and economic indicators for selected countries (varies monthly), such as population, GDP, reserves, exports, imports, production, loans, money supply, and wholesale prices. (Previously titled Bolsa Review.)

B2440


Up-to-date information provided on weather, agricultural products, communication, finance, development, stock exchange, manufactures, and oil in the African nations.

B6875


Statistical information is given for the coffee industry only. Includes world prices (futures and physical markets), exports and imports, and production.

C3220


Provides statistical and up-to-date information about world coffee prices, exports and imports.

C7260


Presents statistics of basic data and economic indicators for Colombia: area, population (and growth), GNP, industrial production (for some sectors), exports, imports, cost-of-living, exchange rates, electricity.
Statistics are given for production, imports, exports, consumption, and prices of commodities such as sugar, cocoa, coffee, rubber, hard fibres, rice, tea, tobacco, cotton, iron ore, copper, lead and zinc, petroleum, bauxite and aluminum, tin, tungsten, and others.

Contains export and import data on commodities.

Statistical tables include population, natality, infant mortality, general mortality, life tables, nuptiality, and divorce.

Provides statistical tables for foreign aid and growth of real product, per capital real product, and population.

Detailed information is given on the value of goods exported to other countries and imports from other countries. (Does not list any goods traded between countries.) Counterpart countries do not always appear in every issue.

Provides historical summaries of value and destination (by country) of exports and imports for each country.

ECONOMIC AND SOCIAL PROGRESS IN LATIN AMERICA. Inter-American Development Bank. Annual.
Surveys recent economic and social development events in Latin America. Three chapters look at regional analysis, country summaries, and capital markets; and an appendix contains statistical tables on population, enrollment in schools, employment, GDP (growths), savings, financing and aid, exports, imports, value added by agriculture, manufacturing and services, government taxes and expenditures, reserves, and public debt and credits. Very comprehensive. Development planning also is included.

Each issue presents varied information about industrial growth, agriculture, employment, education, population, imports and exports, development plans, mining, investment laws and regulations.

ECONOMIC BULLETIN FOR ASIA AND THE FAR EAST. United Nations. Three times a year.
Each issue supplies information pertaining to development plans and economic surveys. Varied information about employment and GDP.
Statistics include production, transport, trade, prices, employment, wages, finance, and construction (for ECAFE countries only).

Contains articles describing technology transfer, resource development, social change, development policies and practices. Statistics vary in content and quality but consist mainly of information on population, production, trade, income and employment, agriculture, and prices.

Provides statistical information on population, natural resources, GDP, capital formation, finance, money and banking, agriculture, forestry, fisheries, industry, services, construction, energy, transport and communications, mining, foreign trade, and health. Development plans (targets, policies, plans) included.

Statistics concentrate on GNP, agriculture, manufacturing, exports and imports, income, employment, prices, and distribution of income. Development plans (progress and policies) included.

**E3000** ECONOMIC SURVEY OF LATIN AMERICA. United Nations. Annual.
Provides statistical and descriptive information regarding recent economic trends, sectors of activity (e.g., agriculture, industry, construction), consumption and investment, prices and wages, public finance, and the external sector. Includes government expenditures and balance of payments.

**F4915** FINANCIAL ANALYSIS. The Korea Development Bank, Seoul, Korea. Annual.
Statistics are given for all enterprises, large enterprises, and small and medium enterprises on ratios of composition of total assets, composition of liability and net worth, profit and loss, manufacturing costs, appropriation of earned surplus, value added, stability, profitability, activity, and productivity. Another section reports estimated amounts of assets, liabilities and net worth, profit and loss, manufacturing costs, and value added by industry type.

**F7140** FOREIGN ECONOMIC TRENDS. U. S. Department of Commerce. Semiannual.
Descriptive information covers current economic situation, GNP growth, balance of payments, foreign debt, monetary situation, statistics on GNP, industrial production, money supply, cost of living, prices, foreign exchange reserves, foreign trade, and exchange rates.

Contains export and import trade in terms of value and direction of trade only. (Exports by country of destination and imports by countries of origin.)

Contains export and import trade in terms of value for commodities traded and direction of trade. (Commodities exported by country of destination and commodities imported by country of origin.)


Presents detailed trade statistics of ECAFE countries; exports only are reported, by SITC and country of origin.


Chapter headings are: Total Imports and Exports by (ECAFE) Countries of Origin and Destination; Imports and Exports by SITC; Trade by Broad Economic Categories; Trade Balance of ECAFE Countries with the World; Intra-Regional Trade Balance; and Trade Balance of ECAFE Countries with Other ECAFE Countries and Principal Regions of the World.


For each industry in every country the following information is given: establishments, person engaged, employees, wages and salaries, electricity consumed, gross output, value added, fixed capital formation, and indices for industrial production.


Statistics are given for total industrial production of each commodity within the national boundaries of each country.


Provides up-to-date information on financing (for development) of projects and amounts of loans.

I3250 IMF SURVEY. International Monetary Fund. Biweekly.

Each issue reports a country's economic profile and development plans. Counterpart countries are covered occasionally. Furthermore, each issue contains notes on fiscal and monetary policies, international finance, balance of payments, trade, foreign exchange rates, and development activities for countries all over the world.


Chapter headings are: (1) Trends in Manufacturing Development, (2) Foreign Trade and Industrialization, (3) Employment in Manufacturing, (4) Investment and Industrialization, (5) Industry and Agriculture in Economic Development. Statistics are often aggregated into developed and developing countries; however, data are available for single countries in most cases. Development plans are covered lightly.
INFORMACION ESTADISTICA. Banco Central del Ecuador. Biweekly.
Statistics include foreign exchange reserves, credit, deposits, money circulation, portfolios and investments, permits for exports and imports, foreign payments, exchange rates.

INTER-AMERICAN BULLETIN ON TAXATION. Organization of American States. Three times a year.
Provides information on taxation (policies and regulations) in the Inter-American system.

ANNUAL REPORT. Inter-American Development Bank. Annual.
Provides descriptive information about development projects funded by the bank, development plans, and statistics on loans made to countries.

INTERNET BULLETIN. College of Mines and Mineral Industries, University of Utah, Salt Lake City, Utah, U.S.A. Quarterly.
Contains information on mineral resources, including fuels such as petroleum, coal and gas, and descriptive information on mining technology in Latin America.

Reports on development projects financed by IBRD/IDA, and provides statistics on external financing and debt.

Development projects funded by IFC are described. Statistics are provided on each country's financing and debt.

INTERNATIONAL FINANCIAL STATISTICS. International Monetary Fund. Monthly.
Provides comprehensive statistical information on exchange rates, gold and SDR reserves, foreign exchange, money and banking, insurance institutions, interest and prices, foreign trade, balance of payments, government finance, and GNP.

Provides statistics and general information regarding exports in manufacturing, mining, and agriculture.

Reports on GDP, capital formation, agriculture, forestry, manufacturing, fuel and power, tourism, trade, transport and communications, currency, foreign exchange reserves, public finance employment, education, population, area, and exchange rates.

Descriptive information and some statistical data are given on government, foreign relations, national defense, national economy, social
affairs, education and culture, and tourism. In addition, there are sections entitled: General Information; Laws and Documents; Directories; and Who's Who. Most of the information is descriptive, historical, and in summary form.

K8400a **ANNUAL REVIEW - KIST 1971.** Korea Institute of Science and Technology (KIST), Seoul, Korea. Annual.

Describes major research activities during 1971 at KIST.


Statistics are given under the following headings: Land; Climate; Population; Economically Active Population; National Income; Agriculture, Forestry and Fisheries; Farm Economy; Mining and Manufacturing; Electric Power; Transportation, Communication and Construction; Business Enterprises; Wholesale and Retail Trade; Prices and Wages; Family Income and Expenditure; Public Finance; Taxation, Money and Banking; Foreign Trade; Foreign Exchange; Education and Culture; Health, Medical Care and Welfare; Government Employees and Elections; Justice and Public Peace; and Natural Disasters and Accidents. There is also a section on International Statistics.

K8448 **KOREA WEEK.** Po Sung Philip Kim, Washington, D. C.

Provides descriptive and occasionally statistical information on foreign trade, investment, aid, tourism, Koreans in foreign countries, employment, and income.

L3552 **LATIN AMERICA ECONOMIC REPORT.** Andean Times, Lima, Peru.

Provides descriptive information about recent mineral findings, production, exports and imports.


Chapter headings are: Population; Manpower; Forestry; Industrial Production; Mining; Manufacturing; Construction; Electricity and Gas; Internal Trade; External Trade; Transport; Wages and Prices; National Accounts; and Finance.


Chapter headings are: Monetary System; Non-Monetary Financial Institutions; Securities; Public Finance; Prices; Foreign Trade; Foreign Exchange; Industry and Transportation; Employment, Wages and Household Economy; National Income Accounts; Flow of Funds; Balance of Payments.

M7894 **MONTHLY FOREIGN TRADE STATISTICS.** Republic of Korea, Department of Customs Administration.

Chapter headings are: Exports and Imports by Year and Month; Exports by Type; Imports by Source of Funds; Exports by Country; Imports by Country; Exports by Commodity and Country; Exports by Country and Commodity; Imports by Commodity and Country; Imports by Country and Commodity.

Definitions and concepts of national income accounts are in Korean. Statistics cover quarterly national income statistics (historical) such as expenditures and industrial origin; national income and product tables; supplementary tables (include value added and output for agricultural, manufacturing, mining, construction, and power generation sectors, among others); and an annex of major indicators on GNP of Korea, per capita national income, and international comparison of natural income statistics.


Presents information on the principal economic assistance activities of the Agency for International Development (A.I.D.) under the Foreign Assistance Act.


Publications vary in information content: Basic Data (Geography, Population, Employment, Income, Agriculture, Forestry, Minerals, Manufacturing, Transport, Communication, Financial Situation, Development Plans); Foreign Trade (Exports and Imports to Selected Countries); Market Profiles; Foreign Trade Regulations; Foreign Investment Legislation; and Starting a Business.

P1870a ANNUAL REPORT. Pan-American Development Foundation. Annual.

Provides information regarding development loans, projects.


Provides census data on population and housing for 1970.


Provides census data on population and housing in the City of Seoul for 1970.


Provides census data on population and housing in the Province of Chungcheong Nam Do for 1970.


Lists (and in some cases, describes) development projects approved for funding by the U. N. and participating agencies on behalf of the U. N. Development Program.
PROGRESS IN LAND REFORM. United Nations/Food and Agriculture Organization/International Labour Organisation. Every four years.
Chapter headings are: Problems and Progress; Investment and Credit in Relation to Land Reform; Administration of Land Reforms; Popular Participation in Land Reform; Land Reform and Balanced Development.

Economic report includes economic indicators (credit, industrial production, prices, money supply), money and banking (credit, loans, reserves), external transactions (imports, exports), prices, and monetary and credit policies.

Statistical summary covers production indices and producers' sales prices, indices of small-scale manufacturing, industry by major industrial group, and principal economic indicators (money supply, foreign trade, reserves, industrial production indices, price indices).

Chapter headings are: (1) Summary for Nation (Employment, Establishments, Costs, Inventories); (2) Summary for Region (Establishments, Wages Paid, Production Costs, Value Added, Investment, Inventories); (3) Commodities (Production, Shipments and Inventories by Size of Industry and by Province; Quantity and Value of Shipments and Number of Establishments by Group of Industry).

Data cover population, labor force in agriculture, area, GNP and electric power per capita, exports, education, and health.

SINOPSE ESTATISTICA DO BRASIL. Brazil. Fundação IBGE. Annual.
Summarizes the most recent statistical figures available as of the date of publication for Brazil on physical and demographic characteristics, the national economy, social conditions, education, finances and organization of the government, and production.

Table headings include: Net Domestic Product at Factor Cost; GNP at Market Prices; Indices of Domestic Product; Gross National Income at Market Prices (Information on GNP by Sectors); Population; Agriculture; Mining; Manufacturing; Construction; Electricity; Transportation; Foreign Trade; and National Accounts.

Chapter headings are: World Summary; Population; Manpower; Agriculture; Forestry; Fishing; Industrial Production; Mining and Quarrying; Manufacturing; Construction; Energy; Internal Trade; External Trade; Transport; Communications; Consumption; Balance of Payments; Wages
and Prices; National Accounts; Finance; Public Finance; Development Assistance; Health; Housing; Education; Science and Technology; and Culture.


Historical/statistical summaries for ECAFE countries provide the following information: population, manpower, national accounts, agriculture, forestry and fishing, industry (production, construction, energy), consumption, transport and communications, internal trade, external trade, wages, prices and household expenditure, finance, and social statistics (education, mass communication, medical facilities).


Provides basic statistics on schools by levels: kindergarten, primary school, middle school, high school, vocational high school, junior vocational college, college and university, graduate school, nurses' training school, special schools, civic schools, trade schools, and other schools. For each level, information is given about teachers, students, buildings, and equipment. The final section presents major administrative statistics of varied types. Very comprehensive.

S7989 STATISTICAL YEARBOOK OF FOREIGN TRADE. Republic of Korea. Department of Customs Administration. Annual.

Chapter headings are: Exports and Imports by Year and Month; Exports by Type; Imports by Source of Funds; Exports by SITC Basic Items; Imports by SITC Basic Items; Exports and Imports by Commodity Group; Exports and Imports by Customs; Vessels and Aircrafts Entered into or Departed from Korea; Passenger Numbers of Aircraft's Flag Entered and Departed, Imports by International Post Office; Exports and Imports by Country; Exports and Imports by Commodity and Country; and Exports and Imports by Country and Commodity.


Contents are divided into five parts: (1) Summary; (2) Direct Tax; (3) Indirect Tax; (4) Tax Collection; and (5) Others. Information is basically about tax payments from companies and Korean citizens in the forms of income taxes; business taxes; transportation taxes; liquor taxes; commodity taxes; textile taxes; electricity taxes; gas taxes; admissions taxes; and stamp taxes. Statistics are provided on location, jurisdiction, employment, and collection costs of the various tax offices.


Reports merchandise exported by the U. S. Each commodity is reported by recipient countries (quantity and value, current and cumulative).


Presents commodities imported by country of origin (quantity and value, current and cumulative).

W9273  WORLD ECONOMIC SURVEY. United Nations. Annual. Statistics for selected countries are given on GDP, agricultural production, food production, per capita food production, terms of trade, consumer prices, balance of trade, international liquidity, oil production, and revenue. (Data are given in percentage growth rates.)

Y3890  YEARBOOK OF AGRICULTURE AND FORESTRY STATISTICS. Republic of Korea. Ministry of Agriculture and Fisheries. Annual. Chapter headings are: (1) Summary; (2) Productive Basis; (3) Agricultural Production; (4) Livestock, Sericulture and Forestry; (5) Farm Economy Production Cost; (6) Others; (7) Appendix (Exports and Imports, Indices, Prices of Commodities, Wages and Charges in Rural Area, Value of Production, International Statistics).

Y3900  YEARBOOK OF INTERNATIONAL TRADE STATISTICS. United Nations. Annual. Statistical table headings are: (1) Trade by Principal Countries of Purchase and Last Consignment; (2) Imports by Commodities According to the SITC Code; (3) Exports by Commodities According to the Standard ITC Code, and (4) Historical Series (Trade in Merchandise and Gold; Indices of Trade).

Y3940  YEARBOOK OF LABOR STATISTICS. International Labor Office. Annual. Chapter headings are: Total and Economically Active Population; Employment; Unemployment; Hours of Work; Labor Productivity; Wages; Consumer Prices; Industrial Accidents; and Industrial Disputes. Exchange Rates are in the Annex.


Y3960  YEARBOOK OF RAILROAD STATISTICS. Korean National Railroad. Annual. Chapter headings are: (1) Operating; (2) Transportation (Passenger and Freight Statistics); (3) Train Operation; (4) Engineering; (5) Machinery and Electric; (6) Finance; (7) Purchase and Store; and (8) Personnel.
PAMPHLETS

Chapter headings are: Growth of Agricultural Output; Contributions of Land and Livestock; Numbers and Productivity; Contributions of Factors Complementary to Land; Factors External to the Farm; and Implications for Agricultural Development.

50091 AGRICULTURAL PRODUCTION AND TRADE OF ECUADOR. U. S. Department of Agriculture. 1968.
Statistics are given for population, GDP, employment, agricultural production, and imports and exports of agricultural products. Descriptions are provided for agricultural policies and programs.

Describes a development program for the generation of employment in Colombia, and serves as a source book of socioeconomic information on Colombia.

Presents development programs and plans and their effects on employment. Occasional statistics are provided on employment and wages.

50216 HANDBOOK OF INTERNATIONAL TRADE AND DEVELOPMENT STATISTICS. 1969.
50217 SUPPLEMENT. 1970.
United Nations Conference on Trade and Development (UNCTAD).
Section headings: World Trade by Regions and Countries; Quantum Unit Value and Terms of Trade Index Numbers; Network of World Exports; Selected Analytical Tables of World Trade; Financial Flows; Aid and Balance of Payments of Developing Countries; Some Basic Indicators of Development; Basic Statistics of Developing Countries. Most of the data are aggregated by region or "economic class."

Provides cumulative information from 1945 to 1965; country summaries on mineral production; and statistics on mineral production, value, and exports.

Provides country summaries on mineral production and statistics on mineral production and value.

Statistics include generating capacities of electric utilities and industries, generating capacities by ownership and prime mover and by
size of plant, major power plants, voltage transmission, generation in electric utilities, energy sales, electric power supply and consumption, revenue of electric utilities, capital employed in utilities, financing of electric utilities, power development projects, and town electrification.


Production, consumption, trade, and resources are given in the following sectors: iron and steel, aluminum, engineering industries, chemical industries, pesticides and insecticides, oils and fats industry, rubber industry, forest products, food processing, pharmaceuticals, and textiles.


Bibliography of publications in the Dag Hammarskjöld Library.

50248 SMALL SCALE INDUSTRIES: WESTERN STATE OF NIGERIA. University of Ife, The Industrial Research Unit, Ile-Ife, Nigeria. 1972.

Lists Nigeria enterprises, date of establishment, initial capital invested, present value of capital invested, and number of employees.


Provides country-by-country descriptive (narrative) surveys of small-scale mining which may include production or extraction data.


Statistics are given on steel imports, exports, consumption, and prices. Annex contains country summaries for steel-producing nations.


Describes development plans for Brazil and Colombia.


Describes and reports statistics on aid to developing countries (1967 and 1968) by recipient country.


Lists development plans made in each country.


Provides statistics on population, per capita product, and growth rates.

Chapter headings are: Global Indicators; Population and Economic Growth; Social Indicators; International Capital Flow and External Debt; and International Trade.

THE LATIN AMERICAN ECONOMY IN 1966. 1967 (pub.).

THE LATIN AMERICAN ECONOMY IN 1967. 1968 (pub.).


Section headings for each country are: Recent Economic Trends; Economic Policy; Domestic Production (varies from country to country). Statistics include GDP, investment (public and private), consumption, exports, and imports.


Statistics are provided for each country on area, production and yield of grains such as wheat, rye, barley, oats, corn, sorghum.


Development plans.


Statistical information includes trade (imports and exports by country and commodity), price and freight rate indices, and prices for agricultural and mineral products.


Statistics cover the following: external debt; debt service; debt outstanding commitments, disbursements, and service payments, by type of capital; and terms of debt (interest rates and maturities).


Chapter headings include: Summary of Basic Data; Population; National Product; Consumer Prices; Indexes; Trade and Investment; Gold and Foreign Exchange Holdings; and Student Enrollment and Teacher Staff.


Chapter headings are: Summary of Basic Data; Population Trends; National Product; Production; Consumer Prices Indexes; Trade; Gold and Foreign Exchange Holdings; Student Enrollment and Teacher Staff.

Chapter headings are: Summary of Basic Data; Population Trends; National Product; Production; Trade; Gold and Foreign Exchange Holdings; Student Enrollment and Teacher Staff.


Descriptive information is given on the dairy industry in the Philippines. Statistics include milk prices, supply and demand, production and consumption, exports, and imports. Also provided are directories of manufacturers, producers, and importers.


Statistics are for 1971 only: Philippine exportations of primary products, semi-manufactures, and manufactures by divisional commodity and country of destination.


Statistics cover imports, exports, production, consumption, and prices. A directory of manufacturers and producers and descriptive information about the petroleum industry also are provided.


Descriptive information is provided about agricultural products. Statistics cover exports, imports, and production of fruits and vegetables. Directories of importers and exporters as well as producers are included.


Describes the rug, carpet, and drapery industry. Statistics cover imports and exports. Includes directories of exporters and buyers.


Describes the drug industry in Philippines with data on exports, imports, morbidity, mortality, firms in industry, production, and sales.


Economic survey of Africa; discusses industrial growth patterns and economic planning. Statistics are varied and sometimes aggregated: population, area, income, employment, mining, chemicals, textiles, production, and trade.
Descriptive and statistical information covers development planning, forest industries, iron and steel industries, availability of raw materials for chemical industries, aluminum industry, food and food products, and building materials industry.

Provides general background information and summary of industrial development plans in selected nations, including Nigeria -- 1970-1974.

General background information and summary of industrial development plans in selected nations, including Kenya -- 1970-1974.

SURVEYS OF FERTILITY, FAMILY, AND FAMILY PLANNING IN NIGERIA, University of Ife, Institute of Population and Manpower Studies, Ile-Ife, Nigeria. 1972.
Statistics include socioeconomic characteristics (education, religion, occupation, income, status), education of children, contraceptive histories (for women), reproductive histories (number of pregnancies, miscarriages, abortions, live births, number of children living), and fertility. Descriptive information is given on how the study was conducted.

Survey of small-scale industries includes data such as identification of establishments, capital formation, sources of funds, employment and earnings, production, cost and value of sales and inventories, and unionism.

INDUSTRIAL STATISTICS OF WESTERN STATE OF NIGERIA. Nigeria. Ministry of Economic Planning and Social Development. 1968.
Statistics include form of ownership, paid-up capital, identification operations, employment and wages, activity, quantity and value of goods sold, value of inventories at beginning and end of year, cost and quantity of raw materials and overhead expenses, value of fixed assets, and capacity of power (equipment and electricity generated). Data are broken down into industry sectors.

Statistical tables cover real product and population, growth of value added by industrial origin, detailed national accounts of selected less-developed countries (expenditure and sector origin of product; income saving and investment).

Data are organized into three sections: (1) Worldwide Overview of Information on Population, Economic Development Government Positions on Family Planning; (2) Demographic, Social and Economic Characteristics for Individual Countries; and (3) National Family Planning Policy and Program Data Such as Personnel and Funds Allocated to Services, Acceptors, and Estimated Current Users of Such Services.


Describes the policy framework for and the program of the reconstruction of the war-damaged areas as well as the construction and development plans for the rest of the country. Chapter headings are: Background; Decision Framework; Public Sector Programs; The Private Sector; Financing; Manpower; Plan Implementation and Control.


The progress report covers the following subject headings: General Survey of the Economy; Capital Expenditure; Financial Resources; General Policy Measures; Institutions; Plan Distortions; Manpower Development and Utilization; Sectoral Review; and Projects Review.


Describes the proposed development program as an annex to the four-year development plan, 1972-1975.


Statistics are given for area, population, GDP, cultivated land areas and major crops, annual consumption and production of fertilizer nutrients, and availability of fertilizer feedstocks. Country summaries include the above information plus descriptive information on agriculture, natural resources and industry, fertilizer manufacture and consumption.


Provides data on population, per capita product, and growth rates.


Provides basic data on and descriptions of aid programs (official and private) of each member of the Development Assistance Committee (D.A.C.) to developing countries. Data also are provided on flows from the main donors that are not members of the D.A.C. Statistics cover 1962-1968.


Summarizes U. S. shares of total exports and exports of manufactures to Brazil from 14 supplier countries, 1966-70. Of these 14 countries, the United States and the eight other major suppliers of manufactures to foreign markets are shown separately on the tabulation: Belgium-Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, United Kingdom, Sweden, and Japan.


Summarizes U. S. shares of exports and exports of manufactures to Ecuador from 14 supplier countries, 1967-71. Of these 14 countries, the United States and the eight other major suppliers of manufactures to foreign markets are shown separately on the tabulation: Belgium-Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, United Kingdom, Sweden, and Japan.


Summarizes U. S. shares of total exports and exports of manufactures to Kenya from 14 supplier countries, 1967-71. Of these 14 countries, the United States and the eight other major suppliers of manufactures to foreign markets are shown separately on the tabulation: Belgium-Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, United Kingdom, Sweden, and Japan.


Summarizes U. S. shares of total exports and exports of manufactures to Republic of Korea, 1966-70, from 14 supplier countries. Of these 14 countries, the United States and the eight other major suppliers of manufactures to foreign markets are shown separately on the tabulation: Belgium-Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, United Kingdom, Sweden, and Japan.
Summarizes U. S. shares of total exports and exports of manufactures to Nigeria from 14 supplier countries, 1967-71. Of these 14 countries, the United States and the eight other major suppliers of manufactures to foreign markets are shown separately on the tabulation: Belgium-Luxembourg, France, Federal Republic of Germany, Italy, Netherlands, United Kingdom, Sweden, and Japan.

Provides basic data on and descriptions of aid programs (official and private) of each member of the Development Assistance Committee (D.A.C.) to developing countries. Data also are provided in annexes on flows from the main donors that are not members of the D.A.C. (e.g., Finland, New Zealand, the U.S.S.R., Eastern European countries, and China). In general, data span the years 1961-1971. (Updates No. 50959, Resources for the Developing World, 1970.)

Contains basic economic, demographic and social data, and trend statistics by individual countries and for the region as a whole.

Contains basic economic, demographic and social data, and trend statistics by individual countries and for the region as a whole.

Contains basic economic, demographic and social data, and trend statistics by individual countries and for the region as a whole.

Contains basic economic, demographic and social data, and trend statistics by individual countries and for the region as a whole.

Data are provided for OECD member countries and selected non-OECD member countries (including Ecuador, Korea, and the Philippines) on (1) occupation by branch of economic activity, (2) occupation by education, and (3) education by branch of economic activity.

Contains data on the disbursements of financial resources in 1966 and 1967 by recipient country or area of flows from developed OECD member countries, Australia, and multilateral agencies to less-developed countries. Lists the amount received by each less-developed country, the type of assistance, and the source from which the funds were obtained.


Records the results of the Wholesale and Retail Trade Census in Korea which was taken as of July 1, 1971. Statistical tables cover industrial establishments, employment, sales, and size, by industry and by commodity groups.


The data cover commitments for economic and technical assistance made by A.I.D., other U. S. agencies, and international organizations from July 1, 1945, to June 30, 1973.


Statistics are provided under the following section headings: National Accounts; Population, Employment and Technical Manpower; Balance of Payments; Public Finance; Investment Programs; and 1981 Economy by Major Indicators.


Describes the third official Economic Development Plan (1972-1976) for Korea and provides summary tables on growth trends in the population, economy, productivity, employment, and trade. Investment programs are also summarized.


Reviews the current state of the economy and the long-range economic development plans of the government. Supported by numerous statistical tables.


Describes a development plan for Tubarão.


Provides indices of agricultural and food production (average 1961-65, annual 1964-73) for each nation in Africa and West Asia.


Reviews the 1973 agricultural year in selected African (including Kenya and Nigeria) and West Asian countries, gives the outlook for 1974 production and trade of selected commodities, and cites 1973 U. S. agricultural trade with the countries.


Provides summaries by industries, capital, and trade.


Provides detailed statistics on demographic characteristics for the State of Santa Catarina as of 1970.


Describes the Third Five-Year Manpower Development Plan (1972-1974) for Korea and provides statistical tables on employment demand projections through 1976 by occupation.


Chapter headings include: Summary of Basic Data; Population Trends; National Product; Production; Consumer Prices; Trade; Gold and Foreign Exchange Holdings; and Student Enrollment and Teacher Staff.


Part I lists data on long-term active loans and credits by the United States Government between July 1, 1941, and June 30, 1973, on short-term loans and credits and accounts receivable, and on foreign government indebtedness to the U. S. Government which arose from World War I. Part II lists data on active loans and credits extended by international development-oriented lending institutions to which the U. S. Government has made capital contributions.
Section headings are: World Trade by Regions and Countries, 1950-1970; Quantum, Unit Value and Terms of Trade Index Numbers by Economic Classes and Regions; Network of World Exports by Selected Commodity Classes and Regions of Origin and Destination; Selected Analytical Tables of World Trade; Financial Flows, Aid and Balance of Payments of Developing Countries and Territories; Some Basic Indicators of Development and Special Studies. Most of the data are aggregated by region or economic class.

Includes information from the regions and industries concerning size of establishments, by sex, age, and level of workers' skill.
GUIDELINES FOR INDUSTRIAL EXTENSION PERSONNEL

by

INDUSTRIAL DEVELOPMENT DIVISION STAFF
Robert E. Collier, Editor

Industrial Development Division
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
November 1974
INTRODUCTION

The Industrial Development Division has a long history of providing practical industrial extension assistance to more than 3,500 existing and new companies which had problems of various kinds. As a result of this interaction with both domestic and international companies, the staff has developed much insight into and experience with typical industry problems.

The staff recognized early that some types of problems recurred frequently and appeared to be characteristic of small and medium industries regardless of their geographical location. Beginning in the mid-sixties, the Division staff began producing a series of generalized counseling notes related to the recurring cases encountered. These original counseling notes were subsequently added to as new needs were perceived, resulting in a series of 13 "Management and Technical Assistance Counseling Notes." Originally these were used on a selective basis with U. S. companies which sought assistance.

The series of guidelines included in this binder have been generalized to be more broadly applicable to companies in developing countries, while recognizing that the counseling notes may not be equally applicable to all country situations.

However, these guidelines do encompass some tested and successful approaches to business and industry planning and operations. They cover separate subject areas and are intended to be used in part, as appropriate, as a supplement to management and technical assistance efforts in the field and as training course background materials.

As with all Industrial Development Division reports, we welcome suggestions and comments which can be utilized in revising and expanding the contents of these guidelines.

Ross W. Hammond, Chief
Industrial Development Division
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AN APPROACH TO FURNISHING INDUSTRIAL EXTENSION SERVICES TO SMALL-SCALE INDUSTRY</td>
<td>1-1</td>
</tr>
<tr>
<td>2</td>
<td>THE GENERATION AND EVALUATION OF VENTURE IDEAS</td>
<td>2-1</td>
</tr>
<tr>
<td>3</td>
<td>SELECTION OF APPROPRIATE TECHNOLOGY</td>
<td>3-1</td>
</tr>
<tr>
<td>4</td>
<td>RESOURCE AND TECHNICAL ANALYSIS</td>
<td>4-1</td>
</tr>
<tr>
<td>5</td>
<td>ADVISING THE PROSPECTIVE ENTREPRENEUR ON GOING INTO BUSINESS</td>
<td>5-1</td>
</tr>
<tr>
<td>6</td>
<td>A SYSTEMATIC APPROACH TO SMALL-SCALE INDUSTRY GROWTH</td>
<td>6-1</td>
</tr>
<tr>
<td>7</td>
<td>THE PRESENTATION OF INVESTMENT PROPOSALS</td>
<td>7-1</td>
</tr>
<tr>
<td>8</td>
<td>FACTORS IN PLANT LAYOUT</td>
<td>8-1</td>
</tr>
<tr>
<td>9</td>
<td>A SIMPLIFIED COST AND CONTROL SYSTEM FOR SMALL INDUSTRIAL CONCERN</td>
<td>9-1</td>
</tr>
<tr>
<td>10</td>
<td>INVENTORY CONTROL FOR SMALL-SCALE MANUFACTURING</td>
<td>10-1</td>
</tr>
<tr>
<td>11</td>
<td>PRODUCTION PLANNING AND CONTROL FOR SMALL-SCALE MANUFACTURING</td>
<td>11-1</td>
</tr>
<tr>
<td>12</td>
<td>HOW TO USE A PRIVATE MANAGEMENT CONSULTANT</td>
<td>12-1</td>
</tr>
<tr>
<td>13</td>
<td>SELECTED BIBLIOGRAPHY</td>
<td>13-1</td>
</tr>
</tbody>
</table>
AN APPROACH TO FURNISHING INDUSTRIAL EXTENSION SERVICES TO SMALL-SCALE INDUSTRY

Introduction

The purpose of this guideline is to describe the concept, structure, approach, and operation of an industrial extension service program that has been in operation in the state of Georgia for the past 14 years. This statewide program of management and technical assistance is conducted by the Industrial Development Division (IDD) of the Engineering Experiment Station (EES) at the Georgia Institute of Technology (Georgia Tech). While the IDD program involves assistance to city and county governments and local, area, and state economic development groups as well as technical services to business and industry, the emphasis in this guideline is on those aspects of the total program that relate to technology transfer and the provision of management and technical assistance to small-scale industrial firms.

A Concept for Technology Transfer

Technology "transfer" is much more complex than the mere transporting of an idea solution or piece of hardware from one place to another. The Georgia Tech industrial extension program is based on a fundamental principle: Technology cannot be force fed; the demand for it must be created and nurtured. Once this basic principle is accepted, technology transfer falls into place and some criteria for program development and management emerge, such as:

- Much technology now exists; the problem is how to apply it.
- In order to create a demand for and motivate institutions to apply technology, management must be convinced that technology will serve its economic needs.
Technology must address the needs of business, industry, and government.
These needs must be communicated to the research and development community at the state and local level, and the research and development community should try to sensitize itself to these needs.

Availability of Management and Technical Assistance Services

The staff of the Industrial Development Division has had a wide range of practical experience in consulting, administrative, and operational work with a variety of industries. Personnel of the Division are skilled as market analysts, plant location specialists, industrial economists, statisticians, research librarians, and engineers in at least six disciplines. In addition, the facilities and personnel of other divisions of the Engineering Experiment Station and of Georgia Tech's academic departments and library are available for consultative work on special projects. Laboratory and shop facilities can also be made available on highly specialized technical problems.

IDD's management and technical assistance services include but are not limited to the following:
Organizational analysis. . .determination of manpower requirements for a new manufacturing venture. . .assistance in improving a personnel selection and training program. . .investigation of possible sources of capital. . .analysis of financial statements. . .development of principles of cost recognition and control. . .assistance in modifying production equipment. . .verification of cost estimates for equipment modification. . .plant layouts. . .determination of feasibility of constructing a new plant. . .evaluation of equipment to support a loan application. . .investigation of the development of a new manufacturing process. . .development of market data. . .investigation of export opportunities. . .assistance in locating suppliers of special equipment and services.

Field Operations of the Industrial Extension Service

Seven area offices have been established throughout Georgia to serve as an extension of the Industrial Development Division activities and to provide resident assistance to meet the increasing need for research and professional guidance in the economic development of the state.
As an extension of the basic Industrial Development Division program, many of the service functions of the Engineering Experiment Station are also carried out through area offices. Therefore, many areas of commonality are found between the activities of the area offices and other branches of the Industrial Development Division, as well as other divisions of the Engineering Experiment Station.

IDD's extension service activities may be divided into two broad categories:

- Technical assistance to business and industry
- Technical assistance to local, area, and state economic development organizations

While all area offices have activities of similar nature, the principal difference in programs is that of emphasis. Each individual office stresses programs geared to the needs of its particular areas.

Technical support to local development groups may take many forms but, for the most part, involves development organization establishment, guidance, and support; economic research; industrial site identification, evaluation, documentation, and development; and prospect servicing.

Technical assistance to area development groups includes participation in land-use studies, zoning recommendations, industrial site or park development, data on worker commuter patterns, area potentials for industrial growth, industrial transportation requirements, prospect handling, economic research, assistance in the preparation of proposals for federal grants and loans, and staff training.

Technical assistance to statewide economic development agencies includes servicing of prospect inquiries, industrial site location, economic research, liaison between statewide agencies and local or area development groups, and the supply of basic data used to promote and sell the state and its communities.

Another function equally important in creating jobs and upgrading a community's economy is to improve existing business and industry through technical assistance. One method of strengthening existing industry is to provide technical services and information to companies that do not have the advantage of large technical staffs or up-to-date technical and management libraries. To implement this method of industrial improvement, the industrial extension service of IDD participates in a program to keep business and industry informed of
the latest advances in management and technology and to assist in the application of this information. Industrial extension field service professionals, operating from the seven area offices, visit industries in their areas to determine how Georgia Tech can best assist them.

Method of Approach

During the initial visit to a company, the field service man explains the various programs carried out by the Industrial Development Division and obtains as much information about the company as he can. This information is noted on a confidential manufacturer's data sheet prepared during the interview. It covers areas of production equipment and capabilities, raw materials and waste (which also include air pollutants and water pollutants), sales and marketing, plant facilities and possible expansion plans, and what the company's technical information and assistance needs might be.

Usually during this initial plant visit, the field service representative will have an opportunity to tour all of the manufacturing facilities. In many instances during this tour, the field service representative is able to make on-the-spot recommendations for improvements. It is sometimes very difficult, however, to get the company officials to expound on all of the company's problems and information needs. Often, if the official identifies symptoms rather than problems, the field service representative is able to deduce, from observations and conversations, what the company's present and potential problems are.

As a result of this initial visit, a write-up of the interview, as well as a profile of the company and any possible requests for information or assistance, is sent to the field service headquarters in Atlanta. The information requests and technical needs are screened and then either assigned to a researcher in the Industrial Development Division or directed to specialists at the Engineering Experiment Station or on the academic faculty. Answers to these industrial questions can come from either reprints of pertinent articles, abstracts, and bibliographies or from the experience and knowledge of Georgia Tech specialists.

The key elements of successful technical assistance and technology transfer are perceptive problem identification, the practical adaptation of technological solutions to the specific needs and capacities of the client firm, and direct personal assistance in interpreting technical information and applying recommended solutions.
General Policy

As a matter of policy, no industrial service project is undertaken which is considered to be competitive with the services of private consulting firms. The purpose of the program is to complement, not duplicate, private sources of service.

A standard policy approach guides all technical assistance projects:

1. Efforts are initially directed toward assisting the firm in solving its problem by itself. This is essentially a matter of assisting company representatives in identifying the true nature of a problem, then guiding them toward a series of steps by which they can correct the problem.

2. If it is impractical for a firm to resolve a problem situation with its own personnel, actual assistance is provided in attacking those aspects of the problem which IDD can competently approach on a short-term basis.

3. If a problem situation requires an inordinate amount of time or if IDD or other Georgia Tech personnel are not available or qualified to attack the problem, the firm is advised of its need for competent consulting specialists. (Certain longer term projects can be undertaken under government grant programs, and under exceptional circumstances where private consulting services are not available, either IDD or another division of the Engineering Experiment Station may undertake special contract assignments.)

Personnel Qualifications

The key to any successful industrial extension service operation is the selection and training of field service representatives.

In recruiting these individuals, the following broad qualifications are used as guidelines for selection:

- Engineering, science, or industrial management education
- Work experience in business or industry, with a plus for actual entrepreneurial experience
- Work philosophy that of "generalist" rather than "specialist"
Evidence of practical rather than theoretical approach to industrial problem-solving
Proven record of ability to work independently with very little supervision

After the selection has been made, a period of indoctrination and training is undertaken. Indoctrination is very informal and consists primarily of providing the new employee with printed material for self-study. This material includes administrative procedures, organization regulations, case study reports of technical assistance and technology transfer efforts, etc. The actual training process begins with the assignment of the new employee to an experienced field service representative. Using on-the-job training experience, the new employee gradually progresses from the passive role of "observer" through the phase of "contributor" and into the active role of working independently on company problems.
THE GENERATION AND EVALUATION OF VENTURE IDEAS

Idea Identification: A Proper Function for a Development Organization

It is a necessary and important function of a development organization to identify fields that offer potentially sound opportunities for the establishment of new industrial enterprises and/or the expansion and diversification of existing ones. In a very real way, this gives a sense of direction to the development of a geographical area and/or an industrial sector and actually constitutes a major responsibility for a development organization.

In essence, since new ventures frequently originate in the form of an idea that some person has, it is important that the professional in the development field be able to perceive through certain happenings in his community, or through conversation with other people, or through his own thought process the existence of ideas for study which harbor the potential for economic growth. That is to say that the developer must train himself to be aware of such opportunities when he comes across them. In one sense, this involves becoming generally knowledgeable about the broad economic circumstances of his area. In another sense, this involves gaining experience in his professional field. In total, however, what is involved is more than either of these. It is the discipline of the developer's mental faculties so that he is sensitive to what he sees and hears as it relates to his pursuits of the industrial and economic development of his area.

In addition to this frame of reference from which the developer must operate, there are more formal and detailed methods of turning up sources of ideas for study that are available to the development organization. The following strategies represent ways in which data may be used to turn up ideas for further development.
Strategies for the Generation and Selection of Venture Ideas

There is no one best way of generating ideas for new ventures or for determining the need for the expansion or diversification of existing industrial operations. There are, however, several general approaches that may be used in exploring new approaches. Some of the strategies that may be used are outlined below.

- **Upgrade and expand existing industry opportunities**
  - Identify opportunities in growth industries
  - Select industries which have potential for upgrading and expansion
  - Analyze markets for development by selected industries
  - Identify appropriate technology which will assist in expansion or upgrading
  - Perform product description to include marketing strategy, labor force availability, risk analysis, facilities location, and environmental enhancement
  - Define enterprise alternatives

- **Create totally new industrial opportunities**
  - Gather information on new products, services, processes, and production from all available sources
  - Identify those items which are applicable to the region
  - Select products, etc., with the greatest income potential
  - Identify appropriate technologies
  - Define enterprise alternatives

- **Attract extra-regional growth industry opportunities**
  - Identify major growth industry opportunities outside region or LDC (developing country)
  - Obtain location criteria used by companies
  - Correlate location criteria with regional and LDC resources and facilities
  - Define enterprise alternatives

- **Identify market opportunities for regional and LDC resources and products**
  - Identify existing regional and LDC resources for external and internal marketing
- For external marketing, determine products with the highest potential for developing markets outside the region and LDC.
- For internal markets, determine those resources which will contribute most significantly to internal income generation.
- Apply to enterprise alternatives.

**Identify investment/venture capital resources relative to enterprise alternatives**
- Develop current information on availability of venture capital.
  - Data on major investment bankers in the nation.
  - Data on all sources of capital in the region.
- Determine policies of regional and LDC investors.
- Apply to enterprise alternatives.

**Identify relevant skills to technologies for each productive enterprise**
- Estimate skill requirements based on production processes.
- Estimate skills availability based on current employment and resources development.
- Determine current and projected labor availability.
- Determine training required to produce required number of skills.
- Apply to enterprise alternatives.

**Determine impact of existing local and regional conditions on enterprise alternatives**
- Housing.
- Health care.
- Water and sewer facilities.
- Public education.
- Public agency involvement with community industrial development.
- Apply to enterprise alternatives.

**Approaches to Idea Identification by the Development Organization**

**Inquiries.** Requests for information on specific industries often prove useful in determining development possibilities. Such inquiries indicating interest in a given industry many times indicate a need or desirability for the industry as well. The use of this approach is especially meaningful if the requests begin to fit a pattern -- a strong indication that further analysis is needed. In addition, if the interest is in an industry that might promote the
need for related industries, such as job shop services, then further analysis often is warranted.

- **Satellite Industry.** It is sometimes desirable to investigate the possibility of developing satellite industries which will tie in with the existing industrial complex. Possibilities fall into two groups -- those satellite industries which will supply raw materials, components, and services to the existing complex, and those which can further process the products or by-products of the existing complex.

- **Investigate the Resources of an Area.** Investigation of the resources of a defined area can lead to identification of specific economic development opportunities. Mineral, forest, agricultural, tourist, and recreational resources can be analyzed based on both published information and interviews, and opportunities showing particular promise for commercial development can be identified for further development. When this approach is applied to industrial resources, it is the same as the satellite approach described earlier.

- **External Evaluation.** External evaluation identifies opportunities for development primarily through analysis of published material and regional data on a broad range of specific industries. Analysis can search for growth industries, industries which tend to serve regional markets, industries which prefer small cities or towns to large metropolitan areas, and industries which are sensitive to freight costs, labor costs, utility costs, and other factors. Through this method, opportunities which are most appropriate for the development of a given area can be identified.

Although statistical standards can be developed for many of the factors considered in the analysis program, judgment and experience are necessary both for measurement of some factors and for overall evaluation of the relative importance of all the factors. Refer to check list for use in connection with adequate statistical information.

- **Developing a Particular Industry Group.** Development organizations sometimes choose to encourage the growth of a particular kind of industry -- sophisticated, space oriented, metalworking, etc. -- usually because they feel that the particular industry will have an important or desirable impact on the total economy. Such a policy decision would call for evaluating the many segments of the selected industry group in order to determine which segments the organization
can hope to successfully develop first or which segments, if developed, will lead to the most rapid development of the total industry group.

Idea Identification by the Small-Scale Entrepreneur

The basic objective of the entrepreneur is to select an economically successful venture. That is one that has a high likelihood of giving him a good return on his investment. The following are areas of investigation that may be suitable for the small-scale entrepreneur. It is noted that some of the areas that must be investigated may require the assistance of industrial extension personnel.

- **Investigate Local Materials** - Minerals, agricultural products, forest wastes, clay for ceramic tile, ocean.

- **Study Available Labor and Management** - What skills, handicrafts, or special arts are involved?

- **Existing Markets** - Existing markets which you can satisfy at an advantage because of proximity and have low transportation costs or because competition lacks capacity.

- **Existing Industry** - Existing industries for expansion or diversification, lack of competition, inefficiencies which can be corrected, too high prices, etc.

- **Imports** - Consider along with domestic production. These do not have to be imports from foreign countries. They can be imports from any distance which presents an opportunity for transportation cost advantage.

- **Tax Situation** - Governmental policy offering special advantages by way of low taxes or other concessions.

- **Inter-Industry Relationships** - Growth in one industry almost always creates opportunities. Analyze input needs of existing firms to determine if you have a cost advantage for any of this, e.g., egg cartons.

Service Industries - Study the service and support needs of existing industry or the public (e.g., maintenance, information service). Here again analyze all inputs to existing industry.

Identify Major National Growth Industries - Is capacity needed in your area? You may be able to compete locally with a firm which has to ship its product in.

Evaluating the Feasibility of New Ventures

These guidelines are suggested as a basic check list for use in evaluating the feasibility of new ventures.

Market Potential

- Define the market for the product:
  - local?
  - regional?
  - national?

- How is this market documented?
  - letters of intent from prospective customers?
  - personal word-of-mouth "survey" by the applicant?
  - firm orders on an "as, if, and when" basis?
  - a market survey carried out by a recognized, disinterested professional?
  - a recognized shortage of the product in relation to demand?

- Is the market for this product apt to be long term or is it:
  - a flash-in-the-pan, a novelty item?
  - a product liable to rapid technological obsolescence?
  - a staple item with only small growth potential?

- What kind of competition does this product face?
  - is it strong nationally but relatively minor locally or regionally?
  - is it oriented to price or quality?
  - has it strength in technology or merchandising ability?
  - is it long-established (e.g., well-known brand) or relatively new to the marketplace (e.g., electric toothbrushes)?
- Is there the possibility of industry "overcapacity"? 
  . locally, regionally, or nationally?

- Financing
  - Is enough money available from all sources to finance the project? 
    . community money?
    . bank or other private financing?
    . applicant's equity?
    . working capital?
  - Has provision been made for: 
    . construction delays?
    . start-up expenses?
    . initial sales and merchandising costs to break into the established market?
    . product modification (possibly involving equipment modification) in response to customer demands?
  - Has the availability of private financing, applicant's equity, and working capital been documented adequately?

- Management Capabilities
  - Will the project have adequate management to handle competently: 
    . selection of site, building, machinery, and equipment?
    . operation of the plant?
    . sales and merchandising?
    . cost controls?
    . accounting?
    . employee relations?
  - What is the business experience of those who will actively manage the project?
  - Do they show a pattern of success in: 
    . identical or similar ventures?
    . closely allied ventures?
    . unrelated businesses?
  - Do they have interests outside the project which will detract from their attention to the project?
  - Do they have other sources of income which will lessen their dependence on the success of the project?
- To what extent are their own resources committed to the project?
- Do they have business connections which might threaten a potential conflict of interest with respect to the project's welfare?

**o Technological Capabilities**
- What special technical knowledge and skills will be required to make the project a success?
- What is the technical background and experience of those who will be actually associated with the project?
- Is the project in a field experiencing rapid changes in technology?
- Has provision been made to meet the problems engendered by technological changes?

**o Materials and Supplies**
- Raw materials:
  - are they available?
  - in sufficient quantity?
  - at acceptable delivery costs?
  - of such quality or grade as to minimize in-plant upgrading?
- Supplies: (e.g., tools and dies, spare parts for machinery, repair facilities)
  - are they available?
  - promptly?
  - at reasonable cost?
  - is there a choice of sources or substitutes?
- State source of information on above items.

**o Machinery and Equipment**
- Production equipment:
  - will it perform the job for which it is intended?
  - will it do so efficiently and at an acceptable cost?
  - is it standard equipment available from several sources?
  - are spare parts or service readily obtainable?
  - if special purpose or of special design, has performance been proven under normal operating conditions?
- Auxiliary equipment
  - will it perform the job intended?
. the same questions as above? PLUS . . .
. is it immediately necessary to the functioning of the operation or is it too elaborate?
- State source of information on above items.
A Guideline for Industrial Extension Personnel

No.3  
November 1974

Published by the Industrial Development Division, Engineering Experiment Station,  
Georgia Institute of Technology and Funded by the United States Agency for International Development

SELECTION OF APPROPRIATE TECHNOLOGY

For the purposes of this guideline, "appropriate technology" is defined as "that level of applied technology which is best suited to the specific cultural, economic, social, and political climates found in the various countries of the world," and which, consequently, may vary from country to country.

The aim of this guideline is to provide a rationale for appropriate technology and to show, in various settings, specific examples of alternative technology levels in order to provide some guidance to development personnel confronted with the need to make level-of-technology decisions.

Why "Appropriate" Technology?

There are a host of unsuccessful examples of transfers of specific technologies from a developed society to the developing countries. The reasons for the failure of these transfers are many and include:

- Technology which is too advanced for or not adapted to the country.
- Ignoring of differences in the labor vs. capital factors found in developing and developed economies.
- Inadequate infrastructure, insufficient trained manpower, inadequate markets, or other social, cultural, or economic barriers to high technology transfer.
- Technology not in keeping with national development goals.

One of the important considerations in selection of appropriate technology is the question of labor vs. capital. In a country where labor costs are high, it is generally feasible to think in terms of mechanization and automated equipment (capital intensive). In countries where labor costs are relatively low (and where unemployment usually is high), it is frequently more desirable to manufacture products using more hand labor and less mechanization (labor intensive).
It is possible to manufacture many products by means of a high proportion of labor and little machinery or a high proportion of machinery and little labor, as well as many other in-between combinations of labor and equipment. It is the selection of the appropriate use of man and machines, based on their relative cost, which determines in many cases the appropriate level of technology to use.

Another major determinant in many countries of the world is government policy. If there is a well defined government plan for economic development, it will probably include special incentive programs and focus on selected industries which the government wishes to develop. This tends to focus the technology on that associated with the key industries which are to be developed. If the government has a major concern of reducing unemployment or underemployment, then the creation of labor-intensive industry becomes very important, usually with a lower level of technology. Again, if foreign exchange (for the purchase of equipment) is in short supply, this too will affect the labor vs. capital relationship and hence the technology utilized. Other factors affect this relationship as well.

Criteria of Appropriate Technology

There are certain basic criteria to be considered in the selection of appropriate technology:

1. Technology is seldom directly transferable. More often than not it must be adapted to different environmental conditions (dry-land rice harvesting machinery will not work well in a wet-land rice growing country).

2. The various cultural, political, economic, and infrastructure conditions must be considered in suggesting the appropriate technology. For example, a high electric power-using technology would be inappropriate for an area devoid of reliable electric power.

3. To the maximum extent possible, local materials and natural, man-power, and man-made resources should be utilized (foreign imports usually are high in cost and foreign exchange in short supply).

4. Appropriate technology should encourage and foster indigenous initiative and innovation. It is not sufficient to buy technology and know-how and transfer and install it without encouraging in
the productive system flexibility and a willingness to change with changing markets and other factors.

5. Appropriate technologies must have or develop logistical support systems, such as maintenance services and spare parts availability.

Some Specific Examples of Appropriate Technology

In order to demonstrate some of the factors which interact in the selection of appropriate technology, the following examples are cited:

1. *Appropriate Technology for Rural Kenya.* Photograph No. 1 was taken at the Machakos Rural Industrial Development Center. It shows two products designed and produced for use in a rural part of Kenya.

Photograph 1
MANUALLY OPERATED CORN SHELLER

The wooden wheelbarrow is made from local resources, obviating the need to import steel wheelbarrows from abroad and reducing the need for foreign exchange. The introduction of the wheelbarrow in a rural subculture which is accustomed to transporting material on the heads of individuals involves a cultural change which takes time to implement, but is an appropriate materials handling technology.

The second object in photograph No. 1 is a manually operated corn sheller for use in areas where electric power is nonexistent. The ears of corn are
rotated manually at the top of the device and the kernels are abraded off on turned-over nails which have been driven into planks. The corn kernels and cobs fall into a container at the bottom and the cobs are manually separated and discarded. This rudimentary but effective device is an appropriate approach where the mechanization infrastructure is not developed.

2. **Appropriate Technology in Rural Korea.** The government of Korea has established a rural development program called "New Village Movement (Sae Maul)," which has as one of its aspects the decentralization or development of industries in rural communities. Photographs Nos. 2, 3, and 4 show scenes at one such rural industry, a fishing pole factory, employing some 50 people in a labor-intensive activity.

Photograph No. 2 shows the raw material, bamboo, stacked to dry in an open area and the preliminary cutting and matching of the bamboo into tapered sections for the fish pole production. The individual bamboo sections are heated in the ovens shown in photograph No. 3 and straightened by hand, using a simple hand-held wooden jig. The sections are then bored and sized (photograph No. 4) so they will form a multi-section fishing pole. The section ends are then wrapped with thread and painted, and all sections are finished and packed for shipment. Monthly production is approximately 10,000 poles.

Photograph 2
RURAL INDUSTRY IN KOREA

3-4
Photograph 3
RURAL INDUSTRY IN KOREA

Photograph 4
RURAL INDUSTRY IN KOREA
Almost all of the jobs are relatively unskilled and manual in nature, which is appropriate to a rural environment where labor costs approximate $1.00 per day. There are frequently great opportunities in labor-intensive activities like this to materially increase productivity through improvements in layouts, methods, and the use of simple tools and jigs, without sacrificing employment.

3. Traditional or Modern Technology. The interior of a Nigerian bakery employing about 20 persons is shown in photograph No. 5. The bread can be seen on the floor in the containers in which it was baked, in the traditional wood-fired earthen oven shown in the left foreground.

![Photograph 5](image)

Interestingly, in the left background is a modern electric oven which was not being utilized at the time this photograph was taken.

Was this a case where the entrepreneur had an opportunity to compare the traditional and modern technology side by side in the bakery and decided the traditional wood-fired oven was superior? Or was the modern technology not competitive in cost with the traditional method of baking bread due to the cost of electricity and other factors?

These and other conjectures occurred to the technicians gathering information about the operations of this enterprise. Further investigation revealed that the reason that the electric oven was not being used was due to a breakdown of the equipment and the unavailability of replacement parts to make the oven operational again.
This highlighted one of the major problems in technology transfer the world over. All too often technology is transferred without adaptation and without establishing adequate maintenance and spare parts services.

4. Adaptability Is an Important Aspect of Appropriate Technology. Small industries in developing countries often have shown a capability to adapt existing technology to suit the country conditions and the availability of component parts.

The work of the International Rice Research Institute (while not a small industry) in the Philippines is a case in point. There, a number of low-cost rice related machines (seeder, thresher, dryer, pumps, etc.) have been designed and produced. One of the features of the designs is the flexibility to utilize motors, materials, and component parts which are readily available locally, indicating that a good deal of adaptability in production of these machines is needed.

Photograph No. 6 shows one process (embossing a design) in a picture frame plant in southeast Brazil. Here an olive green agricultural paste is fed into the machine manually from the right hand side of the embossing machine. As the white picture frame is drawn through the device, the paste is embossed in a repetitive design on the wood and after hardening becomes an artistic and decorative addition to the picture frame. This machine, as well as others in the plant, was designed and fabricated locally.
Various stages of producing polyurethane foam mattresses in Ecuador are shown in photographs Nos. 7, 8, and 9. In photograph No. 7, two of the necessary ingredients are being mixed in the forms used to produce the polyurethane foam. The materials expand about 30 times during the process (shown partly expanded in photograph No. 8). The polyurethane foam blocks are then cut to size for the mattresses, as shown in photograph No. 9.
5. Conversion of Agricultural Waste Products. Photograph No. 10 shows a block diagram for a system to convert agricultural wastes (peanut hulls, coconut shells, cotton gin waste, coffee bean hulls, etc.) into useful products (char, hydrocarbon oils, gases, etc.). It is done by pyrolytic conversion (burning under controlled conditions) and can be done very simply (old oil drums are used in Jamaica, for example) or with fairly complex equipment as shown in photograph No. 11.
utilize in industrialization processes.

1. **Review national goals relating to industrialization.**
   - Is there a national thrust to develop small and medium industry?
   - What kind of government incentive programs exist?
   - Is the need for employment generation demonstrated in the government's national plan?
   - What other public or private information is available which can help in the selection of appropriate technology?

2. **Verify the feasibility of the proposed industrial activity.**
   - Is there a market for the product? What is the nature of the market -- local, national, international, etc.?
   - Is the infrastructure (electricity, gas, oil, water, roads, etc.) available in the proposed industrial location?
   - What are the raw materials needed and are they available?
   - Is the transportation system adequate to permit the proper distribution of products within the market area?

3. **Investigate the social, cultural, and political climate as it affects industrial activity.**

4. **Consider the elements of the proposed enterprise:**
   - Organization
   - Entrepreneurial resources and management capability
   - Technological levels possible in the activity
   - Relative cost of labor and machinery (labor vs. capital)
   - Financial and other restraints
   - Production processes
   - The range of technological alternatives
   - Sales and distribution plans
   - Verification of maintenance and service sources for the level of technology

5. **Based on the above, recommend selection of the appropriate technology.**
RESOURCE AND TECHNICAL ANALYSIS

Introduction

It is becoming more and more evident that one of the most important contributing factors to the failure of newly created small industries in developing countries is the inadequate analysis of technical alternatives prior to equipment purchasing commitments. This type of failure usually is found in those situations where the small industrialist does not have technical assistance available during the critical stages of equipment selection. Unfortunately, however, small industry failures also take place even when "expert advice" goes into the planning of the production system to be selected. The causes of this phenomenon are many and varied. An examination of causes is beyond the scope of this guideline, but the implications of what appears to be the most common one can be mentioned here.

Many developing programs are staffed with specialists whose backgrounds are heavily oriented towards the social sciences and weak on technical exposure or curiosity. If members of a development team are not multidisciplinary, they, like the small industrialist that acts on his own, tend to rely heavily on the word and advice of equipment salesmen. When equipment representatives are not available locally, decisions to purchase machines often are made solely on the basis of information in catalogs or brochures. In this type of situation, the probability of failure can be minimized if a careful, detailed analysis is made of the raw materials to be processed (resource analysis) and the available production technologies (technical analysis).
Resource Analysis

Resource or raw materials analysis is particularly important when foreign technology and equipment is being purchased. Many times raw materials with identical names and appearance can be quite different in composition and internal characteristics in different countries. When seeking foreign equipment sources, therefore, a development analyst can not afford to assume that the raw materials characteristics in another country are the same as the raw materials characteristics in his native environment. An analyst should learn as much as possible about the physical and mechanical characteristics as well as the chemical properties of the raw materials to be processed by the industry he is assisting. Oftentimes such information is already available in the technical libraries or is known by research organizations within his country. If information is not available or is scarce and incomplete, he should encourage the interested parties to have the materials analyzed or tested in national laboratories.

If none of these alternatives are feasible, the development analyst should recommend the shipping of sample lots of the indigenous material to the equipment supplier so that it can be tested on the supplier's equipment to see if the equipment ratings, performance, and yields are the same as those assumed for this type of material. If technical information is available, he should send it to the equipment supplier and ask about the adaptability and performance of the equipment if the raw materials are significantly different from those that the equipment was designed to process.

Selecting the Appropriate Technological "Package"

Once a thorough resource analysis has been performed, and even before equipment sources are contacted, the analyst should research the alternative productions methods available, if any, that produce relatively similar results. If different technologies are available, this often becomes a very critical stage in his analysis, particularly when dealing with small industry. This is so because the small businessman has to derive a trade-off system of analysis that will help him identify, evaluate, and select that production method (technology) that is best suited to the reality of the environment in which the business firm will operate. He will have to balance the trade-off elements such as:
1. An expensive system vs. a less reliable cheaper production method
2. Capital intensive vs. labor intensive
3. High technology vs. lower technology
4. Type of energy to be consumed, e.g., electricity vs. fuel oil
5. The availability of spare parts in the future, e.g., local vs. foreign sources
6. Foreign vs. national equipment
7. New vs. used equipment
8. Type and size of market to be served, e.g., domestic vs. export

These are no quick rules for balancing this set of trade-offs. A close observation of the problem indicates that the decision on the individual trade-off is a function of the financial, managerial, and technical potential of the investors (1, 3, 7). It is also a function of the developmental policies of the native country (2, 5, 6, 8), as well as the economic development stage of the country (1, 3, 4, 8).

Once a technological package has been selected, the analyst should try to obtain at least three different price quotations. Each quotation should be analyzed in detail and pieces of equipment that are not vital or that can be economically replaced by labor should be eliminated. Prior to making his final recommendations, the analyst should, if possible, visit the equipment supplier's manufacturing plant and should discuss the merits of the equipment with previous clients of the supplier.
A SYSTEMATIC APPROACH TO SMALL-SCALE INDUSTRY GROWTH

Basic Problems of Small-Scale Industry

The most persistent problems of small business -- and those that most often lead to business failure -- may be properly classified as "management problems." This fact of small business life has been substantiated over and over again by detailed analyses of business failures and by case study investigations of the problems of small business establishment, growth, and survival.

A detailed study of the problems of growth and survival of small retail and service firms found that "success or failure could not be attributed to single causes but was generally the result of a complex interplay of various factors." These factors, stated positively and grouped in order of importance, include:

1. Adequate capital, managerial competence, and favorable personality.
3. Favorable location, good record keeping, good housekeeping, and advance planning for operating and developing the business.

Since all of these factors are within the control of the small business owner or manager, they may be broadly classified as management factors. Specifically, these factors can be translated into the following array of problems:

1. Recruitment of non-management personnel
2. Training of non-management personnel
3. Training of management personnel
4. Sales promotion
5. Recruitment of management personnel
6. Distribution channels
7. Cost control
The individual areas of operation in which managerial and technical assistance has been found to be most helpful to small manufacturers by the Industrial Development Division are as follows:

1. Cost control
2. Sales promotion
3. Training employees
4. Production methods
5. Maintaining stable work force
6. Diversification
7. Quality control

Based on the experiences of providing industrial extension services to companies, it has been found that many of these problems and needs result from a failure to observe certain basic principles of small business organization and management. It has been concluded that the underlying causes of many of the problems of the small manufacturer were these:

1. Failure to limit his field of competition to that in which he was capable of competing successfully.
2. Lack of management skill and less than adequate knowledge of the manufacturing field in which he operates.
3. Failure to plan for the organizational needs of his company and failure to take full advantage of the abilities of his subordinates.
4. Failure to recognize the fact that manpower resources are no less valuable because a business is small.
5. Failure to maintain complete and accurate records, with the resulting failure to base his operating decisions on known facts.
6. Failure to take advantage of the flexibility that his size affords and to apply an aggressive ingenuity in overcoming problems and meeting changing needs.

Experience clearly indicates that most of the basic problems of small business growth and survival are closely identified with management capabilities and characteristics. The most encouraging feature of this conclusion is the fact that these problems are not inherent parts of small business itself -- but are capable of being resolved through proper education, counseling, and assistance.

Basic Guidelines

- Expansion or diversification should be planned in the light of the company's capabilities and its long-range objectives.
No one management function should control the pattern of growth; a realistic decision can be made only after all influencing elements (financial, sales, production, and personnel capabilities) have been considered.

Steps Toward Systematic Growth

- **Determine the Soundness of the Base for Growth**
  Evaluate the company's existing resources and capabilities in the fields of finance, manufacturing systems, sales programs, research and development facilities, and management personnel capacities.

- **Evaluate the Overall Potential within the Industry**
  Analyze the growth trends within the company's industry group, the projected expansion of the industry, and the product lines which appear to have the most potential in the light of market demand, technical development, and competitive forces.

- **Evaluate the Potential of Related Industries**
  Investigate the potential of related industries to identify and evaluate possible product lines which have significant growth potential and which fall within the present and potential capabilities of the company.
  a. Products which can be made with little or no additional investment.
  b. Products which can be sold with present distribution system.

- **Determine Management's Long-Range Objectives**
  After consideration of the company's available resources and capabilities and the general potential of broad product categories, establish specific and realistic objectives for the company in terms of broadening its financial resources, manufacturing capabilities, and marketing program. Specify what additional resources and capabilities must be developed to achieve these objectives.

- **Search for the Optimum Growth Pattern**
  Working within the framework of the broad product categories which appear to have the most potential, make use of industry associations,
trade contracts, consultants, and specialized development organizations to identify:

a. The most appropriate avenue of expansion within the existing product line.
b. Specific new product possibilities for diversification.

o Measure Alternatives in the Light of Company Objectives

Consider the alternatives of expanding production in the existing product line as opposed to diversification into a new product group. What are the relative advantages and disadvantages? What does each alternative contribute to achievement of the company's long-term objectives? For each alternative, evaluate:

a. Any basic limitations.
   (1) The patent and legal considerations involved for the particular item.
   (2) The impact of the action on the company's existing product line.

b. Salability.
   (1) The particular market potential of the product involved -- to be determined through analyses of existing and potential market demand.
   (2) The nature and extent of existing and probable competition.

c. Costs.
   (1) The availability and costs of raw material.
   (2) The manufacturing costs and related capital expenditures required for putting the product into production.
   (3) The availability and costs of production, management, and sales personnel required to support the new product line.
   (4) The additional sales and distribution costs and marketing effort required for the new product.

d. Profit potential -- the income potential to be achieved, based on projected cash flow estimates for the new product.

o Organize for Action

a. Determine the most appropriate time to enter the market with an expanded or diversified product line.

b. Plan and execute product design and engineering phases.

c. Secure necessary financial reserves as indicated by the projected cash flow.
d. Establish control schedules for the purchase and installation of necessary equipment and inventory.

e. Establish related schedules for the employment and training of additional personnel.

f. Plan advertising, sales promotion, and field marketing programs.

g. Establish and maintain sound quality control procedures to ensure product quality during the critical start-up period.

o Monitor Market Reaction

Follow closely the initial market reaction. Be prepared to act quickly in altering sales strategy to meet unanticipated reactions. Monitor actual operating costs and sales receipts for comparison against initial projections, and make necessary adjustments required in scheduling additional disbursements.
THE PRESENTATION OF INVESTMENT PROPOSALS

In order to attract capital for a new business, the developer should present a complete outline of the proposed business. In the promotion of a new product or process, he should be able to demonstrate its realistic potential in terms of:

1. the market potential,
2. manufacturing requirements,
3. financing requirements, and
4. general management requirements.

The market should be investigated as carefully as possible to determine if the potential is sufficient to attract investment capital. The market should be defined in detail: Is it specialized or broad? Is it regional or national? Is it characterized by many competitors or only a few? How successful have competing products been in the market? What unique appeal does the new product or process have? How is the market likely to react to the new product or process?

The problem of distribution is one that is usually discussed in detail after investment interests have begun their preliminary discussions. However, the developer should be familiar with distribution methods for his type of product, and he should be able to discuss the advantages and disadvantages of several possible methods.

Manufacturing requirements are a major consideration in any presentation of a new product. The developer should be able to present an estimate of production facilities required for a given number of units. This estimate should include data related to major items of production equipment and probable manpower requirements.
Financing requirements cannot be determined with complete accuracy, but
the developer should estimate the probable cost for the preliminary work in
refining the product for manufacture (including any research and development
work required), in securing suitable manufacturing space, in the purchase of
equipment, and in meeting necessary payrolls.

As a matter of basic interest to a prospective investor, and as a working
guide for the developer himself, the preparation of a cash flow projection is
highly desirable. Figures 1, 2, and 3 illustrate a useful format for this
purpose. These forms require the developer to determine specific production,
personnel, and financial requirements. The preparation of the cash flow pro-
jection and the pro forma profit and loss statement will indicate very clearly
specific operating capital requirements. The data will also serve as a basis
for determining what costs are most significant and require the most careful
control.

General management requirements will be determined by the background of
the developer himself and his feelings as to his role in the production and
distribution of the product. In addition, the role of the investment group
will shape the general management of a new enterprise. This is a time for
careful reflection on the part of the originator of the proposal: on one
hand, he may feel that he should control the company since the product is his
idea; on the other hand, he must face the realistic problem of evaluating his
own management capabilities. Many new enterprises lack management skills suf-
ficiently well rounded to cope with all the problems that develop in an oper-
ating situation.

One of the major obstacles to be overcome by the developer of a new prod-
uct or process involves the method of presenting his idea to prospective in-
vestors. It sometimes happens that an individual becomes so familiar with his
idea that he fails to present it in meaningful and concise terms. For this
reason, a very basic sort of background document has been developed by the
technical assistance staff for use in describing the background, potential,
and requirements of the new product or process. This form calls for the fol-
lowing information:

1. Descriptive title of product or process.
2. Names and addresses of developers.
3. Background of the developers.
4. Background of the product or process.
5. Description of the product or process.
6. Advantages of the product or process over similar products or processes.
7. Market for the product or process.
8. Estimated selling price and proposed method of distribution.
9. Consumer or industry reaction.
11. Availability of blueprints or working model.
12. Estimated capital investment and operating capital requirements, preferably including a cash flow projection and pro forma profit and loss statement.
13. Additional information.

This form is not intended to be used to describe in detail all of the features of the new product or process. The form serves two very useful functions, however. It requires the developer to reduce his idea to its basic elements and to determine if he needs to secure additional information before proceeding.
## Figure 1
### CASH FLOW PROJECTION

<table>
<thead>
<tr>
<th>Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Total</th>
</tr>
</thead>
</table>

1. **Gross Sales**
2. **Less: Returns, Allowances, and Discounts**
3. **Net Sales**

**Cash Receipts From:**

4. Accounts Receivable and Notes Receivable (on Books)
5. Collection of Sales (Line 3)
6. Other Income

7. **TOTAL CASH RECEIPTS**

   (Prepare information called for in lines 27, 28, and 29 before proceeding further)

8. Accounts Payable (on Books)
9. Accounts Payable (New Purchases) (See line 28)
10. Direct Labor
11. Manufacturing Expense (Exclude Depreciation and Salaries)
12. Sales Expense (Exclude Depreciation and Salaries)
13. General and Administrative Expense (Exclude Depreciation and Salaries)
14. All Salaries
15. Research and Development Expense
16. Income Taxes
17. Notes Payable (Banks)
18. Notes Payable (Other)
19. Mortgage Payments
20. Interest
21. Other

22. **TOTAL CASH REQUIREMENTS**
23. Cash Receipts
24. Cash Requirements
25. Excess (Deficit)

26. Month End Balance (Cash at beginning)
27. Production Scheduled
28. Material Purchases
29. Purchase Payments (Transfer to line 9)
INSTRUCTIONS FOR PREPARATION OF CASH FLOW PROJECTION

Line

1. Show management estimates of sales to be expected during forecast period (one year).

2. Deduct estimated returns, allowances, and discounts. (If established company, use prior experience.)

3. Line 1 minus line 2.

4. Estimated collection of existing receivables on basis of actual experience. Example:
   \[
   \frac{\text{Average Outstanding Receivables}}{\text{Annual Net Sales}} \times 360 = \text{days to collect after shipping date.}
   \]

5. Same procedure as above to be applied to receivables created from new sales (line 3). (If new company, assume collection on due date of invoices.)

6. Rent, discounts taken, contemplated borrowings.

7. Summary of lines 4, 5, and 6.

8. Include all past due trade payable in first month, spread balance by discount date.

9. Purchase payments. (See line 28 for method of calculation.)

10. Direct labor cost.

11. Exclude depreciation and salaries \( \text{If an existing company, compute these factors as a percentage of Net Sales during a prior period which you consider to be typical. If a new company, use estimates which can be supported. Apply percentages of figures on line 27.} \)

12. Exclude depreciation and salaries

13. Exclude depreciation and salaries

14. All salaries (spread on level basis throughout year).

15. Research and Development costs payable in forecast period.

16. Income Taxes to be paid during forecast period.

17. Notes Payable presently on books or projected.

18. Notes Payable presently on books or projected (new machinery purchases, etc.).

19. Mortgages payable on books or projected.

20. Interest on existing proposed debt.

21. Other cash expenses or payments: Itemize substantial costs peculiar to your type of operation.

22. Summary of lines 8-21.

24. Copy line 22.


26. Start with cash position immediately preceding start of forecast period and carry forward cumulative total by month.

27. Insert the sales dollar value of production necessary to support projected sales and any related inventory build-up, taking into consideration the time required for manufacturing and delivery. All percentages used in lines 9, 10, 11, 12, and 13 of the Cash Flow Chart apply to this figure.

28. List planned purchases by month.

29. Spread purchase payments into the months in which they fall due.
Figure 3
STATEMENT OF INCOME

(Period Covered)

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Per Cent of Net Sales</th>
<th>Projected</th>
<th>Per Cent of Net Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less: Returns, Allowances, and Discounts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Sales</td>
<td></td>
<td>100%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Raw Material Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory Adjustment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selling Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative and General Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Charges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Before Taxes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserve for Taxes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Total amount of depreciation and amortization included in above figures.
FACTORS IN PLANT LAYOUT

The primary purpose of plant layout design is to integrate the basic factors of men, material, and equipment in order to move material through the production sequence at optimum efficiency. Many developments in a business may dictate the need for a revised plant layout: production expansion, new methods, new products, new facilities, and cost-cutting programs. Each of these factors requires a forward look in planning a plant layout. To ensure a well-planned layout, which is essential in meeting competition, the thinking of all facets of the organization should be included.

The various objectives of plant layout include increased production, reduction of operating expenses, improvements in working conditions, greater safety in the plant, improved materials handling, reduction of goods in process, elimination of confusion, reduction of indirect labor, utilization of space, and provision for future expansion. The central objective or objectives should be decided prior to layout design. This decision establishes the requirements of and general operating practices desired in the new plant. The next step is to survey present facilities and determine the type of production required. In general, this can be divided into two categories for the purpose of plant layout -- process-type and product-type.

The process-type (see Figure 1), which groups similar operations in the same area, is particularly suited to job-lot manufacture because of its flexibility in producing a variety of products with the same equipment. Process-type layout has these advantages:

1. Flexibility. (The layout can be adapted to produce a number of different products at the same time, using the same machinery.)

2. Greater utilization of machinery.
3. More consistent operation. Work may be routed to other machines in the event of breakdowns.
4. Lower capital investment on equipment because of less duplication of equipment.
5. More efficient supervision of intricate processes.
6. Production stimulation (greater incentive for individual workers to raise level of production).
7. Lower unit cost (suited to small volumes of work).

The process-type layout has several disadvantages, among them:
1. Problems in routing and scheduling in order to obtain full utilization of machines.
2. High materials-handling costs and extra space requirements for storage of goods in process.
3. Difficulties in cost control.

---

**Figure 1**

PROCESS-TYPE LAYOUT
The product-type layout (see Figure 2) is used most often in small plants where operations are arranged in straight-line production. Where a limited variety of items is produced and the same processes are required on all of them, it is best that operations be arranged in sequence. In this manner, material is moved from one machine to the next and successive operations are performed in sequence.

To meet competition, manufacturers are turning to straight-line production, where in most cases the end result is relatively high output. This type of layout reaches its peak in automation. Among the advantages are the following:

1. Lower materials-handling costs.
2. Lower total production time.
3. Less work in process.
4. Less floor space required for goods in process; less floor space needed per unit produced.
5. Simplified controls and reduced cost accounting problems.
6. More efficient labor utilization and greater group incentive.
7. Smoother flow of materials.

Some of the disadvantages of product-type layout are:

1. Higher investment costs for machines and equipment.
2. A need for a steady high rate of production in order to remain above the break-even point.
3. Increased pressure to keep sales abreast of high production volume.
4. A need for close supervision.
5. Difficulty in adding new products if they require additional production lines.

The type of layout to be employed depends upon the conditions to be met. It is not always necessary for only one of these types to be used; often manufacturers find it advantageous to combine both types in attaining the desired production goals. The objective of good plant layout is to minimize cost of production by adopting that method which most readily attains this goal.

Perhaps the best way to approach the actual layout design is through a method which employs a flow or process chart (Figure 3). A process chart is a graphic representation of the sequence of all operations, transportations, inspections, and storages occurring during a process or procedure. It may
Figure 2
PRODUCT-TYPE LAYOUT

- Waste Bin
- Compressor Room
- Cooling Tower
- Boiler House
- Blast Wall
- Freezer Storage
- Rest Rooms
- Quality Control Lab
- Office
- Storage Area
- Display Room
- 55 Gallon Drum Cleaning Shed
- Chilling Unit
- Jar Conveyor System
- Reprocessing System
- Carton Packing Area
- Capping Machine
- Syruping System
- Slicing & Jar Fill Tables
- Conveyors
- Pasteurizer
- Liquefier
- Pulper
- Thermoconverter
- Juice Tanks
- Basket Rack
- Lye Bath
- Brush Peel & Washer
- Grading Conveyor
- Chiller & Accumulator
- Inclined Conveyor Section
- Inclined Conveyor Section
- Inclined Conveyor Section
Figure 3
FLOW CHART FOR BAKERY SHOP

RECEIVE & STORE

MIX INGREDIENTS

FRIED PIES & TARTS FORMING

PLACE IN DIE & FILLED FINAL FORM

PLACE ON RACK FOR FRYING

DOUGHNUTS FORMING

PLACE IN DIE FORM DOUGHNUT

PLACE ON RACK FOR FRYING

PIES FORMING

PLACE IN DIES FORM 8" & 9" PIES

PLACE ON 8" PIE RACK FOR BAKING

PLACE ON 9" PIE RACK FOR BAKING

BAKING & FRYING

WRAPPING, BAGGING, BOXING, ETC.

STORE FINISHED GOODS

SHIPPING
also include information considered useful in layout analysis, such as time required and distance moved.

A flow chart is useful in illustrating the sequence of operations performed in the production process. It is a visual representation of the flow of materials from the moment they are received until, as finished goods, they are shipped out. Since a flow chart shows all the interrelationships between work area, it is extremely useful in the initial stages of layout. It shows the relationships between operations without regard to the distance or space actually involved. It is an effective means of simplifying the presentation and showing just those factors pertinent to the particular problem.

The over-all purpose of the flow pattern is to plan the movement of the raw materials in as direct a path as possible through the plant. The beginning and ending points of the flow are dependent, to a certain extent, on the location of external transportation facilities, such as highways, railroad sidings, and docks or piers on navigable waterways. Figure 4, below, shows four examples of different types of flow patterns that could be adapted to the same area.

Figure 4
MATERIAL FLOW PATTERNS
A SIMPLIFIED COST AND CONTROL SYSTEM FOR THE SMALL INDUSTRIAL CONCERN

Two major areas in which tighter controls are indicated in order to protect and improve the profit picture of the company are manufacturing costs and inventory. A simplified yet adequate system of control in both fields has been devised that requires a minimum of paperwork and personnel effort.

If the company is of modest size it may appear that cost accounting is unnecessary. However, production and overhead cost can be deceptive, and until these costs are accurately determined, management cannot control as effectively as it should.

In determining true manufacturing costs, three items are needed: total direct labor cost, total material cost, and allocated overhead burden. These costs can be determined in the following manner:

Direct Labor Cost. A form (sample A attached) is provided on which each employee enters by job number the number of hours worked on each job each day. At the end of each week these forms go to the bookkeeper, who determines direct service hour costs and enters them on the Job Cost Summary sheet (sample form C attached).

Total Material Cost. A Bill of Materials form (sample B attached) is used for entering all materials used on the specific job. This form can be the responsibility of the stockroom or the foreman, or it can follow the job as a part of the work order. When costed, these material costs can be entered on the Job Cost Summary sheet weekly or, if more convenient, kept until the job is completed for pricing.

Allocated Overhead Burden. There are several methods of determining this figure, but the most widely used is to divide the estimated overhead (all costs
of operation other than direct labor and materials) as established in the annual budget by an estimate of what the total direct labor hours for the current year will be. This resulting overhead burden figure when multiplied by the direct labor hours charged to the job will yield an Allocated Overhead cost.

If the company does not have a formal annual budget for operations, it will be necessary to review costs for the past year item by item and adjust them in the light of anticipated operations. If the firm already keeps monthly records of direct labor hours and can therefore estimate direct labor hours for the coming year with accuracy, the overhead burden per direct labor hour will be correspondingly accurate. However, a monthly comparison of direct labor hours with the figure of the corresponding month of the year past will disclose quickly any significant variation which will make a revision of the overhead burden figure necessary.

These three cost figures are entered at the bottom of the Job Cost Summary. When subtracted from the sale price, they will reveal the profit or loss on the specific job. After these figures are transferred to the Master Job Cost Record (sample form D), the Job Cost Summary is filed with the job record file. The Master Job Cost Record is retained by management so that it can have at a glance a current and up-to-date record of all costs of all jobs completed.

The Master Job Cost Summary can be extremely valuable to management. It can state with accuracy where the money is going, how much is coming in, and what percent is being retained. It can indicate when labor or materials or overhead are getting out of line. It can show which jobs are profitable and should be pushed in the sales effort. It can also show which jobs are marginal or actually unprofitable and indicate the necessity for re-pricing.

Thus with a minimum of paperwork and a modest investment in bookkeeping time, management will get the current answers that can mean normal and adequate profit on its investment in time, money, and equipment.

The second area of control indicated is that of inventory. The attached sample form E has been designed for inventory usage. Although the design of the form is for production materials, it can also be used as a control for such items as drill bits and welding rods. Although its use for such items is marginal in value, the fact that such an inventory is kept may significantly reduce the pocket-loss of such items. The primary value of this Basic Stock
Contol Record is that it permits management to maintain an adequate planned balance on hand in an orderly manner and to signal when reordering is necessary.

The first three columns on sample form E list the item, the lead time necessary for delivery, and the balance on hand at the start of the control system. Each of the following three columns under the headings "Month" is for the use of the purchasing agent. If an item has been ordered for delivery during the month, the quantity is entered in the column "Scheduled for Delivery." At the end of the month the quantity used, which is taken from the Bills of Material (sample form B), is entered under "Usage" and subtracted from the total of "Starting Balance" and "Scheduled for Delivery." This results in a "Balance on Hand" quantity which must agree with the physical inventory; if not, an internal problem is indicated. From now on the "Starting Balance" figure is no longer necessary since the monthly Balance on Hand is the current total. If the Lead Time for Delivery (column 2) is kept in mind, the figure under Balance on Hand will signal when reordering is necessary.
EMPLOYEE'S DAILY JOB REPORT

Employee Name: 

<table>
<thead>
<tr>
<th>Day</th>
<th>Job No.</th>
<th>Regular Hours</th>
<th>O-T Hours</th>
<th>Total Hours</th>
<th>Office Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3sday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3s In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3s Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 ay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 In</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Out</td>
<td>_______</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**BILL OF MATERIALS FOR ORDER NUMBER**

**Description of Order:**

**Order Quantity:**

**Drawing No.:**

<table>
<thead>
<tr>
<th>Description of Parts/Materials/Supplies</th>
<th>Amount Required Per Unit</th>
<th>Amount Issued</th>
<th>Note: Shortage/Breakage/Scrap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Starting Date**

**Scheduled Delivery Date**
Sample Form C

**JOB COST SUMMARY**

<table>
<thead>
<tr>
<th>Labor</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>Cost</td>
</tr>
<tr>
<td>Cost</td>
<td>Item</td>
</tr>
<tr>
<td>Cost</td>
<td>Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Direct Labor</th>
<th>Total Materials</th>
<th>Allocated Overhead</th>
<th>Total Cost</th>
<th>Sale Price</th>
<th>PROFIT (OR LOSS) $</th>
</tr>
</thead>
</table>

9-6
<table>
<thead>
<tr>
<th>ob #</th>
<th>Direct Labor</th>
<th>Materials</th>
<th>Allocated Overhead</th>
<th>Total</th>
<th>Sale Price</th>
<th>Profit (or loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Lead Time for Delivery</td>
<td>Starting Balance</td>
<td>Sched. for Delivery</td>
<td>Usage</td>
<td>Bal. on Hand</td>
<td>Sched. for Delivery</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>-------</td>
<td>-------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
INVENTORY CONTROL FOR SMALL-SCALE MANUFACTURING

Since materials account for a substantial part of production costs in most manufacturing operations, the need for an effective inventory control system is obvious. The degree of success attained in controlling inventory has a direct bearing on the company's profit and working capital position. The complexity of an inventory control system will be dependent upon the type of manufacturing concern.

It behooves the small-scale manufacturer to have the most economically effective inventory control system possible. This guideline is intended to aid industrial extension personnel in evaluating current systems for possible improvements, as well as to assist the new producer in establishing an effective system.

Primary emphasis will be given here to discussing step-by-step techniques that should be considered in establishing a materials control system. The scope of this discussion will not include work-in-process or finished-goods inventory because these areas normally will receive much attention under a well-administered production planning and control system. The importance of an effective production planning and control system and its interrelation with inventory control cannot be emphasized too strongly. Much attention should be given to establishing accurate short- and long-range plans -- especially running plans and forecasts for the next 12 months. Close attention should be given to relating actual production with the forecasts in these plans and adjusting these forecasts as indicated. Effort in this area will result in keeping the inventory of finished products in line with marketing conditions and helping to maintain a stable work force, as well as forming a workable budget for materials inventory control.
Setting Inventory Control Policies and Standards

To have an effective inventory control system it is necessary to establish policies and standards peculiar to the individual manufacturer. Policies should be set down relating to the following points:

1. What will be the company's policy as to delivery time to customers?
2. Will warehouse space be available for volume purchasing?
3. To what extent will volume purchasing be permitted?
4. What specific basis will be used in estimating rate of material consumption?

To set such policies, management must consider such things as competition's policies and practices, location of plant with respect to suppliers, production volume of plant, financial position of company, segment of market that company seeks to serve, and market forecast and establishment of production plans.

After all of these variables are thoroughly evaluated and general policies are formulated, inventory control standards can be established. These standards include a short-range inventory budget and anticipated inventory turnover rates. These standards will serve as indices or benchmarks to help control future planning and budgeting.

Developing Order Rules

With the aid of established policies and standards, order rules on each inventory item should be written. An order rule is a statement of when to replenish an inventory item, in what quantity and mix, and how frequently to review the item to determine whether it should be reordered.

A prerequisite for writing accurate order rules is an economic review of each inventory item. This will necessitate a reliable method of forecasting future usage, the determination of the amount of time required to replenish each item, the establishment of the most economical quantity to order, a practical estimate of the minimum inventory level to maintain for safety against stockout, and the segregation of the items into classes as to their relative importance.

In determining the economic order quantity (EOQ) for the inventory items, only a few items will warrant thorough study. The ones that should be carefully evaluated are those with substantial price differentials for quantity purchases, items of high unit cost, or items of high inventory-carrying costs. The mathematical formulas are as follows:
\[
T = \frac{QIC + SA}{2} \text{ or } \frac{Q}{2}
\]

\[
\text{EOQ} = \sqrt{\frac{2AS}{IC}}
\]

for items without price differentials, and

\[
T = \frac{QIC + SC}{2}
\]

for items with price differentials, where:

- **T** = total annual cost, dollars
- **Q** = order quantity, units
- **I** = Inventory-carrying cost as a decimal fraction
- **C** = unit cost of the item, dollars
- **S** = expected annual usage, units
- **A** = out-of-pocket setup and ordering cost, dollars.

The latter formula gives the total cost separately for each price, relative to the minimum order quantity for that price. The EOQ would be that quantity corresponding to the lowest T evaluated for each price.

The EOQ for many items will be obvious without going through an elaborate evaluation. This will depend on such things as location of suppliers, service of suppliers, and price differentials. For example, if a manufacturer's upholstered furniture supplier is within a one-day truck service zone, if the only price break is for truckload quantities, and if the supplier offers short lead-time service, then the manufacturer usually will order once each week and maintain minimum inventory levels. Other EOQ considerations involving upholstered furniture are style options and high inventorying carrying cost because of bulk and damage risk.

After evaluation, inventory items can be segregated into classes for inventory control. This method advocates giving more attention to the more important items. Items that are relatively expensive, or that could prove costly in the event of a stockout, or which require long lead time usually warrant close scrutiny. These are class A items, and special care is used to maintain accurate perpetual-inventory records for them.

Class B items have average importance and warrant the normal amount of attention. This group includes items that are neither class A nor class C.
The class C items are relatively unimportant. This category includes a large number of items but accounts for only a small part of the inventory investment. Generally the cost of maintaining liberal quantities of these items in stock is less than keeping them under close inventory control. Examples of these items are fasteners, electrical connectors, and glue. No perpetual-inventory records are kept, and they are usually controlled under a "two-bin" method. For instance, two bins are maintained for a certain type fastener. Usage is from one of the bins while the other is sealed. When the opened bin is emptied and the seal is broken on the full bin, the fasteners are reordered. Upon receipt of shipment, the empty bin is filled and sealed.

**Maintaining Inventory Records**

A perpetual-inventory control system brings together all the planning and study previously discussed in the form of perpetual-inventory cards. Information recorded on these cards include: part number and description; order rule information, such as reorder point, order quantity, minimum quantity, or danger point; cumulative usage information, such as receipts and disbursements, with dates; and supplier information, such as name, lead time, and unit price. (See Exhibit A.) The card will carry much more information, depending on the individual needs of the manufacturer. The perpetual-inventory system facilitates physical control of inventories and also provides valuable information to be used for future planning and control.

Most manufacturing operations do not use a stock requisition system, but are set up on a standard cost system. Therefore, the materials are not received into stock and reissued to production on a stock requisition form as such. Rather, the stock foreman approves the receipt of materials and sends the receipt copy to inventory control for posting to perpetual-inventory records. Periodically, the completed production orders are channeled to inventory control, and by comparison with standard bills-of-material for that unit, the disbursement from stock can be recorded on the perpetual-inventory cards.

**Physical Inventory Verification**

Physical inventory verification must be made periodically to insure the accuracy of inventory records. Depending on the class of inventory, this check can be by actual count, sight estimate, etc. Experience and the class of inventory item will dictate how often verification is necessary. Some manufacturers
take physical inventories on special items each week, while other manufacturers find it necessary only once per quarter. It is recommended that in most manufacturing concerns, physical inventories be taken on a continuous schedule, with the more important items checked on a periodic cycle throughout the year. It may be necessary once a year to take a more accurate and complete inventory of all items over a one- to two-day period.

Feedback of the Inventory Control System

Feedback information, in the form of reports to management, is a valuable benefit of a good inventory control system. These reports, when properly analyzed, will aid in comparing the effectiveness of the system, help eliminate slow-moving or obsolete items, and provide valuable information to be used in future planning.

Management should receive a monthly running report of individual item inventory levels in units and dollars, with comparisons with previous periods. From this report, possible slow-moving or obsolete items can be pinpointed for investigation.

Management also should receive a monthly report of total inventory investment with turnover rates for comparison with standards for the industry. This can be in the form of a monthly financial balance sheet and will aid in future financial planning. Several months should be shown for comparison purposes.
PRODUCTION PLANNING AND CONTROL FOR SMALL-SCALE MANUFACTURING

The primary purpose of this guideline is to outline the general factors involved in production planning and control and the steps needed to implement a system for a particular operation. The purpose is not to advocate a specific system for implementation because each manufacturing plant or organization has different characteristics and, therefore, different needs; rather, it is to outline general considerations involved in establishing a production planning and control system.

The task of managing production and inventories can be broken into three major functional areas: production planning, production control, and material control. Only the first two areas are discussed in detail here; however, it is recognized that production control and material control are interrelated. The prerequisites for a production planning and control system are outlined first, followed by discussions of production planning for general manufacturing operations, aspects of a production control system, and some benefits to be expected from such a system.

Preliminary Analysis, Standardization, and Preparation

Several important steps must be taken before a production planning and control system can be implemented. All of these steps should be given thorough consideration no matter how large or small the organization. Those firms which have already given attention to some of these steps should carefully review their work to make sure it is accurate and reflects the latest information available and then establish the missing links. Listed below are the phases that must be considered:
1. Product analysis
2. Methods analysis
3. Time standards
4. Plant layout analysis
5. Preparation of design information
6. Analysis of present production control system

A person in the organization should be selected to take the lead in completing this phase of the work. This person should be selected for his ability to work with people, his ability for analytical thinking, and knowledge of production and management goals in the organization. He could be the production superintendent, plant engineer, or assistant to the general manager. Whoever is selected should be given full support of top management and should work very closely with the general manager.

**Product Analysis.** The first step is to take a thorough look at the products that are manufactured or will be manufactured. The number of models or type of product should be kept to the minimum that is possible without adversely affecting sales. Effort should be made to standardize materials, component parts, and subassemblies.

**Methods Analysis.** Each operation should be studied for possible improvements as to method. From this analysis, more efficient use of tools, machinery, and materials will become evident. After these new ideas are incorporated, where justified, the new method should be specifically set down as the production method for that operation. This production method should be as well-defined as possible and should include a workplace layout for the operation.

**Time Standards.** After the product has been analyzed for possible improvements as to design, materials, and standardization and the methods have been studied and improved where possible, time standards should be established for each operation. Time standards are helpful in many areas of plant operations, such as cost accounting, production scheduling, comparison of new methods and improvements, and wage incentive systems.

It is very important to establish consistent time standards for all operations. Some companies may want to contract for the services of an experienced time study engineer for establishing these standards. A second alternative is to train someone in the organization in the art of time study and setting
standards. It is definitely not recommended that an inexperienced person be allowed to establish standards.

Time study and methods study are closely related and are interdependent. Results of a time study often indicate a new method, and the new method will have a different time standard. The method and time study are combined on page 1 of the time study sheet (Exhibit A). Page 2 of the time study sheet (Exhibit B) is the work sheet for performing the time study. Since it is essential that page 1 and page 2 of the time study sheet be kept together, they should be printed on the opposite sides of the same sheet.

These time study sheets for each plant operation should be safeguarded and filed for reference. They are the standards for production. The standard times developed from these sheets are usually listed on a standards data sheet which is issued to the various departments that use standard time data.

Plant Layout Analysis. Equipped with method and time standards for each operation, the analyst should scrutinize the plant layout for possible improvements. A helpful tool for pinpointing areas needing improvement is the material flow-process chart. (See Exhibit C.) Where justified, the improvements should be incorporated into a new layout that will integrate the workplace layouts developed under the methods study into the most efficient overall plant layout.

Preparation of Design Information. Before a production planning and control system can be implemented, it is necessary to have all needed information in a usable form. A complete bill-of-materials for each major product is necessary. It should be broken down for each department in the plant. Each item must have an identification number and name, and other specifications should be as complete as possible.

Engineering drawings may be required for major items of production. These should include drawings of each subassembly (structural drawings, electrical, plumbing, etc.). Applicable portions of the bill-of-materials should be shown on these drawings. The engineering drawings pertinent to each department should be prepared and issued to the department along with the bill-of-materials.

Copies of the standards data sheet, discussed previously, are necessary for the production scheduling and cost accounting departments and the production manager. A copy of the complete materials flow-process chart developed while analyzing the plant layout is necessary for the production scheduler.
Analysis of Present Production Control Systems. The present production control system should be understood thoroughly. The system should be analyzed to determine "why" and "for what purpose" each phase is performed; then a decision should be made as to what features of the old system will be retained and what changes are indicated.

Production Planning

In major manufacturing operations, there is a need for both long-range planning and current planning. Long-range planning is usually done by top management with assistance from the sales, engineering, production, and materials control departments. Current planning is usually done by the general manager of each individual division or plant, who naturally draws on the information, knowledge, and assistance of his department managers.

Long-range planning can be broken down further into long-term plans and short-term plans. Long-term plans usually cover a period of from three to five years ahead of the current date. Plans of this nature are fixed, project-type plans. They will include consideration of such areas as new plants, major expansions of existing plants, and possible diversification. Factors considered in long-term planning include the general economic picture, market trends of the industry, company sales trends, and current demands.

Short-term plans cover the next one to three years. Usually these are moving plans which are adjusted quarterly for the first future year and annually for the second and third future years. Again, the sales forecast is based on the general economic picture, market studies, sales trends, and current demands. Attention is focused on the most profitable models and customer acceptance trends for new models. Consideration is given to inventory levels and decisions on acquiring additional machinery and plant facilities. Of particular importance is the balancing of sales and production plans with the financial requirements for inventory, machinery, and plant facilities.

Planning for product diversification is an important aspect of long-range planning. Management should be continuously investigating the profitability of introducing a new product, and these ideas should be incorporated in long-range planning.
Current plans are those made for a period of one year. For most manufacturing, it appears more advantageous for these to be moving plans. With this type planning, plans are made for a 12-month period, but every three months the plan is revised and extended. The current plan is more detailed than the long-term or short-term plans; by using sales forecasts, it takes into account inventory levels, plant capacities, and the level of manpower needed for the required production. While the general manager of a plant is responsible for establishing the most efficient current plan and adhering to it, top management must provide certain policy guidelines for the plan. Top management must dictate policies in such areas as inventory levels to be maintained, manpower levels to be maintained, and lead time for meeting dealers' orders. By comparison of actual production with the current plans, manpower requirements can be leveled, inventory levels can be held in check, and other production control is possible.

Production Control

Production control in general manufacturing includes analyzing the sales orders, scheduling the production orders, dispatching production orders to production, and following up to make sure production schedules are met.

In general manufacturing, the sales orders are usually scheduled in batches. Once every two weeks a scheduling meeting should be held. The accumulation of sales orders is studied and scheduled for two weeks' production to begin two weeks from the meeting date. The materials manager is furnished a copy of the schedule to make necessary purchases. This scheduling system will necessitate a four weeks' lead time for the dealer. Management will have to decide whether the dealers can live with this. If competition dictates a shorter lead time, bigger materials inventories are necessary -- this is costly. If a shorter dealer lead time is necessary, it may be beneficial for the materials manager to review the sales orders immediately upon receipt. This will enable him to make earlier purchases for the items requiring longer lead time.

The production controller is aided in preparing the schedule by the material flow-process charts mentioned earlier. These charts must include standard times for each operation. With this information, decisions can be made as to the amount of lead time necessary for each subassembly and the production line can be balanced for the most efficient operation. For quick reference, an assembly line balancing sheet can be prepared on each product.
One technique in scheduling that will be beneficial in some plants is that of scheduling some units to be manufactured for stock. This will allow the substitution of a rush order in place of a scheduled stock order. Experience will indicate the number of units to schedule for stock.

Production orders should be prepared weekly from the production schedule. Before they are issued, the purchasing manager should check on the inventory of necessary materials. Production orders should be issued on Friday morning for the following work week, thus allowing a department that gets ahead of the current schedule to begin working on the following production order. Production orders should be issued to the production manager who, in turn, dispatches copies to foremen in each department.

The flow of forms in the production control system is important. The 12-month current plan is kept in the general manager's office. A copy also is kept by the production controller, production manager, sales manager, cost accountant, and materials manager. The two-week production schedule is kept in the production control office. It may be a large board prominently displayed for quick reference. The production orders can be copies of the sales orders. They should give a complete description of what is required by each department. Copies of these or equally descriptive production forms are given to each foreman, who distributes them to his department. (See Exhibit D.) At the end of each day, the completed work orders are returned to the production control department, which passes them along to purchasing, cost accounting, sales, and the general manager. Actual production is posted each day so that progress may be ascertained for control purposes.

After the system begins operating, the work has only begun. The production control function is to watch for weaknesses in the system, analyze them, and take corrective action. The methods and time studies should be reviewed continuously for possible improvements. The forms and reports used in the system also should be checked constantly. If they are not necessary, they should be eliminated, and if better forms and reports are needed, they should be installed. Forms should contain only information necessary for the intended purpose. Nonessential information is confusing.

The control provided by the system should be analyzed. Reports as to percent plant efficiency can be prepared periodically and submitted to management. Also, comparison of changes in direct labor hours per unit of production
before and after the installation of the system is a good evaluation technique. The effect of the new system on material shortages and surpluses and capital investment is easy to determine.

**Some Expected Benefits**

Some benefits to be expected from a production planning and control system of this nature are listed below:

1. More efficient plant operation is possible. With the standard times, each operation can be scheduled more precisely, thereby eliminating delays. Standards are especially useful in balancing the assembly line in that each operation can be balanced as to time. If some operations are necessarily longer, the faster production workers can be assigned to the task, and for necessarily short operations, new, inexperienced workers can be broken in on the job.

2. Standards and methods set down in print give reference points for future improvements. A new piece of equipment or new method can be better evaluated by comparison with existing standards and methods.

3. Better control is immediately available. Also, when the operation grows and becomes more complex, the system will prove even more valuable.

4. Better cost control is afforded because of standards.

5. A more stable work force is possible because of the coordination of sales forecasts with production.

6. The system can be easily adapted for computerized operation.

7. Better quality control can be achieved.
EXHIBIT A - PAGE 1 OF TIME STUDY SHOWING WORKPLACE LAYOUT, METHOD, AND STANDARD TIMES.

<table>
<thead>
<tr>
<th>ELEMENT DESCRIPTION</th>
<th>No. Obs.</th>
<th>Std. Time (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk to B - place 2-TT14 and 2-TT15 components in jig (A) - reach for glue brush on D - Grasp Glue Brush.</td>
<td>8</td>
<td>0.28</td>
</tr>
<tr>
<td>Apply glue to ends of spruce members - place brush back into container - Release Brush.</td>
<td>8</td>
<td>0.46</td>
</tr>
<tr>
<td>Reach and grasp lever under jig table - pull lever bringing spruce components together at glued ends - Release Lever.</td>
<td>7</td>
<td>0.13</td>
</tr>
<tr>
<td>Apply glue to plywood, gussets - place gussets - get stapler from E and staple gussets - place stapler back at E - Release Lever.</td>
<td>7</td>
<td>0.95</td>
</tr>
<tr>
<td>Turn trusses over - apply glue to gussets and place - staple - put stapler back to E - Release Stapler.</td>
<td>8</td>
<td>0.52</td>
</tr>
<tr>
<td>Set trusses upright - get nailer from E - nail from top at ends - put nailer back at E - Release Nailer.</td>
<td>8</td>
<td>0.33</td>
</tr>
<tr>
<td>Place both finished trusses in Rack C - Release Last Truss.</td>
<td>8</td>
<td>0.23</td>
</tr>
</tbody>
</table>

STANDARD TIME FOR 2 TRUSSES: 2.90

(Min.) Total Standard Time Per Piece: 1.45

Production At Standard: 41 Trusses Per Hour

Production During Study: 52 Trusses Per Hour
<table>
<thead>
<tr>
<th>No.</th>
<th>TERMINAL POINT</th>
<th>R</th>
<th>T</th>
<th>R</th>
<th>T</th>
<th>R</th>
<th>T</th>
<th>R</th>
<th>T</th>
<th>R</th>
<th>T</th>
<th>R</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grasp Crude Brush</td>
<td>.20</td>
<td>.20</td>
<td>.27</td>
<td>.45</td>
<td>.22</td>
<td>.71</td>
<td>.23</td>
<td>.92</td>
<td>.39</td>
<td>.65</td>
<td>.36</td>
<td>1.1</td>
</tr>
<tr>
<td>2</td>
<td>Release Brush</td>
<td>.57</td>
<td>.37</td>
<td>.79</td>
<td>.34</td>
<td>.57</td>
<td>.49</td>
<td>.39</td>
<td>.65</td>
<td>.36</td>
<td>1.19</td>
<td>.32</td>
<td>1.44</td>
</tr>
<tr>
<td>3</td>
<td>Release Lever</td>
<td>.64</td>
<td>.07</td>
<td>.92</td>
<td>.76</td>
<td>.52</td>
<td>.63</td>
<td>.14</td>
<td>.77</td>
<td>.12</td>
<td>1.12</td>
<td>.08</td>
<td>1.45</td>
</tr>
<tr>
<td>4</td>
<td>Release Lever</td>
<td>1.39</td>
<td>.75</td>
<td>.92</td>
<td>.43</td>
<td>.59</td>
<td>.69</td>
<td>.39</td>
<td>.39</td>
<td>.85</td>
<td>.81</td>
<td>1.29</td>
<td>1.44</td>
</tr>
<tr>
<td>5</td>
<td>Release Stapler</td>
<td>1.80</td>
<td>.41</td>
<td>.85</td>
<td>.37</td>
<td>.46</td>
<td>.63</td>
<td>.42</td>
<td>.86</td>
<td>.42</td>
<td>1.36</td>
<td>.44</td>
<td>1.58</td>
</tr>
<tr>
<td>6</td>
<td>Release Nailer</td>
<td>2.03</td>
<td>.33</td>
<td>.45</td>
<td>.38</td>
<td>.56</td>
<td>.63</td>
<td>.27</td>
<td>.82</td>
<td>.25</td>
<td>1.10</td>
<td>.30</td>
<td>1.59</td>
</tr>
<tr>
<td>7</td>
<td>Release Last Truss</td>
<td>2.18</td>
<td>.15</td>
<td>.45</td>
<td>.30</td>
<td>.68</td>
<td>.91</td>
<td>.22</td>
<td>9.10</td>
<td>.18</td>
<td>1.14</td>
<td>.16</td>
<td>1.76</td>
</tr>
</tbody>
</table>

**RECAPITULATION**

<table>
<thead>
<tr>
<th>ELEMENTS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>RATING</th>
<th>1.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Time in Mins.</td>
<td>1.77</td>
<td>2.84</td>
<td>0.70</td>
<td>5.23</td>
<td>3.34</td>
<td>2.06</td>
<td>1.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Obs.</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Pro-Rate Divisor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>Average Per Cycle</td>
<td>0.22</td>
<td>0.36</td>
<td>0.10</td>
<td>0.75</td>
<td>0.41</td>
<td>0.26</td>
<td>0.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leveling Factor</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level Time</td>
<td>0.24</td>
<td>0.40</td>
<td>0.11</td>
<td>0.83</td>
<td>0.45</td>
<td>0.29</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowance Factor</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Time</td>
<td>0.28</td>
<td>0.46</td>
<td>0.13</td>
<td>0.95</td>
<td>0.52</td>
<td>0.33</td>
<td>0.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symbols Used: M - Missed Reading

EXHIBIT B - PAGE 2 OF TIME STUDY
FLOW PROCESS CHART

**SUMMARY**

- **Operations**: 3
- **Transports**: 3
- **Inspections**: 0
- **Delays**: 2
- **Storages**: 0
- **Distance Traveled**: 162 ft.

**CHART BEGIN**: At Rip Saw

**CHART END**: At Sidewall Station

**CHARTERED BY**: H. Clark  
**DATE**: 3/10/70

**MAN OR MATERIAL**: Spruce Lumber Studs

**JOB**: Ripping, cutting, dadoing No. SW 12 studs and delivering to sidewall station

**DETAILS OF WORKED**

1. Rip 2" x 12" into 2" x 3" studs (2 men)  
   - **Distance**: 48
   - **Quantity**: 50

2. Deliver to cut-off saw on dolly  
   - **Distance**: 140
   - **Quantity**: 25

3. Awaiting cut-off operation  
   - **Distance**: 85

4. Cut to 7/8 ft. lengths (2 men)  
   - **Distance**: 78
   - **Quantity**: 140

5. Deliver to dado saw  
   - **Distance**: 17

6. Awaiting dado operation  
   - **Distance**: 38

7. Dado studs (2 men)  
   - **Distance**: 138
   - **Quantity**: 260

8. Deliver to sidewall station  
   - **Distance**: 120

**NOTES**

- Congestion at station
- Purch. auto. saw. Comb. with dado oper.
- Congestion - need better scheduling
- Purch. auto. dado saw Comb. with oper. 4
- Move mill oper. closer to sidewall st.
ACCUMULATED SALES ORDERS

PREPARE MASTER PRODUCTION SCHEDULE

CHECK PRODUCTION SCHEDULE AGAINST INVENTORY RECORDS AND PLACE PURCHASE ORDERS ACCORDINGLY

COPY OF ORIGINAL SALES ORDER GOES TO FIRST OPERATION AS PRODUCTION ORDER. IT TRAVELS WITH MOBILE HOME THROUGH PRODUCTION.

PREPARE PRODUCTION ORDERS AND MANPOWER ALLOCATIONS AND ISSUE ON FRIDAY FOR FOLLOWING WORK WEEK.

TIME STANDARD DATA FOR EACH PRODUCTION OPERATION AND WORK BALANCE SHEETS FOR EACH MODEL OF MOBILE HOME SHOULD BE AVAILABLE FOR REFERENCE.

NOTE: EACH DAY COMPLETED PRODUCTION ORDERS ARE RETURNED TO PRODUCTION CONTROL. COMPLETED SALES ORDERS ARE SENT TO COST ACCOUNTING, MATERIALS CONTROL, SALES, AND THE GENERAL MANAGER.

SCHEMATIC OF PRODUCTION CONTROL SYSTEM

EXHIBIT D
HOW TO USE A PRIVATE MANAGEMENT CONSULTANT

Development Organization Role

It is a necessary and important function of a development organization to provide management and technical assistance to small-scale industry. This support may be furnished through the organization's industrial extension personnel and/or private consultants. As a developing country becomes more industrialized, the possibility exists that private individuals will become involved in furnishing advice and assistance to enterprises. The development organization should be in a position to advise small-scale management on matters relating to the employment of private consultants and should provide guidance to individuals who are preparing themselves to enter the private consulting field.

Why Use a Private Consultant

Regardless of a company's size, problems often arise which cannot be resolved within the company. Perhaps the pressure of day-to-day operations leaves management with insufficient time to analyze and study the problems properly. Perhaps specialized knowledge and skill is needed which management does not possess and cannot afford to hire permanently. Or perhaps only symptoms of problems are evident -- and an independent and fresh approach is needed to identify basic causes.

In situations such as these, business organizations are relying more and more on the professional advice and assistance of management consultants. It is no longer considered a sign of weakness for a company to seek help in the field of management -- no more so than it is to seek legal advice from a lawyer or financial advice from a banker. Outside management assistance is often the best answer not only when specific problems are encountered, but also when the
need arises for the installation of specialized systems or the development of special information required in the formulation of management decisions.

The following outline of criteria, admittedly sketchy, can serve as a guide to the businessman considering the use of consultants. The businessman should ask himself the following questions:

1. How do I determine the need for consulting assistance?
2. How do I select a specific firm?
3. How should I use the consultant?
4. What should I do with the results?

Determining the Need

First it should be realized that a consultant is a diagnostician. His strong suits must be analytical ability, objectivity, knowledge and experience in his area, and time to devote necessary attention to definition and solution of the problem. Knowing what a consultant is, determining the need for a consultant becomes a matter of recognizing certain signs, such as

-- high turnover of personnel,
-- declining sales or unsatisfactory growth rate,
-- rapid increases in costs,
-- unaccountable shifts in product mix,
-- loss of major accounts,
-- declining market share on major products,
-- lack of realistic corporate objectives,
-- desire to diversify product line,
-- need to survey for new product potential,
-- customer reaction survey,
-- need for personnel selection program,
-- requirement to recruit key personnel,
-- audit of present or proposed manufacturing plans or marketing programs,
-- need to establish or revise compensation plans to meet changing conditions and objectives,
-- declining or unsatisfactory growth of net profits, or
-- need to acquire or merge with another company.
Selecting a Consultant

Next comes the matter of selecting the consultant. And the connotation of "consultant" is just as important, if not more so, than "consulting firm." The work accomplished will be no better than the men who are assigned to the project. The cost of the project must be analyzed in terms of what it is worth to you to have the problem solved. Just as in corporate business, but more so, a consultant is paid what he is worth and his firm must charge accordingly. Per diem rates and productivity of consultants varies little among the major consulting firms.

To select the consultant:

1. Define the field in which the problem lies. If it is a legal question, then a law firm may be your best choice. If the problem is oriented to accounting, data processing, systems, or procedures, a public accounting firm or perhaps a general management consultant may offer the best answer. If the problem is general management, marketing, personnel, production, or engineering, then a general management consulting firm or a specialty firm is usually the best choice.

2. Select two or three firms in the general class you have chosen by
   -- talking with friends and fellow businessmen who have used consultants successfully,
   -- checking with present service groups such as your accounting firm, advertising agency, or bank, or
   -- asking your college or university industrial development of business management leaders.

3. Interview the principals of the selected firms with respect to their
   -- knowledge of your problem,
   -- capability and that of their staff members in your business,
   -- approach to doing business, and
   -- clients and amount of repeat business.

4. Request each firm, if interested, to submit a written proposal of the assignment for you. Give the firms no more than two to three weeks to do so and then make your own decision equally as fast. The proposals you receive should contain
-- a definition of the purpose and scope of the assignment,
-- a description of how the work is to be performed,
-- an estimate of the elapsed time to complete the assignment and its cost, and
-- background on the firm and biographical data on the men who will work on the assignment.

Do not overly concern yourself with price differences. Instead analyze price differences in terms of the firm's experience, the caliber of the men on the assignment, the time that firm's principals will devote to it, and your own needs for differing levels of qualification.

5. Ask for a few references from the firm you have tentatively selected or from the two you are trying to decide between when all other factors are equal. Check these references in person or by telephone and probe the reference on the firm's performance in terms of
-- successful implementation of recommendations,
-- failure to upset "applecarts,"
-- attention of principals to assignment, and
-- capability and attitudes of staff personnel assigned.

6. Make your selection and then put your trust and confidence in the firm. However, your work is not ended. There is the matter of starting the assignment.

How to Use a Consultant

You and the members of the consulting firm most directly concerned with the assignment should meet to
-- review the proposal letter, clarify its intent, and make any changes necessary,
-- familiarize your key personnel with the consultants,
-- introduce the study to affected members of your staff, if this has not already been done,
-- develop a plan of action and timetable of activity,
-- establish periodic checkpoints, and
-- supply or arrange for supplying needed data, documents, and other records to the consultant.
Then the consultant is on his own. A good one will keep you abreast of
where he stands on his schedules, but he will not feed you exceptionally pre-
liminary conclusions or confidential information from your personnel or specific
customers. Do not embarrass him by asking for such information; his code of
ethics should prohibit such actions.

He will probably want to discuss his preliminary findings and conclusions
with you near the completion of the work, but before the final report is de-
ivered. This is not unusual, and it can be beneficial to the assignment
because he has the chance to play back findings and get another side of the
story. Also he can gauge your reaction and know how much he will have to doc-
ument certain points where management understanding may be removed from actions
required by the findings.

What to Do with Results

Nothing is so disappointing to a consultant as to see his work "cubby-
holed" at the conclusion of an assignment. Use the work, implement it, and
gain from it. In some cases it is advisable to use the consultant on the
implementation of the recommendations. But be careful not to lean too heavily
on him because over the long run, you must build the experience in your
organization.

Conclusion

Once you have established a consulting relationship, you will find it
easier and easier to use the consultants to assist on other specific problem-
solving assignments. You usually will find it unnecessary to go through the
selection procedure again, but you should always demand and have a written
proposal letter for each assignment no matter how good the relationship.

If the relationship did not work out as well as you thought it would, the
consulting firm may be at fault, but remember you selected it. Also, much
of the fault for poor performance may lie within your organization.

Do not let a bad experience stop you, though. Try to learn from it and
do a better job next time, because in every business there is a time and an
event when an outside consultant is the most economical and effective way to
turn a problem into an opportunity.
SELECTED BIBLIOGRAPHY

The following publications are suggestions for further information on topics presented in GUIDELINES FOR INDUSTRIAL EXTENSION PERSONNEL. All items are held by the International Development Data Center, Georgia Institute of Technology.

GENERAL APPROACHES TO FURNISHING INDUSTRIAL EXTENSION SERVICES TO SMALL-SCALE INDUSTRY


GENERATION AND EVALUATION OF VENTURE IDEAS


**TRANSFER OF APPROPRIATE TECHNOLOGY**


RESOURCES AND TECHNICAL ANALYSIS OF PROJECT ALTERNATIVES


ADVISING THE PROSPECTIVE ENTREPRENEUR ON GOING INTO BUSINESS


013 The Supervisory Six.
014 New Foreman Training Plan.
023 Effective Job Organization.
025 Fundamentals of Management.
056 Public Relations Training.
057 Industrial Training Methods.


081 Purchasing.
083 Manufacturing and Manufacturing Engineer.
094 Personnel Administration.
135 Performance Discussions.


THE BASIC PROBLEMS OF SMALL BUSINESS SURVIVAL AND GROWTH


THE PRESENTATION OF INVESTMENT PROPOSALS

FACTORS IN PLANT LAYOUT

A SIMPLIFIED COST AND CONTROL SYSTEM FOR SMALL SCALE INDUSTRIAL CONCERN

INVENTORY CONTROL FOR SMALL SCALE INDUSTRIAL CONCERNS

PRODUCTION PLANNING AND CONTROL FOR SMALL SCALE INDUSTRIAL CONCERNS


AN INTERNATIONAL COMPILATION
OF SMALL-SCALE INDUSTRY DEFINITIONS

Compiled by
Kay Ellen Auciello
Richard Johnston
Linda M. Wagenveld

This information document was prepared under
funding provided by the U. S. Agency for
International Development under a 211(d) grant.

Industrial Development Division
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
Atlanta, Georgia
January 1975
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>COUNTRY DEFINITIONS</td>
<td>1</td>
</tr>
<tr>
<td>STATISTICAL TABLE</td>
<td>55</td>
</tr>
<tr>
<td>INDEX</td>
<td>65</td>
</tr>
<tr>
<td>APPENDIX: Response Form</td>
<td>69</td>
</tr>
</tbody>
</table>
INTRODUCTION

The Industrial Development Division (IDD), Engineering Experiment Station, Georgia Institute of Technology is currently operating under a 211(d) grant from the U. S. Agency for International Development. The grant, received in 1973, is entitled "Employment Generation through Stimulation of Small-Scale Industry." IDD's First Annual Report summarizes the program's objectives as follows:

The general objective of this program is to strengthen the capabilities of the Georgia Institute of Technology to more effectively apply its present interests, skills, and experience in developing small-scale industries in Georgia and Latin America to the problems of small industry in the less developed countries.

The International Development Data Center (IDDC) was created to provide information and research support for this program. The compilers of this publication, IDDC staff members, recognizing that neither a standardized concept of "small-scale industry" nor a comprehensive listing of individual country definitions of "small-scale industry" existed, attempted to gather such information in the interest of international cooperation and understanding regarding industrial development.

The project had the following objectives:

1. To obtain, from each country, its official or legal definition of small-scale industry, particularly in terms of capital invested, sales, employment, and nature of product.

2. To obtain, from each country (in the absence of a legal definition), the general understanding of what constitutes small-scale industry.

3. To publish and disseminate the documented results of this worldwide survey.

4. To update such publication in 1976.

The approach to accomplish the outlined objectives was as follows: A letter incorporating the aims of this particular information project was formulated and sent to appropriate agencies of each country. In general, the order of correspondence was:

a. The country's embassy to the United States in Washington, D. C.

b. An agency in that country to which the compilers were referred by embassy officials.
c. A country/governmental agency involved in small-scale industry promotion and suggested by embassy officials, other country agencies, or otherwise identified by the IDDC staff.

d. The country's ambassador to the United Nations, New York.

e. An agency of the country named by United Nations officials.

When satisfactory data, in terms of the statistics desired, were obtained, correspondence was terminated.

It was necessary to initiate the publication process in January 1975. At that time, 72 countries or areas had graciously responded with their individual definitions of small-scale industry. Later responses will be included in a revised edition of this publication.

The publication consists of two main sections -- excerpted country or area definitions and a statistical table of relevant data. The country definitions are arranged alphabetically by each country's short-form name and are direct quotations from the original correspondence, except in the case of a definition translated from the original letter. Such cases are indicated. Editing of replies occurred only in areas of grammar and spelling to ensure clarity of the information. Interpolations by the editors are enclosed in brackets. Sources of the quoted material are cited below each country definition. Full documentation of all material is maintained at the International Development Data Center.

The statistical table attempts to illustrate quantitative data on several dimensions commonly used in measurement of small-scale industry, namely, population, per capita national income, employment, and capital/fixed assets. The countries are divided into developed and developing areas and then arranged alphabetically under geographic area. In cases where the information provided could not be converted conveniently to tabular format, the reader is referred to the quoted country definition. Sources used in designing the statistical table are indicated at the end of the table.

The results of the IDDC survey indicate that there is no precise definition of small-scale industry that can be applied to all countries, owing to the fact that each area is unique in its social structure, population, educational system, and level of economic development. Only in a few instances do legal definitions exist, although most areas have specific regulations and
promotion agencies concerned with indigenous small industries or handicraft operations. Quantitative parameters are not readily available, for the most part, and may indicate the need for further research in this area.

The International Development Data Center staff hopes that An International Compilation of Small-Scale Industry Definitions will assist those involved in the development of small-scale industry. At the least, it may offer some indication of the future need to design a universal set of criteria for measurement of small industries.

IDDC invites comments concerning the usefulness, format, and accuracy of this publication. A response form is included as an appendix.

IDDC also extends deep appreciation to all those instrumental in the compilation of this work, notably its correspondents throughout the world, translators, editor, and typists.
COUNTRY DEFINITIONS
AUSTRALIA
Commonwealth of Australia

There is no legal definition of small business in Australia. [However, in an address of the Secretary of the Department of Trade and Industry] the definition recommended by an independent committee was that "a small business is one in which one or two persons are required to make all the initial management decisions -- finance, accounting, personnel, purchasing, processing or servicing, marketing, selling -- without the aid of internal specialists and with specific knowledge in only one or two functional areas" . . . and would normally encompass firms with 100 or less employees.

The . . . National Small Business Bureau considers that no single, quantifiable definition can be entirely satisfactory. While it may be sensible to define a small firm in certain areas of Australian manufacturing industry as one with up to 100 employees, quite different figures are likely to be appropriate in non-manufacturing industry or even within certain sectors of manufacturing industry itself, e.g., capital intensive industries.

Source: National Small Business Bureau, Department of Manufacturing Industry, Commonwealth of Australia, quoting and summarizing a statement of the Secretary of the Department of Trade and Industry at a National Small Business Seminar held in Canberra, November 1973.

AUSTRIA
Republic of Austria

In Austria, we do not know a legal definition of small-scale industry. However, small business can be characterized as employing 0-50 persons, although investment, turnover and position in the market are more important as characteristics for the size of the business. (Translation)

Source: Institut fur Betriebswirtschaftslehre des Gewerbes und der Klein- und Mittelbe-triebe (Marketing Institute for Small and Medium Business of the University for World Trade).

There is no legal definition, but criteria for small-scale industry are:
- major portion of the company assets is manager owned
- actual management is in his hands

-3-
- the manager oversees the business
- the number of employees is 0-30  (Translation)

Source: Bundeskammer der Gewerblichen Wirtschaft (Department of Labor, Republic of Austria).

BANGLADESH

People's Republic of Bangladesh

Small-scale industry in Bangladesh has been defined in Government policy announcements as a manufacturing and servicing establishment with a capital investment not exceeding Tk.25 lacs (Taka 2.5 million) [US$307,389] in fixed assets. In this definition, the requirement of working capital has been excluded. At the moment no other criterion except the size of investment in assets is used to determine what is a small-scale industry.

Source: Bangladesh Small Industries Corporation, People's Republic of Bangladesh.

BARBADOS

There is no legal definition of small-scale industry in Barbados. However, it is generally accepted that a small business is one which qualifies under any two of the following three criteria:

(1) Employment not exceeding 25 persons.
(2) Annual sales value not exceeding $250,000.
(3) Owners' investment not exceeding $50,000.

Source: Industrial Development Corporation, Barbados.

BELGIUM

Kingdom of Belgium

In Belgium there does not exist a legal definition of small-scale industry. This is a controverted notion, which should be specified by several standards: the nature of the enterprise, the legal form, the amount and the constitution of the capital, the management, and finally, the number of the employed people. In this context an upper limit could be found in the legislation about certain credit facilities for industrial enterprises accessible only to enterprises
employing no more than 50 persons. This does not permit to conclude that there are no medium or big enterprises employing less than 50 persons.

Source: Belgian Administration, as transmitted by the Belgian Embassy in the United States.

BRAZIL

The Federative Republic of Brazil

There is no legal definition of small and medium-scale industry in Brazil. Some semi-official institutions have adopted their own definitions. They read as follows:

(a) Central Bank of Brazil, National Monetary Council (Conselho Monetario Nacional Banco Central do Brasil) -- Industrial enterprises to be considered small or medium-scale industries have to have annual sales which do not exceed 70,000 times the current minimum wage of the country.

(b) Bank of Brazil, Inc. (Banco do Brasil S.A. Carteira de Credito Agricola e Industrial) (For industrial development loan purposes - agricultural and industrial) -- Small or medium enterprises are those which do not employ more than 100 employees and sales do not exceed Cr $12,000,000 [US$1,716,738].

(c) Bank of Brazil FUNDIPRA (Banco do Brasil S.A. FUNDIPRA) (For industrial development of fishing, agricultural products) -- Small and medium-scale enterprises are those whose sales are in the bracket between 250 and 750 times the current minimum wage of the country.

(d) Ministry of Finance of Guanabara State (Secretaria de Financas do Estado da Guanabara) -- Small industry is that which sells less than Cr $900,000,000 [US$128,755,360] per year and medium-scale industry is that which sells more than Cr $901,000,000 per year [US$128,898,420].

(Translation)

Source: Banco de Dados - DEP/DAMPI/CNI, as transmitted by Confederação Nacional da Industria, Federative Republic of Brazil.
BRUNEI
State of Brunei

We have no official or legal definition of what constitutes small-scale industry. For a small country and for administrative purposes, the definition should be flexible enough to allow for expansion and growth. However, ... I would personally consider small-scale industries to be employing less than 50 workers and having capital investment in plant and machinery not exceeding B$250,000 [US$105,000].

Source: Economic Officer for State Secretary, Brunei.

CAMEROON
United Republic of Cameroon

A small-scale company in Cameroon is one that realizes a turnover of $4,000 or less per year. Companies classified in this category are not of the industrial type and they are predominantly engaged in retail trade.

Source: Economic Mission of Cameroon in the United States.

CANADA
Dominion of Canada

There is no one definition which adequately suits all situations. Consequently, we now consider the size of business in relation to each specific measure. For example, the Small Business Loans Act has recently been amended to provide guaranteed loans to firms with less than $1,000,000 in annual gross revenues. This is double the previous limit of $500,000.

In the area of management counselling, firms are eligible to use the Counselling Assistance to Small Enterprises (CASE) program if they have no more than 100 employees and no more than $5 million in annual sales. At this time, CASE is available primarily to firms in the manufacturing and tourism sectors.

On the other hand, the Industrial Development Bank (IDB) does not have limitations on the size of the client. The IDB gives particular attention to the needs of small business, and provides financing when credit or other
financial resources would not otherwise be available on reasonable terms and conditions. These criteria have worked out well in the past as the average loan size of the IDB has been under $50,000.

Source: Small Business Section, Program Development Division, Office of Industrial Policy, Department of Industry, Trade and Commerce, Dominion of Canada.

CHINA
Republic of China

Those manufacturing, processing and handicraft industries which fall under one of the following categories are classified as small- and medium-scale industries:

(1) An enterprise with a registered capital below NT$5,000,000 (US$131,600 at a conversion rate of US$1 to NT$38) and total assets below NT$20,000,000 (US$526,300); or

(2) An enterprise with a registered capital below NT$5,000,000 (US$131,600) and employment of:
   (a) 300 or less for electronics, garment and footwear industries;
   (b) 200 or less for food processing industry;
   (c) 100 or less for other manufacturing, processing and handicraft industries.

In addition, an enterprise engaged in commerce, transportation and services and employing 50 workers or less with annual sales amounting [to] NT$5,000,000 (US$131,600) or less is classified as small- and medium-scale business.

Source: Industrial Development Bureau, Ministry of Economic Affairs, Republic of China.

COLOMBIA
Republic of Colombia

Small industrial enterprises include bakeries, automotive repair shops and manufacturers of footwear, wooden furniture, bricks and tiles, flour and coffee mills. These plants employ between 5 and 24 workers.

Source: Colombia Today, Vol. 9, No. 6 (1974).
COSTA RICA

Republic of Costa Rica

According to the Banco Central de Costa Rica, there is no official definition of small-scale industry. A commission of the Ministry of Economics, Industry and Commerce is working on an official definition. For special purposes, like credit purposes, there are two definitions, and they read as follows:

a. The National Banking System of Costa Rica defines small-scale industry as follows: "The industrial activity whose principal asset is constituted by the work, technical capability and moral integrity of the proprietor and his relatives is considered small-scale industry.

b. The Central American Bank of Economical Integration defines, for the purpose of financing, small-scale industry as follows: "An industry to be called small-scale industry must be engaged in the production of finished goods, semifinished goods or of intermediate goods and must:

(1) Preferably use national or regional raw products.
(2) Have more than 2 employees but not more than 50.
(3) Net worth must be in the bracket of SCA 2,500 and SCA 50,000 [US$2,500-US$50,000].
(4) The manufacturing process must be based on simple technology, utilizing manual tools, mechanical machinery or equipment and, as possible, it should not use automatic processes or machinery." (Translation)

Source: Banco Central de Costa Rica, Republic of Costa Rica.

DENMARK

Kingdom of Denmark

We have no official or legal definition of the concept of "small-scale" industry.

Our industrial statistics cover manufacturing companies with more than 6 employees, and generally speaking the size of Danish industrial companies is fairly small in international comparison.

Source: Industrirådet, Kingdom of Denmark.
ECUADOR
Republic of Ecuador

An industry will be considered small-scale industry if it is engaged in the transformation of raw material or semifinished products into semifinished or finished goods, but in which the use of machinery operations predominates over manual operations. Also, its fixed assets, excluding land and buildings, must not exceed the maximum set by the Comité Interministerial de Fomento de la Pequeña Industria y Artesanía (Committee for Small-Scale Industry) which in no case is to exceed 1,500,000 sucrés [US$59,405]. (Translation)

Source: Codification de la Ley de Fomento de la Pequeña Industria y Artesanía, Ministry of Industries, Commerce and Integration, Republic of Ecuador.

ETHIOPIA
Empire of Ethiopia

We do not have an official, legal definition of what constitutes small-scale industry. However, various studies and surveys have been made on the topic.

The Central Statistical Office of the Ethiopian Government in its 1971 survey used the following criteria to characterize small-scale industries: (1) fixed capital investment of up to Eth.$100,000 [US$48,309] and (2) employment level between 10 and 50. The International Bank for Reconstruction and Development used these same criteria in its survey of the Ethiopian economy titled "Recent Economic Performance and Future Prospects in Ethiopia," 1972.


FIJI

We have not as yet evolved a legal definition for small-scale industry. We know that other countries have, and base their definitions on either the number of people employed, the level of capital invested, or both.
The word small-scale industry is used very loosely in this country and at times may refer to an enterprise employing fewer than twenty people.


FINLAND
Republic of Finland

In Finland an enterprise is considered to belong to the category of small industries if the number of workers employed does not exceed 100 and if its annual business turnover is not more than 2 million markkas [US$522,193].

Source: Report entitled Small Business Administration in Finland, transmitted by the Embassy of Finland in the United States.

GAMBIA, THE
Republic of The Gambia

There exists no legal definition of small-scale industry in The Gambia.

We have indeed, under the auspices of I.L.O., had a number of reports on this subject and intend to establish a small indigenous business advisory service -- but so far there is no strict definition. In the West African context, and perhaps generally, it is best defined negatively; thus it does not:

(a) Directly fully employ more than circa ten persons.
(b) Have expatriate management and/or technicians.
(c) Use a purpose built facility of more than 2,000 square feet.
(d) Have a capital investment per employee of more than circa $5,000 (usually far less).
(e) Have an annual turnover of more than circa $150,000.
(f) Does not produce an article or service which requires a high technical skill for most of the employees (there may be one or two highly skilled), excepting artistic production (e.g., handicrafts).

Such small businesses in The Gambia fall within:

(i) Trading
(ii) Handicraft production (silversmiths, woodcarvers, et al.)
(iii) Simple metalwork and mechanical repair services
(iv) Simple carpentry
(v) Construction
(vi) Fishing
(vii) Simple food processing
(viii) Simple manufacture and assembly from imports (e.g., candles)
(ix) Simple weaving
(x) Tailoring

Source: Ministry of Economic Planning and Industrial Development, Republic of The Gambia.

GERMANY

Federal Republic of Germany

Dr. Gabler's Economic Dictionary has the following entry:

Small-scale industry is an economic production unit which, given its reduced amount of capital and labor, has a limited production. LIMITS: 1. According to statistics; (a) Agricultural sector: area utilized is 0-5 hectares, (b) Manufacturing sector: industries with 0-5 employees. 2. According to the economic production viewpoint: units with 0-20 employees. Advantages of the small-scale industries: capacity to adapt to market variations; relatively simple social relationships (narrow production community); capacity to utilize rational manufacturing procedures . . . 3. According to trade organizations: Industries with a staff of 5-20 employees, who have the right to vote for the work council . . . (Translation)

Source: Dr. Gabler's Wirtschaftslexikon as transmitted by the Goethe House New York, German Cultural Institute/Branch of Goethe Institute Munich.

GUATEMALA

Republic of Guatemala

Small Industry Characteristics:
- have a limited market or a limited number of clients
- the size of the enterprise corresponds to a limited production program and to the management capacity of the entrepreneur
- manufacture of common products with simple production processes
- few employees
- use local raw materials that are easily accessible or nonfinished products
- simple production equipment and machinery
- simple accounting and control systems (Translation)

Source: Ministerio de Economia, Republic of Guatemala.

GUYANA

A Small Industries Corporation has been set up by Government to promote, stimulate and facilitate the establishment of small industries in the economy of Guyana.

- Emphasis will be placed on those industries which will utilise raw materials produced in Guyana or capable of being produced in Guyana.

- Economies of location might dictate the siting of large-scale industries in urban areas, but small-scale industries may be located in rural and hinterland areas which will assist Government's policy of regionalism by encouraging the establishment of small businesses in rural areas and by utilising human and material resources found in these areas.

The Small Industries Corporation grants loans up to a maximum of $160,000.

Who are entitled to apply:
- Guyanese owners or intending owners of small manufacturing businesses
- Note this: - the value of the fixed assets of the investment should normally not exceed $200,000
  - the applicant will be expected to provide part of the capital costs of the project
  - if it is a new project, a minimum of 20% of the capital costs must be met by the applicant
  - if it is an existing project, the applicant must meet at least 50% of the capital costs

HONDURAS
Republic of Honduras

The definition of small-scale industry is "any enterprise having 5 or less workers." This is the definition that has been used in the recent industrial census and in the industrial survey made by government institutions. In other cases, the criterion used to define small industry is the one with a capital of 10,000 dollars or less. (Translation)

Source: Asociación Nacional de Industriales de Honduras, Republic of Honduras.

HONG KONG
Colony of Hong Kong

"Small-scale industry" is defined, for the purposes of this Scheme,\(^1\) as "factories employing not more than 200 workers and having not more than HK$1,000,000 [US$196,850] in proprietors' funds."

\(^1\) The Scheme has been instituted by the Hong Kong Government to assist small industrial enterprises to increase their productivity by the purchase of modern machinery and equipment.

Source: Report entitled "Loans for Small Industry (Revised Terms and Conditions, 1973)," as transmitted by the Colonial Secretariat of Hong Kong.

INDIA
Republic of India

In India, small-scale industry includes all industrial units with capital investment of not more than Rs.750,000 [US$93,225] in plant and machinery, irrespective of the number of persons employed. This definition dates back to 1966, when a unit could not have capital investment of more than Rs.500,000 [US$62,150] in order to qualify as a small-scale unit. Moreover, till then, capital investment included not just plant and machinery, but also such assets as land, etc. Thus, since 1966 the definition of small-scale industry has been revised to cover somewhat larger units than used to be the case.

Source: Economic Wing, Embassy of India in the United States.
INDONESIA
Republic of Indonesia

The definition for small-scale industries is: those industries which have 1-4 labourers and utilise power equipment or 5-9 labourers without power equipment.

Source: Embassy of Indonesia in the United States.

IRAN
Empire of Iran

According to the Organization for Small-Scale Industries and Industrial Estates of Iran, "small-scale industry" covers the category of an industry owning not more than Rials 7.5 million [US$110,913] worth of machinery and equipment, and not being of a handicraft nature.

Source: Iranian Economic Mission, Embassy of Iran in the United States.

IRAQ
Republic of Iraq

We have no legal definition for small-scale industry in Iraq.

For statistical purposes, The Central Statistical Organization which belongs to the Ministry of Planning defines small-scale industry as those establishments which employ 9 persons or less.

Law No. 22 of 1973, "For The Promotion of Industry," confines most of its promotional and organizational articles to industrial establishments with machines and equipments costing not less than I.D. 6.000 [US$20,263].


ISRAEL
State of Israel

There is no legal definition of the term "small-scale industry" in Israel.
For the purpose of research, planning and classification, our Ministry applies a single criterion, i.e., the number of employees. Accordingly we define a small-scale industrial enterprise as one having up to 25 employees.

Source: Ministry of Commerce, State of Israel.

ITALY
Italian Republic

For the characterization of small and medium-size business for which the financial aid of the Mediocredito Centrale is reserved, the following criteria have been established by the Comitato Interministeriale Credito e Risparmio:

- number of employees not to exceed 500
- invested capital not to exceed 3 billion lira [US$454,200]

For the nondepressed area of Northern Italy, the criteria are the following:
- 0-500 employees
- invested capital not to exceed 3 billion lira [US$454,200]

For the depressed area of Northern Italy, the following criteria apply:
- 0-500 employees
- invested capital not to exceed 5 billion lira [US$757,000]
- depressed area of Northern Italy: Valle d'_sta, Treatino Alto Adige, Veneto, Frioli-Venezia Givlia, Emiliamagna, Toscana, Marche, Umbria, Lazio

For the depressed area of the "industrial triangle" (Piemonte, Lombardia and Ligoria), the following criteria apply:
- New Plants
  - 0-500 employees
  - invested capital not to exceed 1.5 billion lira [US$227,100]
- Expansions
  - 0-500 employees
  - invested capital not to exceed 3 billion lira [US$454,200]

For the area of Cassa to the Mezzogiorno:
- invested capital not to exceed 6 billion lira [US$908,400]
In January 1973, the occupational restriction was suspended, applying only the invested capital criterion. *(Translation)*

**Source:** General Confederation of the Italian Industry, as transmitted by the Italian Embassy in the United States.

**JAMAICA**

An enterprise or proprietorship in which the principal owner is involved in the very "core" of the operation of the business and who generally assumes the responsibility of the total operations.

**Source:** Jamaica Industrial Development Corporation, Small Industries Division, as transmitted by the Embassy of Jamaica in the United States.

**JAPAN**

The Small Business Policy Act defines "small and medium-sized enterprises" as follows:

1. manufacturing, mining and transportation industries -- those with no more than 300 employees or those with no more than 50 million yen in capital [US$5,072,022]
2. commerce and service industries -- those with no more than 50 employees or those with no more than 10 million yen in capital [US$1,014,404]

**Source:** Embassy of Japan in the United States.

**JORDAN**

Hashemite Kingdom of Jordan

No legal definition for small-scale industry in Jordan exists. But only for statistical purposes, industrial establishments with total value of assets in plant, machinery and equipment not exceeding JD 5,000 [US$15,974] and with total number of employees not exceeding 5 are considered to belong to the small-scale industry.

**Source:** Industrial Development Bank, Hashemite Kingdom of Jordan.
KENYA
Republic of Kenya

A legal definition of a small-scale industry has not yet been formulated, but we do consider an industry employing less than 50 employees as a small-scale industry.


KOREA
Republic of Korea

The revised size criteria for the definition of small and medium industries are as follows:

- **Manufacturing**...employment from five to 200 workers, or total assets not exceeding 50 million won [US$125,313].
- **Mining and transportation**...employment from five to 300 workers, or total assets not exceeding 50 million won [US$125,313].
- **Construction**...employment from five to 20 workers, or total assets not exceeding 50 million won [US$125,313].
- **Commerce and services**...employment from five to 20 workers, or total assets not exceeding ten million won [US$25,062].


LESOTHO
Kingdom of Lesotho

We regret that we do not have an official, legal definition of small-scale industries. But, for all practical purposes there is an understanding that:

- at the present stage of development there will be only very few large-scale industries
- whatever enterprise does not require expatriate management or (non-national) participation is considered small-scale (which does not mean that a national could not operate a large-scale enterprise)
we would at present consider any project employing more than 100 people or having more than $150,000 in fixed assets as being large, but may also do so in much smaller cases.

Source: Ministry of Commerce and Industry, Kingdom of Lesotho.

LIBYA
Libyan Arab Republic
Small Projects:

The purpose of these projects is to satisfy the needs of a limited part of the country over a wide range of consumable commodities.

Small projects are spread all over the country in big numbers and, therefore, it is difficult to define them in the development programme, but a lump sum figure is allocated for their expected investments during the programme period. These projects depend basically on both hand work and rather small simple machines and, therefore, they can be self-financed by the private sector.

Normally, initiation of small projects is started by the private sector and, therefore, the public sector will only be interested in projects which are deemed necessary to the national economy and for which the private sector shows no interest.

In addition to the wide scope open for the private sector to participate in the medium and major projects as explained before, and for the sake of encouragement, the state industrial financing corporations will grant loans at a limit of 60,000 Libyan pounds [US$202,771] for those projects which are proposed by the private sector and approved by the competent authorities.

Traditional and cottage industries:

Traditional and cottage industries will receive full care and support. Financial resources will be made available to those who are responsible for them and better means for marketing their production will be assured. Also, free technical expertise will be provided on the spot.

Luxembourg

Grand Duchy of Luxembourg

There exists no legal definition of small-scale industry in Luxembourg.

The actual situation is the following in the Grand Duchy:

On the one hand we have the handicraft shops, generally considered as small-scale firms, and on the other hand we have the industrial firms, federated in our "Federation des Industriels Luxembourgeois," including big, medium and small enterprises. When these firms are considered as industrial enterprises -- our board decides this when we have demands for affiliation -- they depend from the Ministry of Economic Affairs and are ruled by this Ministry. The only difficult situation occurs when a handicraft shop grows and is too big to remain among the handicraft sector and still too small, or due to his production, to enter the industry sector.

Source: Federation des Industriels Luxembourgeois.

Malaysia

In Malaysia there are five (5) developmental institutions catering to the needs (financial, managerial and technical) of the small sector as part of their respective spheres of activities. They are namely:

1. Majlis Amanah Raayat (MARA)
2. National Productivity Centre (NPC)
3. Malaysian Industrial Development Finance Industrial Consultants (MIDFIC)
4. National Institute for Scientific and Industrial Research (NISIR)
5. Federal Industrial Development Authority (FIDA)

Early in 1973, the National Advisory Council on Consultancy and Advisory Services for Small-Scale Industries and Businesses, comprising the above five institutions, was formed to mobilise and co-ordinate existing efforts and facilities for the effective development and promotion of the small sector. Among its work, the Council has adopted (on March 22, 1973) the following definitions for the small sector:

a. A small-scale manufacturing unit is "an industrial unit with a total capital investment of about M$250,000 [US$103,305] in land, building,
plant, machinery and equipment, regardless of the number of persons employed. Such unit is characterized by the owner/manager performing a wide range of tasks, in addition to production, involving guidance and leadership without the help of full-time specialist officers in his organisation."

b. "Small-scale businesses are business units with proprietor's or shareholder's capital of about M$50,000 [US$20,661] or less and with an annual turnover of M$250,000 or less, employing simple management techniques. The management of such business unit is identified with ownership."

Source: Federal Industrial Development Authority, Malaysia.

MALTA

There is no legal definition of a small-scale industry in Malta. However, . . . the practice adopted by the Central Office of Statistics and the Director of Labour is that a small-scale establishment is one that employs ten (10) persons or less.


MEXICO

United Mexican States

Small-scale industries in Mexico . . . are understood as . . . those whose capital investment is no less than 25,000 Mexican pesos [US$2,001] and no greater than 25,000,000 Mexican pesos [US$2,001,601].

Source: Ministry of Industry and Commerce, United Mexican States, as transmitted by the Mexican Embassy in the United States.

NETHERLANDS

Kingdom of the Netherlands

The Dutch government does not know a legal definition, nor a uniform statistical criterion for small-scale industry. Only in some cases are quantitative limits specified. Small-scale industry is divided into:
- crafts and small manufacturing industry
- wholesale and retail trade
- service industry (transportation, mail service, dry cleaners, etc.)

(Translation)

Source: Ministerie van Economische Zaken te 's-Gravenhage (Department of Economic Business in The Hague) as transmitted by the Economic Secretary, Royal Netherlands Embassy in the United States.

Generally spoken, the term "small-scale industry" is used for industries with more than 10 but less than 50 employees. (Translation)

Source: Economic Secretary, Royal Netherlands Embassy in the United States.

NEW ZEALAND
Dominion of New Zealand

In effect, most of New Zealand industry is characterised by small-scale enterprises. . . . Approximately 60 percent of all factory establishments in the country have no more than 10 people engaged in employment, whereas less than 2 percent have in excess of 200 employees.

Similarly, only a very small proportion of industrial establishments have an annual turnover greater than $5,000,000. These would possibly be the only enterprises to be regarded as large-scale in this country.

The large-scale industries in New Zealand operate principally in the fields of forest products, food and beverages, petroleum refining and construction. Small-scale enterprises operate in some of these sectors and are dominant in most other areas of production and manufacturing.

Source: Ministry of Trade and Industry, Dominion of New Zealand.

NICARAGUA
Republic of Nicaragua

According to the National Bank of Nicaragua, there are two classifications for small industries:

- Corresponds to a BNN/AID program, effective since October 1968
  (a) total assets = C$300,000 [US$42,857]
  (b) employees greater than 5
- Corresponds to a BNN/BID program effective since January 1973
  (a) total assets = C$420,000 [US$60,000]
  (b) employees greater than 5


NIGERIA
Federal Republic of Nigeria

We have no legal (definitive) definition. However, ... small-scale industries in Nigerian context would certainly include establishments employing less than 500 personnel, and ones in which fixed capital involved is low and turnover of no higher magnitude than $50,000.


NORWAY
Kingdom of Norway

In Norway there is no invariable authoritative definition of what constitutes small-scale industry. The Government has, however, felt the need for some kind of such definition in the operation of the Governmental Fund for Handicraft and Small Business. When this fund was reorganized and expanded in 1966, the Government declared that this fund should primarily aim at assisting enterprises with maximum twenty employees. This is the only official attempt to define small-scale industry.

The number of employees used (20) should be viewed in the context of the size of Norwegian industrial enterprises. The majority of those employed in Norwegian industry, approximately 70 percent, are employed in enterprises with less than 200 employees, and the average number of employees in all industrial enterprises is 40 persons.

Source: Royal Norwegian Embassy in the United States.
PAKISTAN
Islamic Republic of Pakistan

Small-scale industries are governed by the Provincial enactments, and the official/legal definitions of the said industry in the Provinces of the Punjab, Sind and North-West Frontier Province are as follows:

Province of Punjab and Sind:

Small-scale industry means an industry engaged in handicrafts or manufacture of consumer or producer goods, the value of the total fixed assets whereof (excluding the cost of land) does not exceed twenty lakhs rupees [US$200,000].

Province of N.W.F.P.:

Small industry means an industry engaged in handicrafts or manufacture of consumer or producer goods the value of total assets whereof (including land) does not exceed Rs. 30 lakhs [US$300,000].

Source: Ministry of Industries, Government of Pakistan.

PANAMA
Republic of Panama

Although there is no legal definition of small-scale industry in Panama, a recent study done in conjunction with the Ministry of Commerce and Industry established the following definition of small-scale industry:

A manufacturing enterprise to be considered small-scale industry has to employ 5 to 29 employees and have a fixed assets investment no greater than B/75,000 [US$75,000].

The limits to which the definition refers are not rigorous. Cases are considered independently.

This definition has been used for planning and financing programs for small-scale industry since 1973. (Translation)

Source: Centro de Desarrollo y Productividad Industrial, Ministerio de Comercio e Industrias, Republic of Panama.
PERU
Republic of Peru

At present, there is no explicit legal definition of the term "small-scale industry" (pequeña industria) in Peru. The General Industries Law (Ley General de Industrias, Decreto Ley No. 18350), however, in Article 281 of its by-laws, refers in this respect to Article 2 of the Industrial Communities Law of 1970 (Ley de Comunidad Industrial, Decreto Ley No. 18384), which stipulates that all industrial enterprises having fewer than 6 workers and an annual turnover of less than S/. 1 million [US$25,840] are subject to pending special legislation. The new law regarding the small industries sector is presently under consideration and probably will be enacted within the next few months.

For the purposes of a Programme of Industrial Extension Services to small industries presently in preparation in this Ministry with bi-lateral and multi-lateral assistance, the selected target group is those industrial enterprises employing less than 20 workers and with a maximum investment of S/. 2 million [US$51,680] in machinery and equipment.

The National Training Center of Industry and Tourism (SENATI) defines small-scale industries as those employing between 5 and 19 workers.

The Industrial Development Bank of Peru (BIP) has selected as a target group for its small industry credit programme those enterprises with a capital investment of less than S/. 1.2 million [US$31,007] and an annual turnover of less than S/. 5 million [US$129,198].

Source: Ministerio de Industria y Turismo, Government of Peru.

PHILIPPINES
Republic of the Philippines

Regarding the legal and official definition of small-scale industry . . . there is none, so far, that we know of, but as embodied in Republic Act No. 3470, creating the National Cottage Industries Development Authority (NACIDA), the term "cottage industry" may also be considered small-scale industry. Section 11 of said Act is quoted below for your information and reference:
Section 11 Definition.- The term "cottage industry" as used in this Act shall mean an economic activity in a small scale which is carried on mainly in the homes or in other places for profit and which is mainly done with the help of the members of the family. It shall include the following: (1) fiber crafts such as making of abaca ropes and twines, buntal fiber extracting and buri leaf braiding; (2) woodcraft such as making wooden shoes, wooden fans, walking sticks (canes) and wood carvings; (3) hat weaving such as Calasiao, buri, rafia, buntal and bamboo hats, salakots, and helmets; (4) mat weaving such as door, buri, pandan, balilan, and sabutan mats; (5) metal craft such as making of jewelries, knives, boloes, scissors, razors, silverwares, and brassworks; (6) ceramics such as making of pottersies, hollow blocks, tiles, firebricks, clay stoves and other ceramic products; (7) shell crafts such as making of sea shell buttons and coconut shell products; (8) bamboo and rattan crafts such as making of hammocks, basketry, making of sawali and other bamboo and rattan furniture and articles; (9) small agricultural hand tools such as plow points; (10) toy craft such as making of dolls and toys; (11) embroidery industries; (12) needlecraft (including knitting and crocheting); (13) loom weaving such as making of fish nets, making of mosquito nets, weaving of Ilocano cloth, Igorot weaving, pina "barong Filipino," jusi and sinamay; (14) machine parts manufacture such as wheels and stone mortars; (15) poultry including duck raising and "balut" making; (16) piggery; (17) home cigar making; (18) food preservation and canning, including the making of vinegar wine, "bagoong," "mazapan" pili, "tostado compitado" de pili, "bucayo"; (19) small mining operations; (20) other related crafts such as making of brooms, nito and buri bags, "karagomay" bags, bead making, guitar and other musical instruments; and (21) such other industries done in the home with the aid of electrical gadgets and/or by hand manipulation. The cottage industries shall be owned and operated by Filipino citizens, or if a corporation, partnership or cooperative, at least seventy-five percent of its Board of Directors shall be Filipino citizens.

Source: Embassy of the Philippines in the United States.

Any enterprise with total assets of less than 1 million [US$147,126] is considered a small-scale industry.

Source: Commission on Small and Medium Industries, 1974.

POLAND
Polish People's Republic

An understanding of the definition of "small industry" is best comprehended in the light of the more frequently used term "small manufactures."

Among the many important criteria of the economic characteristics of small manufactures . . . there should be mention of:
1. Production output small in quantity but with great elasticity for adjustment to different or changing necessities and consumer tastes
2. Especially simplified forms of management and administration
3. Secondary position on large market sales and investments
4. Limited accessibility to organized credit market
5. Close ties with local market sales and profiting in underdeveloped places
6. Organizational ties with organs of area administration

Equally applicable . . . are various criteria dealing with the size of the establishments of small industries. Among these, the most useful criterion is the employment in the establishment of less than 100 workers. (Translation)

Source: Ministry of Light Industry, Polish People's Republic.

PUERTO RICO
Commonwealth of Puerto Rico

There is no legal definition for small-scale industry in Puerto Rico. . . . A definition of this nature may be based on a wide variety of criteria which depend on the needs of the user.

The only criterion that may be useful . . . is the one given by our Department of Puerto Rican Industries which requires a minimum of $10,000 to $15,000 of capital invested and 5 persons employed as one of the requisites for promoting a manufacturing plant.


ROMANIA
Socialist Republic of Romania

There is no legal or official definition of small-scale industry in our country.

However, according to our personal opinion based on actual situation, small-scale industry in our country may be defined as that branch of industry which turns into account local natural resources of a town or a county (there are 39 counties in Romania), and which supplies mainly the local markets with
specific products. Usually the plants, factories, etc., included in the local industry (small-scale industry) are smaller than the factories, plants, etc., of national importance. At the same time, local industry is subordinated to the local governments to which they pay taxes under different forms.

In addition to the state local enterprises, there are also cooperative enterprises in the field of manufacturing different products or supplying various services for the people living in a town or a certain area of a county.

The construction of new units of local industry is financed by the local governments using their own budget.

Source: Office of the Economic Counselor, Embassy of the Socialist Republic of Romania.

SAINT CHRISTOPHER (ST. KITTS)-NEVIS-ANGUILLA
State of St. Christopher (St. Kitts)-Nevis-Anguilla

In St. Kitts, based on the normal practice accepted by the Caribbean Development Bank, the ceiling for fixed investment accepted for small industries is US$50,000.

In my own view, for small industries the investment should not exceed US$25,000, but the terms of loans and facilities accorded should be very liberal so that in the developing countries the small man can be helped.

Source: Development and Finance Corporation, St. Kitts, W.I., as transmitted by St. Kitts-Nevis Chamber of Commerce.

SAINT VINCENT
State of Saint Vincent

There is no official, legal definition of small-scale industry that we know of in St. Vincent. In the context of St. Vincent, where there is little industrial activity, no large-scale (by any definition) industrial enterprises, and no foreseeable likelihood of there being any large-scale enterprises, a definition for small-scale industry would be rather otiose and pretentious. What seems more important is to have a set of criteria (which criteria may tally with the characteristics of small-scale industry) by which the suitability of
industrial projects may be assessed. At the moment the Corporation favours projects with a high percentage local value added; projects that are labour intensive; projects which utilize local raw materials where these exist; projects that are export-oriented, particularly enclave projects which export their total output; projects which promote inter-sectoral and inter-industry linkages; import-substitution projects, and especially import displacement projects; and also projects in which there is local proprietary participation.

Notwithstanding, under the Corporation's Small Industry Credit Scheme and under the Corporation's Scheme for the provision of industrial buildings to small industry, eligibility for finance and for industrial building space is determined by the applicant not having a net worth (including the net worth of the applicant's spouse) in excess of $100,000 East Caribbean Currency [US$49,261].

Source: Development Corporation, St. Vincent, as transmitted by the Ministry of Trade, Agriculture and Grenadines Affairs, State of St. Vincent.

SAUDI ARABIA
Kingdom of Saudi Arabia

Small-scale industries include all industrial establishments that employ less than fifty workers or with investments in machinery and equipment of less than SR 250,000 [US$70,422].

Source: Industrial Studies and Development Centre, Kingdom of Saudi Arabia.

SENEGAL
Republic of Senegal

There is not an official definition of small and medium industry in Senegal. Law 72-43, regulating only large-scale industry, states that an investment of 100 million CFA francs [US$410,255] within 3 years and minimum employment of 50 persons is necessary. Law 72-46, regulating small and medium industry, states that the benefits of this law are limited to those programs which have, among other qualifications, a minimum investment of 5 million
francs [US$20,512] over a 2-year period, or if an agricultural enterprise, an investment of 3 million francs [US$12,307]. (Translation)

Source: Publications transmitted by the Societe Nationale d'Etudes et de Promotion Industrielle (SONEPI), Republic of Senegal.

SIERRA LEONE
Republic of Sierra Leone

A small-scale industry is defined by the Central Statistics Office as an industrial establishment employing less than six persons, including the self-employed.

Source: Ambassador and Permanent Representative of the Republic of Sierra Leone to the United Nations.

SINGAPORE
Republic of Singapore

There is no legal or official definition of small-scale industry in Singapore. However, our authorities traditionally consider those manufacturing industries employing less than 50 workers and/or having a capital (not including land and building) of less than S$250,000 [US$100,806] as small.

Source: Embassy of Singapore in the United States.

SOMALIA
Somali Democratic Republic

A definition of small industry, and based on that, a law for promoting its development, is still in the offing. However, in general, small industry had been, in the past, understood to cover industrial units using fixed assets of the value around one million Somali shillings [US$158,856], employing 50 or less workers.

A formal and legal definition of small industry is now being worked [out] and on the basis of investment criteria alone.

The investment ceiling will be fixed for this purpose, keeping in view the specific requirement of Somalia related to the possible use of:
(a) Private enterprise for the development of small industry.
(b) Small industrial units as subsidiaries of large and medium industrial plants in the public sector, and
(3) Industrial co-operatives for the establishment and the management of small industrial units based on modern technology.

Source: Ministry of Industry, Somali Democratic Republic.

SOUTH AFRICA
Republic of South Africa

I regret to advise that I am unfortunately not aware of any "official, legal definition of a small-scale industry" in my country. The Industrial Development Corporation of South Africa, Limited, a semi-government institution, however, considers a small-scale industry as an independent, industrial undertaking with total assets not exceeding R500,000 (five hundred thousand Rand) [US$725,058].

Source: Economic Minister, Embassy of South Africa in the United States.

SUDAN
Republic of the Sudan

[Small-scale industries are] those in which the fixed capital in an establishment "for machinery, land and building" is less than $S.30,000 [US$86,157] or the number of operatives is less than 30.

Small-scale industries include metal containers, iron and wooden furniture workshops, general engineering workshops, vegetable oil mills, macaroni and vermicelli units, perfumery works, printing process, etc.

Source: Ministry of Industry and Mining, Republic of the Sudan.

SWAZILAND
Kingdom of Swaziland

A legal definition of small-scale industries does not exist in Swaziland.
As a working guide, we are using the definition that a small-scale industry is an enterprise employing less than 50 people and/or giving a material an added value requiring an investment of less than E50,000 [US$72,505] and/or with a turnover of less than E200,000 [US$290,023].

Source: The Small Enterprises Promotion Office, Ministry of Industry, Mines and Tourism, Kingdom of Swaziland.

SWEDEN

Kingdom of Sweden

Legal definitions of small-scale industries in Sweden . . . do not exist. With regard to taxation, a "family business" is defined as a firm with a maximum of ten persons owning 75% or more of the shares, but on other fields than taxation, no legal definitions exist.

However, there are, of course, rather widespread definitions of small-scale industries in Sweden which are not legally founded. These definitions often use some kind of employment figure as a firm size measure. Because of the fact that size distributions of firms differ from one industry branch to another, the exact borderline between small and middle sized firms varies in different branches. Usually the employment level of a small-scale industry is maximized to 100 or (in some large-scale dominated branches) to 200 employees.

There is also a tendency in Sweden to differ between "little" and "small" business firms. This tendency is, however, especially pronounced in the trade and service sector of the economy and not in the industry sector. Little business is, in this respect, equal to the "one-man" firm or a firm where all activities are taken care of within the family or within a small group of relatives.

Source: National Industrial Board, Kingdom of Sweden.

SWITZERLAND

Swiss Confederation

According to official Swiss industrial statistics, firms employing up to 49 persons are considered as small-scale business, firms employing from 50 to
499 persons as medium-scale business, and firms employing 500 and more persons as large-scale concerns.

Source: Embassy of Switzerland in the United States.

THAILAND

Kingdom of Thailand

According to the definition given by our Ministry of Industry, the industrial firm which has registered capital or fixed assets less than 2,000,000 Baht [US$97,799] is categorized as a small-scale industry. The purpose of this classification is just for the convenience of the government in subsidiary consideration.

Source: Ministry of Industry, as transmitted by the Office of Commercial Counselor, Royal Thai Embassy to the United Nations.

TONGA

Kingdom of Tonga

We do not have an "official, legal definition," but the one which we more or less accept is "an industry having an investment not exceeding T$100,000 [US$148,743] may be classified as small-scale industry irrespective of the value of land, building and working capital and the number of workers employed in the project."

Source: Ministry of Labour, Commerce and Industry, Kingdom of Tonga.

TRINIDAD AND TOBAGO

The Trinidad and Tobago Industrial Development Corporation (IDC) is the principal agency in the implementation of Trinidad and Tobago's industrial programme.

While there is no legal definition on what constitutes small-scale industries, there are certain criteria which are used in determining which industries would qualify for help from the IDC. There is a separate unit of the IDC which gives assistance to small businesses in Trinidad and Tobago to (1) provide employment; (2) use local raw materials; (3) satisfy local or foreign
The amount committed by IDC to these enterprises [from May 1970 to April 1972] ranges from TT$300 to TT$45,000 [US$144-$21,739] and [these establishments] give employment [to] from one person to fifty persons. These are what we consider small-scale industries.

Source: Embassy of Trinidad and Tobago in the United States.

UNITED KINGDOM
United Kingdom of Great Britain and Northern Ireland

The definition of a small firm adopted by the British Government is as follows:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Statistical Definition of Small Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>200 employees or less</td>
</tr>
<tr>
<td>Retailing</td>
<td>$50,000 pa or less</td>
</tr>
<tr>
<td>Wholesale Trades</td>
<td>turnover $200,000 pa or less [US$466,417]</td>
</tr>
<tr>
<td>Construction</td>
<td>25 employees or less</td>
</tr>
<tr>
<td>Mining/Quarrying</td>
<td>25 employees or less</td>
</tr>
<tr>
<td>Motor Trades</td>
<td>turnover $100,000 pa or less [US$233,208]</td>
</tr>
<tr>
<td>Miscellaneous Services</td>
<td>turnover $50,000 pa or less [US$116,604]</td>
</tr>
<tr>
<td>Road Transport</td>
<td>5 vehicles or less</td>
</tr>
<tr>
<td>Catering</td>
<td>all excluding multiples and brewery-managed Public Houses</td>
</tr>
</tbody>
</table>

The British Government are well aware that no definition is perfect. Although 200 employees is quoted in the manufacturing field, an electronics firm which has this number of employees will be quite different in character to one of similar size in, say, textiles. A true small firm in the Government's view is, therefore, one that is owner-managed or whose policy is indicated by the owner/director; its policies not being influenced in another factory or group headquarters located elsewhere.

Source: British Embassy in the United States.
121.3 Statutory provisions.

(a) Small Business Act, as amended.

Sec. 3. For the purpose of this Act, a small business concern shall be deemed to be one which is independently owned and operated and which is not dominant in its field of operation. In addition to the foregoing criteria, the Administrator, in making a detailed definition, may use these criteria, among others: Number of employees, and dollar volume of business. Where the number of employees is used as one of the criteria in making such definition for any of the purposes of this Act, the maximum number of employees that a small business concern may have under the definition shall vary from industry to industry to the extent necessary to reflect differing characteristics of such industries and to take proper account of other relevant factors.

(See attached sheets for full information.)

whether or not affiliation exists, consider-
of the Small Business Act and, in con-
of 1940, are affiliates of each other when
franchisee, if the franchisee has the right
trol and, therefore, is affiliated with the
franchise agreement shall not be con-

relationships: Provided,
vestment companies licensed, or state

office of the applicant, not including its
vestment. Such determination shall be

§ 121.3-2 Definition of terms used in

(a) Affiliates: Concerns, other than in-
vestment companies licensed, or state
development companies qualifying under the
Small Business Investment Act of 1958 and the
regulations issued pursuant thereto, or investment
companies registered under the Investment Company Act
of 1940, are affiliates of each other when
either directly or indirectly (1) one con-
cern controls or has the power to control
the other, or (2) a third party or parties
controls or has the power to control both.
In determining whether concerns are
independently owned and operated and
whether or not affiliation exists, consider-
ation shall be con-

common ownership, common management, and contractual
relationships: Provided, however, That

interest having a stock interest greater
than 50 percent of the voting stock of a

block sufficient to give him control or the

(2) Control through stock ownership.

(a) A party is considered to control or
have the power to control a concern if he
controls or has the power to control 50 percent or more of its voting stock.
(b) A party is considered to control or
have the power to control a concern even
though he owns, controls, or has
the power to control less than 50 percent
of the concern's voting stock if the block
of stock he owns, controls, or has the
power to control is less than 50 percent
when compared with any other outstanding block of stock. If two or more parties
each own, controls, or has the power to control less than 50 percent of the voting stock of a

and such minority block is (1) equal or substantially equal in size, and (2) large as compared with any other block outstanding, there is a presumption that each party or parties owns or has
the power to control such concern; how-
ever, such presumption may be rebutted by
a showing that such control or power
to control, in fact, does not exist.
(c) If a concern's voting stock is
distributed other than as described above, its
management (officers and directors) is
deemed to be in control of such concern.

EXAMPLE. In a corporation where the
officers and directors own various size blocks of
stock totaling 40 percent of a concern's vot-
ing stock, stock ownership has a
larger block of stock to give him control or the
power to control and the remaining 60 per-
centage is widely distributed among individual
stockholders having a stock interest greater
than 10 percent, management has the power
to control.

(iv) Stock options, convertible deben-
tures, and convertible debentures
exercisable at the time of or within a rela-
tively short time after a size determina-
tion and agreements to merge in the fu-
ture are considered as having a present

EXAMPLE. If, on the date of the determi-
ination, company "A" holds an option to pur-
chase a controlling interest in company "B"
and such option can be exercised prior to the
determination, further, if, as of the
date of a determination, company "A" has
terminated an agreement to merge with
corporation "B" in the future, the situation
is treated as though the merger had taken
place prior to the date of the determination.

(v) Voting trusts. If the purpose of a
voting trust or similar agreement is to
separate voting power from beneficial
ownership of voting stock for the purpose
of shifting control of or the power to
control, in order that such concern or another concern may qualify
as a small business within the size regu-
lations, such voting trust shall not be
considered valid for this purpose, regard-
less of whether the trust is or is not
valid within the appropriate jurisdic-
tion. However, if a voting trust is
entered into for a legitimate purpose as
discussed above, and it is a valid trust within the appropriate
jurisdiction, it may be considered valid
for the purpose of a size determination.

(vi) Control through common
management. A concern is considered as
controlling or having the power to con-

ers or another concern may qualify
as a working majority of the board of direc-
tors or officers of another concern.

(b) Common facilities. One concern
shares common office space and/or em-
ployees and/or other facilities with another
concern particularly where such

(c) New organized concern. Former
officers, directors, principal stock-
holders, and/or key employees of one
concern organize a new concern in the
same or a related industry or field of operation
such concerns were formerly affiliated.

(d) New organized concern. Former
officers, directors, principal stock-
holders, and/or key employees of one
concern organize a new concern in the
same or a related industry or field of operation,
and serve as its officers, dire-
ctors, principal stockholders, and/or
key employees, and one concern is
furnishing or will furnish the other con-
cern with technical assistance, and/or
facilities, whether for a fee or otherwise.
(vi) Control through contractual relationships.—(a) Definition of a joint venture for size determination purposes. A joint venture, for size determination purposes, is an association of persons or concerns with interest in any degree or proportion by way of contract, express or implied, or by any other arrangement whereby one or more persons or concerns control each other and are considered as being affiliated. For the purpose of financial assistance to a joint venture, the parties thereto are considered as controlling or having the power to control each other and are considered as being affiliated.

(b) Joint ventures—financial assistance. For the purpose of financial assistance to a joint venture, such concern is not considered as being affiliated with its joint venture.

(c) Joint venture—procurement assistance. Concerns bidding on a particular procurement as joint venturers are considered as being affiliated with their joint venture.

(d) Where a concern is not considered as being affiliated with a concern with which it is participating in a joint venture, it is necessary, nevertheless, in computing annual receipts, etc., for the purpose of applying size standards to increase its size by the sum of the concern’s share of the joint venture receipts (as distinguished from its share of the profits of such venture).

(e) Franchise and license agreements. If a concern operates or is to operate under a franchise (or a license agreement), the following policy is applicable: In determining whether the franchisor controls or has the power to control and, therefore, is affiliated with the franchisee, the restrictions imposed on the franchisee by its franchise agreement shall not be considered provided that the franchisee has the right to profit from its effort and the risk of loss or failure, commensurate with ownership. Even though a franchisee may not be controlled by the franchisor by virtue of the contractual relationship between them, the franchisee may be controlled by the franchisor or others through common ownership or common management, in which case they would be considered as affiliated as joint venturers.

(b) "Annual receipts" means the gross income (less returns and allowances, sales of fixed assets, and interaffiliate transactions) of a concern (and its domestic and foreign affiliates) from sales of products and services, interest, rents, fees, commissions, and/or from whatever other source derived, as entered on its regular books of account for its most recently completed fiscal year (whether on a cash, accrual, completed contracts, percentage of completion, or other acceptable accounting basis) and, in the case of a concern subject to the U.S. Federal income taxation, reported or to be reported to the U.S. Treasury Department, Internal Revenue Service (IRS). (Pro-vided, however, that whenever the contracting officer determines prior to the issuance of bids that the estimated value of the entire contract constitutes more than 50 percent of the estimated value of the entire contract, the contract shall not be classified as base maintenance but in the industry in which such service is classified. (f) "Bona fide feed stocks" means crude and any other hydrocarbon material actually charged to refinery processing units, as distinguished from materials used as components in products to be delivered after merely filtering, settling, or blending.

(g) "Crude-oil capacity" means the maximum daily throughput of a refinery in complete operation, with allowance for necessary shutdown time for routine maintenance, repairs, etc., to approximate the maximum daily average crude runs to stills that can be maintained for an extended period.

(h) "Certificate of Competency" means a certificate issued by SBA pursuant to the authority contained in section 8(b)(7) of the Act stating that the holder of the certificate is competent as to capacity and credit to perform a specific Government procurement or sales contract.

(i) "Concern" means any business entity organized for profit (even if its ownership is in the hands of a nonprofit entity) with a place of business located in the United States and which makes a significant contribution to the U.S. economy through payment of taxes and/or use of American products, material and/or labor, etc. "Concern" includes but is not limited to, an individual, partnership, corporation, joint venture, association, or cooperative. For the purpose of making affirmative findings (e.g., the facility is a concern), whether organized for profit or not, and any foreign business entity, i.e., any entity located outside the United States, shall be included.

(j) "Contracting officer" means the person executing a particular contract on behalf of the Government and any other employee who is a properly designated contracting officer; the term includes the authorized representative of a contracting officer acting within the limits of his authority.

(k) "Convalescent or nursing home" means those facilities for the accommo-dateation of convalescents or other persons who are not acutely ill or not in need of hospital care but who may require nursing care and related medical services, which facility is privately owned and operated for the purpose of obtaining profits which shall inure to the benefit of its owners, stockholders, or members.

(l) "Department store" means a business which is privately owned and operated for the purpose of obtaining profits which shall inure to the benefit of its owners, stockholders, or members. (m) "Department" means the Department of Labor, the Department of Commerce, or the Department of the Treasury, as the case may be.

(n) "Discretionary expansion programs" means the programs established by the Department of Commerce for the purpose of encouraging participation by small businesses in the government procurement program.

(o) "District" means one of the administrative districts established by the Department of Labor, the Department of Commerce, or the Department of the Treasury, as the case may be.

(p) "Employee" means any individual, whether organized for profit or not, and any foreign business entity, i.e., any entity located outside the United States, shall be included.

(q) "Encroachment" means the increase in the size of a concern due to the shortage of energy or other reason causing a concern to expand its facilities.

(r) "Equipment" means any tangible property, whether real or personal, held for use in or incident to the conduct or operation of a concern.

(s) "Expense limitations" means the limits, within which the expenses of a concern may be deducted in computing a concern’s annual receipts.

(t) "Federal Register" means the publication of the United States Government, which is the official repository for the publication of rules and regulations, for the purpose of providing public notice and opportunity for public comment before the rules and regulations are published.

(u) "Foreign sales corporation" means a concern that is a U.S. corporation that makes sales of services, products, and/or plant outside the United States and which makes a significant contribution to the U.S. economy through payment of taxes and/or use of American products, material and/or labor, etc. "Foreign sales corporation" includes but is not limited to, an individual, partnership, corporation, joint venture, association, or cooperative. For the purpose of making affirmative findings (e.g., the facility is a foreign sales corporation), whether organized for profit or not, and any foreign business entity, i.e., any entity located outside the United States, shall be included.

(v) "Franchise" means a contract, other than a supply contract, which requires a concern to pay to another concern royalty payments, royalties, management fees, and/or other fees, or which provides a concern with the right to use an identifiable service, device, trademark, or method, or any combination of such rights, which is controlled by another concern or its representative. (v) "Franchisee" means any person or concern who is a party to a franchise agreement.

(w) "Full-time equivalent" means the number of full-time employees of a concern, including self-employed individuals, during any period.
each of the following merchandise lines: (1) Furniture, home furnishings, appli-ances, radios, and television sets; (2) a general line of apparel for the family; and (3) household linens and dry goods; provided, however, that sales within any one of the preceding merchandise lines do not exceed 80 percent of the concern’s total sales and the aggregate of such merchandise lines account for at least 50 percent of the concern’s total sales.

(1) "Hospital" means a health facility primarily engaged in providing services to doctors, dentists, hospitals, and other health facilities which provide services to doctors, dentists, hospitals, and other health facilities which provide services to doctors, dentists, and others.

(2) "Medical and dental laboratory" means the average employment of any concern, including the employees of its domestic and foreign affiliates, based on the number of persons employed on a full-time, part-time, temporary, or other basis during the pay period ending nearest the last day of each calendar quarter for the preceding four quarters: Provided, however, if, for the purpose of determining a concern’s eligibility for Small Business Administration programs, it is determined that a concern’s employment in the most recently completed calendar quarter is at least 25 percent lower than its employment in the corresponding quarter in the preceding calendar year and that such reduction in employment was primarily due to the shortage of energy or materials, its “number of employees” for size determination purposes shall be determined by reducing its average employment for the preceding four calendar quarters by the determined percentile. If a concern has not been in existence for four full calendar quarters, “number of employees” means the average employment of such concern during the period of the entire applicable accounting period rather than only its employment during the period in which it has been an affiliate’s number of employees on a full-time, part-time, temporary, or other basis.

(1) "Nonmanufacturer" means any concern which, in connection with a specific Government procurement contract other than a construction or service contract, does not manufacture or produce the products required to be furnished by such procurement. Nonmanufacturer includes a concern which can manufacture or produce the products referred to in the specific procurement but does not do so in connection with that procurement, for size determination purposes, there can be one manufacturer of the end item being procured. The manufacturer of the end item being procured is the concern which, with its own forces, transforms into an end item through processes, including raw materials and/or miscellaneous parts or components into such end item. Whether a bidder on a particular procurement is the manufacturer or nonmanufacturer of the product is determined by the contracting officer. The determination is not for determination by the contracting officer. The determination shall be made by the appropriate Assistant Administrator for Procurement, but need not be consistent with the contracting officer’s decision as to whether such concern is or is not a manufacturer for the purpose of the Walsh-Healey Act, etc.

(a) A concern is “not dominant in its field of operation” when it does not exercise control over another concern in a national basis in a kind of business activity in which a number of business concerns are primarily engaged. In determining whether dominance exists, consideration shall be given to all the appropriate factors, including volume of business, number of employees, financial resources, competitive status or position, ownership or control of materials, processes, plant facilities, sales territory, and nature of business activity.

(b) "Number of employees" means the average employment of any concern, including the employees of its domestic and foreign affiliates, based on the number of persons employed on a full-time, part-time, temporary, or other basis during the pay period ending nearest the last day of each calendar quarter for the preceding four quarters: Provided, however, if, for the purpose of determining a concern’s eligibility for Small Business Administration programs, it is determined that a concern’s employment in the most recently completed calendar quarter is at least 25 percent lower than its employment in the corresponding quarter in the preceding calendar year and that such reduction in employment was primarily due to the shortage of energy or materials, its “number of employees” for size determination purposes shall be determined by reducing its average employment for the preceding four calendar quarters by the determined percentile. If a concern has not been in existence for four full calendar quarters, “number of employees” means the average employment of such concern during the period of the entire applicable accounting period rather than only its employment during the period in which it has been an affiliate’s number of employees on a full-time, part-time, temporary, or other basis.

(3) "Hospital" means a health facility primarily engaged in providing services to doctors, dentists, hospitals, and other health facilities which provide services to doctors, dentists, and others.

(q) "Medical and dental laboratory" means the average employment of any concern, including the employees of its domestic and foreign affiliates, based on the number of persons employed on a full-time, part-time, temporary, or other basis during the pay period ending nearest the last day of each calendar quarter for the preceding four quarters: Provided, however, if, for the purpose of determining a concern’s eligibility for Small Business Administration programs, it is determined that a concern’s employment in the most recently completed calendar quarter is at least 25 percent lower than its employment in the corresponding quarter in the preceding calendar year and that such reduction in employment was primarily due to the shortage of energy or materials, its “number of employees” for size determination purposes shall be determined by reducing its average employment for the preceding four calendar quarters by the determined percentile. If a concern has not been in existence for four full calendar quarters, “number of employees” means the average employment of such concern during the period of the entire applicable accounting period rather than only its employment during the period in which it has been an affiliate’s number of employees on a full-time, part-time, temporary, or other basis.

(v) "Redevelopment area" means a geographical area within the United States which has been designated as a "redevelopment area" in accordance with the Public Works and Economic Development Act of 1965 (Pub. L. 89–136, sec. 401, 79 Stat. 481).
RULES AND REGULATIONS

or Source Search Program, or for any other purpose relating to Government procurement, and he concludes that a size determination is necessary, provided, however, that a regional director or his delegate may, whenever he deems such action necessary, determine the size status of a concern for the purpose of the Government Timber Sales Program.

§ 121.3-5 Protest of small business status

(a) How to protest: Any bidder or offeror or other interested party may challenge the small business status of any other bidder or offeror on a particular Government procurement or sale. Such challenge shall be made by delivering a protest to the contracting officer responsible for the particular procurement or sale involved. In order to apply to the procurement or sale in question, such protest may be filed prior to the close of business on the 5th day, exclusive of Saturdays, Sundays, and legal holidays, after bid or proposal opening, except that in the case of negotiated procurements, a protest may be filed within 5 days exclusive of Saturdays, Sundays, and legal holidays after receipt from the contracting officer of notification of the identity of the successful offeror being protested. Such filing shall be made by delivering a protest to the contracting officer by hand, telegram, or mail within the 5-day period allotted. Provided, however, that a protest shall be considered timely if made by telephone to the contracting officer within the 5-day period allotted and the contracting officer therefrom receives a confirming letter (1) within such 5-day period or (2) postmarked no later than 1 day after the date of such telephone protest. Any contracting officer who receives a protest shall promptly forward such protest to the district office serving the geographical area in which the principal office of the protested concern, not including its affiliates, is located. A contracting officer may at any time after bid or proposal opening question the small business status of any bidder or offeror for the purpose of a particular procurement or sale by filing a protest with the SBA district office serving the area in which the principal office of the protested concern, not including its affiliates, is located. A protest by a contracting officer shall be timely for the purpose of the procurement or sale in question whether filed before or after award.

(b) Notification of protest: Upon receipt of such protest, the SBA district director or his delegate shall immediately notify the contracting officer and the protestant of the date such protest has been received and that the size of the concern being protested is being considered by SBA. The district director or his delegate shall also advise the protested bidder or offeror of the receipt of the protest and shall forward to the protested bidder or offeror a copy of the protest and a blank SBA Form 355, Application for Small Business Size Determination, by certified mail, return receipt requested. Such bidder must, within 3 working days of receipt of the copy of the protest and SBA Form 355, file the completed form as directed by SBA, must attach thereto a statement in answer to the allegations of the letter of protest, together with evidence to support such position. If such bidder or offeror does not submit the completed SBA Form 355 within the billing period provided above, then an additional period of time granted by SBA, if so, SBA will rule the protested concern is other than a small business.

(c) Notification of determination. After receipt of protest and responses thereto, SBA shall determine the small business status of the protested bidder or offeror and, by certified mail, return receipt requested, notify the contracting officer, the protestant, and the protested bidder or offeror of its decision within 10 working days, if possible.

(d) If SBA has determined that a concern is other than a small business for the purpose of apportioning procurement, it cannot thereafter become eligible for the purpose of such procurement by taking affirmative acts to constitute itself a small business concern. Such act or acts shall constitute a reclassification of the concern and shall constitute an invalidation of its application for small business status. No such act or acts shall be taken within 5 days exclusive of Saturdays, Sundays, and legal holidays after receipt requested, notify the contracting officer by hand, telegram, or mail within the 5-day period allotted, except that because of the urgency of pending procurements, appeals concerning the small business status of a bidder or offeror in a pending procurement must be taken within 5 days, exclusive of Saturdays, Sundays, and legal holidays.

§ 121.3-6 Appeals

(a) Organization. The Size Appeals Board shall review appeals from size determinations made pursuant to §§ 121.3-4 and 121.3-5 and from product classifications made pursuant to §§ 121.3-5 and 121.3-10. The Size Appeals Board shall conduct such proceedings as it determines appropriate to enable it to discharge its duties.

(b) Method of appeal—(1) Who may appeal. An appeal may be filed by:

(i) Any concern or other interested party which has protested the small business status of another concern pursuant to § 121.3-5 and whose protest has been denied by a regional director or his delegatee.

(ii) Any concern or other interested party which has been adversely affected by a decision of a regional director or his delegatee or by the Associate Administrator for Finance and Investment pursuant to §§ 121.3-4 and 121.3-5;

(iii) Any concern or other interested party which has been adversely affected by a decision of a contracting officer regarding product classification pursuant to § 121.3-5; and

(iv) The Small Business Administration Associate Administrator for the Small Business Administration program involved.

(2) Where to appeal. Written notices of appeal shall be addressed to the Chairman, Size Appeals Board, Small Business Administration, Washington, D.C. 20416.

(3) Time for appeal. (i) An appeal from a size determination or product classification by a regional director, or his delegatee, may be taken at any time, except that because of the urgency of pending procurements, appeals concerning the small business status of a bidder or offeror in a pending procurement must be taken within 5 days, exclusive of Saturdays, Sundays, and legal holidays, after receipt of a decision by a regional director or his delegatee. Unless written notice of such appeal is received by the Size Appeals Board before the close of business on the 5th working day following the opening date or deadline for submitting proposals or quotations, in cases wherein the bid opening day or deadline for submitting proposals or quotations, in cases wherein the bid opening date or last date to submit proposals or quotations is 30 or less days, except that because of the urgency of pending procurements, appeals concerning the small business status of a bidder or offeror in a pending procurement must be taken within 5 days, exclusive of Saturdays, Sundays, and legal holidays, before the bid opening day or deadline for submitting proposals or quotations, in cases wherein the bid opening date or last date to submit proposals or quotations is more than 30 days after the issuance of the invitation for bids or request for proposals or quotations, or (b) not less than 5 days, exclusive of Saturdays, Sundays, and legal holidays, before the bid opening day or deadline for submitting proposals or quotations, in cases wherein the bid opening date or last date to submit proposals or quotations is more than 30 days after the issuance of the invitation for bids or request for proposals or quotations, or

The timeliness of an appeal under paragraph (b) (1) and (ii) of this section shall be determined by the time.
of receipt of the appeal by the Size Appeals Board: Provided, however, That an appeal received after such time limit has expired shall be deemed to be timely and shall be considered if the case of mailed appeals, such appeal is sent by registered or certified mail and the postmark thereof indicates that the appeal would have been received within the requisite time limit but for delays beyond the control of the appellant, or in the case of telegraphed appeals, the telegram date and time line indicates that the appeal would have been received within the requisite time limit but for delays beyond the control of the appellant.

(4) Notice of appeal. No particular form is prescribed for the notice of appeal. However, the appellant shall submit to the Board an original and four legible copies of such notice and, to avoid time-consuming correspondence, the notice should include the following information:

(i) Name and address of concern on which the size determination was made;

(ii) A concise and direct statement of the reasons why the decision of a regional director, or the contracting officer, or the Size Appeals Board is in question; such statement is in question from which appeal is taken and its date;

(iii) If applicable, the IFB or contract number and date, and the name and address of the contracting officer;

(iv) A concise and direct statement of the reasons why the decision of a regional director, or his delegatee, the contracting officer or the Associate Administrator for Finance and Investment is alleged to be erroneous;

(v) Documentary evidence in support of such allegations; and

(vi) Action sought by the appellant.

(c) Notice to interested parties. The Size Appeals Board shall promptly acknowledge receipt of the Notice of Appeal and shall send a copy of such Notice of Appeal to the appropriate regional director or his delegatee and to the contracting officer or the Associate Administrator for Finance and Investment, setting forth the name and address of the contracting officer.

(d) Statement of interested parties. After an appeal has been filed, any other interested party shall also provide any of such interested parties with copies of applicant’s Notice of Appeal, or parts thereof, when the Board determines that this would be in the interest of fairness or would assist it in the performance of its functions.

(e) Reconsideration. (1) Following any decision in a size appeals case, an interested party, within no more than 5 business days following the decision, may petition the Board for reconsideration upon presentation of appropriate justification therefor. The petition for reconsideration shall be considered if the concern whose size status is in question, the Board will provide copies of such statements, or other evidence, submitted in connection with the appeal or a reconsideration thereof to such appellant.

(2) Decision of the Size Appeals Board. The decision of the Size Appeals Board shall be predicated upon the entire record and shall state the basis for its findings and conclusions. The Chairman shall promptly notify, in writing, the appellant and the other interested parties of the Board’s decision together with the reasons therefor.

(3) The Board shall consider the petition for reconsideration together with the statement and other evidence presented by the petitioners and any other evidence the Board, in its discretion, deems necessary.

(4) Grounds for reconsideration. Grounds for reconsideration shall be:

(i) A material error of fact in the original decision; or

(ii) Relevant information not previously considered by the Board or relevant information not previously available to any of the parties involved.

(iii) When a request for reconsideration is made by any of the interested parties, the Board shall promptly render a decision which shall state the reason for such decision.

(iv) Procedures in oral inquiries. In considering size appeals, and in reconsidering size appeals decisions, the Size Appeals Board may hold an oral inquiry to assist it in arriving at facts necessary to deciding the appeal. The following rules shall govern such oral inquiries:

(i) Oral inquiries may be held by the Size Appeals Board upon the request of any party to a size appeal or by the Board on its own motion, in its discretion, determine whether an oral inquiry will be of assistance in its determination of a size appeal. The Board shall inform the party making the request for oral inquiry whether its request is granted. If the Board grants the request for an oral inquiry, it will so notify all other interested parties.

(ii) Oral inquiries held by the Board are investigative in character and not adversary. Such inquiries shall be conducted informally in a manner which will facilitate the Board’s factfinding function and insure fairness to all participants.

(5) Following its reconsideration of the matter, the Board shall promptly render a decision pursuant to paragraph (f) of this section. The decision of the Board shall constitute the final administrative remedy afforded by this Agency.

§ 121.3-7 Differentials.

(a) Alaska. If an applicant for a size determination is a concern which has 50 percent or more of its annual sales or receipts attributable to business activity within Alaska then, whenever “annual sales or annual receipts” are used in any size definition contained in this part, said dollar limitation is increased by 25 percent of the amount set forth therein.

(b) Substantial or persistent unemployment; areas of concentrated unemployment; certified eligible concerns and redevelopment areas.

(1) Financial assistance programs of the Small Business Administration and financial assistance under the Small Business Investment Act of 1958, as amended. Notwithstanding any other provision of this part, the applicable size standards for the purpose of all financial assistance programs of the Small Business Administration, except the surety bond guarantee assistance program, and for the purpose of financial assistance under the Small Business Investment Act of 1958, as amended, are increased by 25 percent whenever the concern maintains or operates a plant, facility, or other business establishment within an area of substantial unemployment or underemployment or redevelopment areas as defined in § 121.3-2 (d) and (v) or is designated as a “Certified Eligible Area” by the Department of Labor and Employment as appropriate for the establishment of such area, or, if it does not maintain a plant, facility, or other business establishment within such area, agrees to utilize the assistance for the establishment and/or
operation of a plant, facility, or other business establishment within such area.

(2) Government procurement assistance, sales of Government property, and Government subcontracting. Section 421.5-7 contains, in addition to the provisions applicable to size determinations for the purpose of Government procurement assistance, sales of Government property, or Government subcontracting, the SBA's regulations implementing § 121.3-7. (See § 421.5-7 for a discussion of the applicability of these regulations to size determinations for the purpose of Government procurement assistance, sales of Government property, or Government subcontracting.)

§ 121.3-8 Definition of small business for Government procurement.

A small business concern for the purpose of Government procurement is one which, including its affiliates, which is independently owned and operated, is not dominant in the field of operation in which it is bidding on Government contracts and can further qualify under the criteria set forth in this section. When computing the size status of a bidder or offeror, the number of employees, annual receipts, or other applicable standards of the bidder or offeror and all of its affiliates shall be included.

In the submission of a bid or proposal on a Government procurement, a concern which either do not qualify under the size standards provided in this section and which either has not been determined by SBA to be ineligible, or has been determined to be ineligible but subsequently has on the basis of a significant change in ownership, management, or contractual relations, applied for recertification and had its application granted, may represent that it is a small business under such size standard by

(1) Making known to the contracting officer the absence of a written protest or other information which would cause him to question the veracity of the self-certification, the contracting officer shall accept the self-certification at face value for the particular procurement involved. If a concern has been determined by SBA to be ineligible as a small business under a particular size standard and it has already self-certified as a small business on a pending procurement subject to the same or lower number of employees or annual receipts size standard (whichever is applicable), it shall immediately thereafter either self-certify on a procurement subject to the same or a lower employee or annual receipts size standard (whichever is applicable) until it has applied for recertification based on a significant change in its ownership, management, or contractual relations, and has been determined eligible as a small business under such size standard by either the regional office which issued the adverse determination or the Small Business Review Board. If the contracting officer has cause to question the veracity of a self-certification and elects to do so, he shall refer the eligibility issue to SBA by filing a formal protest pursuant to § 121.3-5. If a procurement calls for more than one item and the bidder can bid on any or all items, the bidder must meet the size standard for each item for which it submits a bid. If the procurement calls for more than one item and a bidder is required to bid on all or none of such items, the bidder can qualify as small business for such pro-
curement if it meets the size standard for the item accounting for the greatest percentage of the total contract value. The determination of the appropriate classification of a product or service shall be made by the contracting officer. Both clause (a) of the applicable size standard (number of employees, average annual receipts, etc.) shall be set forth in the solicitation and such determination of the size standard (number of employees, average annual receipts, etc.) shall be final unless appealed in accordance with paragraph (f) of this section.

(2) In the submission of a bid or proposal on a Government contract, a small business concern when:

(a) Construction. Any concern bidding on a construction contract included in Division C, Contract Construction, of the Standard Industrial Classification Manual, as amended, prepared and published by the Office of Management and Budget, Executive Office of the President, is:

(1) Small if its average annual receipts for its preceding 3 fiscal years do not exceed $7.5 million: Provided, However, That, if the requirements of the contracts are classified in an industry set forth in Schedule B of this part, it is small if it does not exceed the size standard established therein for such industry.

(2) Small if it is bidding on a contract for dredging and (i) its average annual receipts for its preceding 3 fiscal years do not exceed $5 million and (ii) it performs the least 5 percent of the yardage advertised in the plans and specifications with dredging equipment owned by the bidder or obtained from another small business dredging concern.

(b) Manufacturing. Any concern bidding on a contract for a product it manufactured is classified:

(1) As small if it is bidding on a contract for food canning and preserving and its number of employees does not exceed 500 persons, exclusive of agricultural labor as defined in section (k) of the Federal Unemployment Tax Act, 26 U.S.C. 3306.

(2) As small if it is bidding on a contract for a product classified within an industry not set forth in Schedule B of this part and its number of employees does not exceed the size standard established for that industry.

(3) As small if it is bidding on a contract for a product classified within an industry not set forth in Schedule B of this part and its number of employees does not exceed 500 persons.

(4) As small if it is bidding on a contract for a product within Census Classification Codes 30111 and 30112: Provided, That (i) the value of the pneumatic tires within Census Classification Codes 30111 and 30112 which it manufactured in the United States during the preceding calendar year is more than 50 percent of the value of its total worldwide manufacture, (ii) the value of the pneumatic tires within Census Classification Codes 30111 and 30112 which it manufactured worldwide during the preceding calendar year was less than 50 percent of the value of all such tires manufactured worldwide for that time period, and (iii) the value of the principal products which it manufactured or otherwise produced and sold worldwide during the preceding calendar year is less than 10 percent of the total value of such products manufactured or otherwise produced or sold in the United States during said period.

(5) As small if it is bidding on a contract for passenger cars within Census Classification Code 37171: Provided, That (i) the value of the passenger cars within Census Classification Code 37171 which it manufactured or otherwise produced in the United States during the preceding calendar year is more than 50 percent of the value of its total worldwide manufacture or production of such passenger cars, (ii) the value of the passenger cars within Census Classification Code 37171, which it manufactured or otherwise produced during the preceding calendar year was less than 5 percent of the total value of all such manufactured or produced in the United States during the said period, and (iii) the value of the principal products which it manufactured or otherwise produced or sold during the preceding calendar year is less than 10 percent of the total value of such product manufactured or otherwise produced or sold in the United States during said period.

(6) Rebuilding on a factory basis or equivalent: As small if it is bidding on a contract for rebuilding machinery or equipment on a factory basis, the purpose of which is to restore such machinery or equipment to as serviceable and as like-new condition as possible and its number of employees does not exceed the number of employees specified for the classification code applicable to the manufacturer of the original item.

Note: The size standard contained herein is not limited to concerns who are manufacturers of the original item but it is applicable to all bidders or offerors. The term "rebuilding on a factory basis" as used in this subsection does not include ordinary repair and/or preservation operations.

(c) Nonmanufacturing. Any concern which is bidding on a contract for services for the purpose of which is to restore such machinery or equipment to as serviceable and as like-new condition as possible and its number of employees does not exceed the number of employees specified for the classification code applicable to the manufacturer of the original item.

(1) Its number of employees does not exceed 500 persons, and

(2) In the case of Government procurement reserved for or involving the preferential treatment of small businesses, such nonmanufacturer furnishes in the performance of the contract the
RULES AND REGULATIONS

products of a small business manufacturer or producer, which products are manufactured or produced in the United States; Provided, however, if the goods to be furnished are woolen, worsted, knitted, duck, and webbing, dealers and converters shall furnish such products which have been manufactured or produced by a small weaver (small knitter for knitwear), and if finishing is required, by a small finisher. If the procurement is for thread, dealers and converters shall furnish such products which have been finished by a small finisher. (Finishing of thread is defined as all "dyeing, bleaching, glazing, mildew proofing, coating, waxing, and other applications required by the pertinent specifications but excluding mercerizing, spinning, throwing, or twisting operations."

(ii) If the procurement is for a refined petroleum product, other than a product classified in Standard Industrial Classification Industries No. 2951, Paving Mixtures and Blocks; No. 2952, Asphalt Felts and Coatings; No. 2992, Lubricating Oils and Greases; or No. 2999, Products of Petroleum and Coal, Not Elsewhere Classified, of the Standard Industrial Classification Manual, not elsewhere defined in this section, is classified:

- For size determination purposes there can only be one manufacturer of the end item being procured. The manufacturer of the end item being procured is the concern which with its own forces transforms the raw materials and/or miscellaneous parts or components into such end item. Whether a bidder on a particular procurement is the manufacturer or a nonmanufacturer for the purpose of a size determination is not for determination by the contracting officer. The decision shall be made by the appropriate SBA regional director or his delegatee, and need not be consistent with the contracting officer's decision as to whether such concern is or is not a manufacturer for the purpose of the Walsh-Healey Act, etc. The Government often purchases items of kits, but not limited to, tool kits and survival kits, which are not manufactured items but merely groupings of separate manufactured items. Accordingly, a concern which purchases some or all of such items and packages them into kit form is considered to be a nonmanufacturer for size determination purposes. Such a concern can qualify as a small business only if it meets all other qualifications of a small nonmanufacturer set forth in this part and if more than 50 percent of the total value of the kit and its contents is accounted for by items manufactured by small business. For the purpose of a size determination, a sawmill is considered as the manufacturer of treated lumber even if it contracts out the treatment of the lumber. Therefore, a small business sawmill can deliver in the performance of a set-aside procurement lumber which has been treated by a concern which does not qualify as a small business concern. For the purpose of a size determination, a concern which converts liquid oxygen to gaseous oxygen, with or without additives, is a nonmanufacturer of the gaseous oxygen and, therefore, must furnish gaseous oxygen converted from liquid oxygen manufactured by a small business concern.

(d) Research, development, and testing. Any concern bidding on a contract for research, development, and/or testing is classified:

- As small if it is bidding on a contract for research and/or development which requires delivery of a manufactured product and (1) it qualifies as a small business manufacturer within the meaning of paragraph (b) of this section for the industry into which the product is classified, or (2) it qualifies as a small business nonmanufacturer within the meaning of paragraph (c) of this section.

- As small if it is bidding on a contract for research and/or development which does not require delivery of a manufactured product or on a contract for research and/or development, and it qualifies as a small business nonmanufacturer if the number of its employees does not exceed 500 persons.

(e) Services. Any concern bidding on a contract for services (including but not limited to, research and/or development, engineering services, advertising services, (i) Services, of the Standard Industrial Classification Manual), not elsewhere defined in this section, is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $1 million.

- Any concern bidding on a contract for engineering services other than mass production or research and/or development, is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for motion picture production or motion picture services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for janitorial and custodial services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for base maintenance is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for marine cargo handling services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for air transportation and its number of employees does not exceed 1,500 persons.

- Any concern bidding on a contract for air transportation and its number of employees does not exceed 500 persons.

- Any concern bidding on a contract for data processing services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $3 million.

- Any concern bidding on a contract for computer programming services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for aeronautical services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for laundry services including linen supply, food service, ad industrial laundrying is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $3 million.

- Any concern bidding on a contract for cleaning and dyeing including rug cleaning services, is classified as small if its average annual receipts for the preceding 3 fiscal years do not exceed $1 million.

- Any concern bidding on a contract for flight training services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $3 million.

- Any concern bidding on a contract for motoror rental and leasing services or truck rental and leasing services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for small business sawmill can qualify as a small business concern. For the purpose of a size determination, a concern which does not qualify as a small business concern. For the purpose of a size determination, a concern which converts liquid oxygen to gaseous oxygen, with or without additives, is a nonmanufacturer of the gaseous oxygen and, therefore, must furnish gaseous oxygen converted from liquid oxygen manufactured by a small business concern.

- Any concern bidding on a contract for research and development which requires delivery of a manufactured product and (1) it qualifies as a small business manufacturer within the meaning of paragraph (b) of this section for the industry into which the product is classified, or (2) it qualifies as a small business nonmanufacturer within the meaning of paragraph (c) of this section.

- Any concern bidding on a contract for research and development which does not require delivery of a manufactured product or on a contract for research and development, and it qualifies as a small business nonmanufacturer if the number of its employees does not exceed 500 persons.

- Any concern bidding on a contract for services (including but not limited to, research and/or development, engineering services, advertising services, (i) Services, of the Standard Industrial Classification Manual), not elsewhere defined in this section, is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $1 million.

- Any concern bidding on a contract for engineering services other than mass production or research and/or development, is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for motion picture production or motion picture services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for janitorial and custodial services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for base maintenance is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for marine cargo handling services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for air transportation and its number of employees does not exceed 1,500 persons.

- Any concern bidding on a contract for air transportation and its number of employees does not exceed 500 persons.

- Any concern bidding on a contract for data processing services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $3 million.

- Any concern bidding on a contract for computer programming services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for aeronautical services is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $5 million.

- Any concern bidding on a contract for laundry services including linen supply, food service, ad industrial laundrying is classified as small if its average annual receipts for its preceding 3 fiscal years do not exceed $3 million.

- Any concern bidding on a contract for cleaning and dyeing including rug cleaning services, is classified as small if its average annual receipts for the preceding 3 fiscal years do not exceed $1 million.
§ 121.3-9 Definition of small business for sales of Government property.

In the submission of a bid or proposal for the purchase of Government-owned property, a concern which meets the criteria provided in subparagraph (i) of this section to furnish the product of a refinery not qualified as small business if such product is obtained pursuant to a bona fide exchange agreement, in effect on the date of the bid or offer, and the refinery, and the product of the refinery is delivered to the concern which is primarily engaged in manufacturing timber (or forest products industry; (1) It is primarily in the sawmilling business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary to meet the requirements established therein for such area. The term "sell" includes but is not limited to the exchange of sawlogs for sawmills on a product-for-product basis with or without monetary adjustment, and an indirect transfer such as the sale of the assets of (or a controlling interest in) a concern after it has obtained one or more set-aside sales of timber. Under the latter circumstances, if, after being awarded a set-aside sale of timber a concern merges with or becomes subject to the control of a large business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary for compliance with the 30 percent (50 percent in Alaska) restriction.

(2) Other than manufacturers. Any concern which is primarily in the sawmilling business when the Government timber being purchased is to be resold, a concern is a small business when:

(i) It is a small business within the meaning of subparagraph (1) of this paragraph, and

(ii) It agrees that it will not sell to a concern which is not a small business within the meaning of this paragraph more than 30 percent of such timber or, in the case of timber from certain geographical areas set forth in Schedule B of this part, more than the percentage established therein for such area. The term "sell" includes but is not limited to the exchange of sawlogs for sawmills on a product-for-product basis with or without monetary adjustment, and an indirect transfer such as the sale of the assets of (or a controlling interest in) a concern after it has obtained one or more set-aside sales of timber. Under the latter circumstances, if, after being awarded a set-aside sale of timber a concern merges with or becomes subject to the control of a large business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary for compliance with the 30 percent (50 percent in Alaska) restriction.

(2) Other than manufacturers. Any concern which is primarily in the sawmilling business when the Government timber being purchased is to be resold, a concern is a small business when:

(i) It is a small business within the meaning of subparagraph (1) of this paragraph, and

(ii) It agrees that it will not sell to a concern which is not a small business within the meaning of this paragraph more than 30 percent of such timber or, in the case of timber from certain geographical areas set forth in Schedule B of this part, more than the percentage established therein for such area. The term "sell" includes but is not limited to the exchange of sawlogs for sawmills on a product-for-product basis with or without monetary adjustment, and an indirect transfer such as the sale of the assets of (or a controlling interest in) a concern after it has obtained one or more set-aside sales of timber. Under the latter circumstances, if, after being awarded a set-aside sale of timber a concern merges with or becomes subject to the control of a large business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary for compliance with the 30 percent (50 percent in Alaska) restriction.

(2) Other than manufacturers. Any concern which is primarily in the sawmilling business when the Government timber being purchased is to be resold, a concern is a small business when:

(i) It is a small business within the meaning of subparagraph (1) of this paragraph, and

(ii) It agrees that it will not sell to a concern which is not a small business within the meaning of this paragraph more than 30 percent of such timber or, in the case of timber from certain geographical areas set forth in Schedule B of this part, more than the percentage established therein for such area. The term "sell" includes but is not limited to the exchange of sawlogs for sawmills on a product-for-product basis with or without monetary adjustment, and an indirect transfer such as the sale of the assets of (or a controlling interest in) a concern after it has obtained one or more set-aside sales of timber. Under the latter circumstances, if, after being awarded a set-aside sale of timber a concern merges with or becomes subject to the control of a large business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary for compliance with the 30 percent (50 percent in Alaska) restriction.

(2) Other than manufacturers. Any concern which is primarily in the sawmilling business when the Government timber being purchased is to be resold, a concern is a small business when:

(i) It is a small business within the meaning of subparagraph (1) of this paragraph, and

(ii) It agrees that it will not sell to a concern which is not a small business within the meaning of this paragraph more than 30 percent of such timber or, in the case of timber from certain geographical areas set forth in Schedule B of this part, more than the percentage established therein for such area. The term "sell" includes but is not limited to the exchange of sawlogs for sawmills on a product-for-product basis with or without monetary adjustment, and an indirect transfer such as the sale of the assets of (or a controlling interest in) a concern after it has obtained one or more set-aside sales of timber. Under the latter circumstances, if, after being awarded a set-aside sale of timber a concern merges with or becomes subject to the control of a large business, so much of such timber (or sawlogs therefrom) shall be sold to one or more small businesses as is necessary for compliance with the 30 percent (50 percent in Alaska) restriction.
business until the products have been manufactured. Accordingly, if, after acquiring the set-aside sale the buyer purchased by sale of Government timber, or merged with a large business, so much of such timber (or sawlogs therefrom) as is necessary shall be sold to one or more small businesses for compliance with the 30 percent (50 percent in Alaska) restriction. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of timber is primary to protect the Government's interest set-aside sale of Government timber. The small business concern is certified as a small business concern for the purpose of award under a small business set-aside sale of timber to small businesses for compliance with the 30 percent (50 percent in Alaska) restriction. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of Government timber is primary to protect the Government's interest set-aside sale of Government timber.

§ 121.3-10 Definition of small business for SBA loans.

A small business concern for the purpose of receiving an SBA loan is a concern, including its affiliates, which, on the date of the application for the loan, is primarily engaged in manufacturing or providing services. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of timber is primary to protect the Government's interest set-aside sale of Government timber. The small business concern is certified as a small business concern for the purpose of award under a small business set-aside sale of timber to small businesses for compliance with the 30 percent (50 percent in Alaska) restriction. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of timber is primary to protect the Government's interest set-aside sale of Government timber.

(1) Manufacturing. Any manufacturer of such timber (or sawlogs therefrom) as is necessary shall be sold to one or more small businesses for compliance with the 30 percent (50 percent in Alaska) restriction. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of timber is primary to protect the Government's interest set-aside sale of Government timber. The small business concern is certified as a small business concern for the purpose of award under a small business set-aside sale of timber to small businesses for compliance with the 30 percent (50 percent in Alaska) restriction. Any concern which self-certifies as a small business concern for the purpose of award under a small business set-aside sale of timber is primary to protect the Government's interest set-aside sale of Government timber.

(2) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(3) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(4) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(5) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(6) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(7) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(8) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(9) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(10) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(11) As small if, including its affiliates, it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.

(12) As small if it is primarily engaged in the motion picture production industry and its annual receipts do not exceed $5 million.
(f) Transportation and warehousing. Any concern primarily engaged in passenger or freight transportation or warehousing is classified:
   (1) As small if its annual receipts do not exceed $1 million;
   (2) As small if it is primarily engaged in the transportation industry and its number of employees does not exceed 1,000 persons;
   (3) As small if it is primarily engaged in the storage of grain and it does not exceed the size standard established in Schedule G of this part.

§ 121.3-11 Definition of small business for the purpose of receiving financial or other assistance from small business investment companies or by development companies.

A small business concern for the purpose of receiving financial or other assistance from small business investment companies or by development companies is one which:
   (a) Is primarily engaged in the manufacture of products, or in the operation of a fish farm, a zoo, a park, or a plantation, or in any other similar activity, and is not a "small business concern" unless it qualifies under § 121.3-12;
   (b) Is primarily engaged in the storage of grain and it does not exceed the size standard established in Schedule F of this part.

(g) Wholesale. (1) Any wholesaling concern is classified:
   (i) As small if it is primarily engaged in the storage of grain and it does not exceed the size standard established in Schedule C of this part and its annual receipts do not exceed $2 million.
   (ii) As small if it is primarily engaged in the transportation industry and its number of employees does not exceed 1,000 persons.

§ 121.3-12 Definition of small business Government subcontractors.

(a) Any concern in connection with Government subcontracting of $2,500 or less which is not a "small business concern" under § 121.3-11 will be considered a small business concern if, including its affiliates, its number of employees does not exceed 500 persons.

(b) Any concern in connection with Government subcontracting of $2,500 or less which is not a "small business concern" under § 121.3-11 will be considered a small business concern if, including its affiliates, its number of employees does not exceed 500 persons.

§ 121.3-13 Definition of small business for the purpose of lease guarantee.

A small business concern for the purpose of lease guarantee is a concern that qualifies as a small business concern for the purpose of Government procurements.

§ 121.3-14 Definition of small business for the purpose of Government leases of uranium prospecting or mining rights.

In the submission of a bid or proposal for a Government lease of uranium prospecting or mining rights, a concern whose number of employees does not exceed 100 persons may represent that it is a small business in the absence of a written protest or other information which would cause him to question the veracity of the self-certification at face value for the particular lease involved.

§ 121.3-15 Definition of small business for the purpose of surety bond guarantee assistance.

A small business concern for the purpose of surety bond guarantee assistance is a concern that qualifies as a small business under § 121.3-10, with the following exception:
   (a) Construction. Any construction concern is small if its annual receipts for its preceding fiscal year or its average annual receipts for its preceding 3 fiscal years do not exceed $2 million; Provided, however, that, if the concern is primarily engaged in an industry set forth in Schedule I of this part, it is small if its annual receipts for its preceding fiscal year do not exceed $2,500,000.

Effective date: This revision shall become effective on December 24, 1974.

THOMAS S. KLEPPE, Administrator.

SCHEDULE A—EMPLOYMENT SIZE STANDARDS FOR CONCERNS PRIMARILY ENGAGED IN MANUFACTURING

The following size standards are to be used when determining the size status of applicants for SBA business loans, economic opportunity zone, minority business guarantee assistance, and as alternate standards for Sections 501 and 502 loans and 8(a) assistance.


THOMAS S. KLEPPE, Administrator.

MAJOR GROUP 20—FOOD AND KINDRED PRODUCTS

MAJOR GROUP 21—TOBACCO MANUFACTURES

MAJOR GROUP 22—TEXTILE MILL PRODUCTS

RULINGS AND REGULATIONS
<table>
<thead>
<tr>
<th>Census classification code</th>
<th>Industry or class of products</th>
<th>Employment size standard (number of employees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2271</td>
<td>Woven carpets and rugs</td>
<td>750</td>
</tr>
<tr>
<td>2272</td>
<td>Tufted carpets and rugs</td>
<td>500</td>
</tr>
<tr>
<td>2273</td>
<td>Carpets and rugs, n.e.c.</td>
<td>500</td>
</tr>
<tr>
<td>2581</td>
<td>Pressed hardboards, synthetic</td>
<td>1,000</td>
</tr>
<tr>
<td>2584</td>
<td>Thread mills</td>
<td>500</td>
</tr>
<tr>
<td>2596</td>
<td>Tire cord and bolts</td>
<td>800</td>
</tr>
</tbody>
</table>

**MAJOR GROUP 23—APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS**

- 2321 Men's, youth's, and boys' shirts (except work shirts) and nightwear.

**MAJOR GROUP 25—FURNITURE AND FIXTURES**

- 2522 Metal office furniture.

**MAJOR GROUP 29—PAPER AND ALLIED PRODUCTS**

- 2948 Rags, except textile rags.
- 2949 Paper mills, except building paper mills.

**MAJOR GROUP 33—CHEMICALS AND ALLIED PRODUCTS**

- 3361 Vitreous china plumbing fixtures, and china and earthenware fittings and bathroom accessories.
- 3362 Vitrified china table and toilet articles.
- 3363 Ceramic wall and floor tile.
- 3364 Sanitary ware.

**MAJOR GROUP 35—MACHINERY, EXCEPT ELECTRICAL**

- 3541 Cement, hydraulic.
- 3542 Blast furnaces (including coke ovens).
- 3543 Steel wire drawing and steel wire mills and plants.
- 3544 Innovating and bending machinery and equipment.

**MAJOR GROUP 39—PLASTICS PRODUCTS**

- 3926 Porcelain electrical supplies.
- 3927 Linoleum.
- 3928 Gypsum products.

**MAJOR GROUP 47—MINING EXCEPT METALLIC MINES**

- 4733 Oil field machinery and equipment.
- 4734 Elevators and moving stairs.

**MAJOR GROUP 51—MAQUINERY, EXCEPT ELECTRICAL**

- 5155 Printing trades machinery and equipment.
- 5156 Pumps and pumping equipment.

**MAJOR GROUP 55—ELECTRICAL MACHINERY, APPARATUS & SUPPLIES**

- 5567 Electronic computing equipment.
- 5568 Calculating and accounting machines, except electronic computing equipment.
- 5569 Office machines, n.e.c.
- 5570 Air-conditioning and warm-air heating equipment and commercial and industrial refrigeration equipment.

**RULES AND REGULATIONS**

<table>
<thead>
<tr>
<th>Census classification code</th>
<th>Industry or class of products</th>
<th>Employment size standard (number of employees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2271</td>
<td>Woven carpets and rugs</td>
<td>750</td>
</tr>
<tr>
<td>2272</td>
<td>Tufted carpets and rugs</td>
<td>500</td>
</tr>
<tr>
<td>2273</td>
<td>Carpets and rugs, n.e.c.</td>
<td>500</td>
</tr>
<tr>
<td>2581</td>
<td>Pressed hardboards, synthetic</td>
<td>1,000</td>
</tr>
<tr>
<td>2584</td>
<td>Thread mills</td>
<td>500</td>
</tr>
<tr>
<td>2596</td>
<td>Tire cord and bolts</td>
<td>800</td>
</tr>
</tbody>
</table>

**MAJOR GROUP 23—APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS**

- 2321 Men's, youth's, and boys' shirts (except work shirts) and nightwear.

**MAJOR GROUP 25—FURNITURE AND FIXTURES**

- 2522 Metal office furniture.

**MAJOR GROUP 29—PAPER AND ALLIED PRODUCTS**

- 2948 Rags, except textile rags.
- 2949 Paper mills, except building paper mills.

**MAJOR GROUP 33—CHEMICALS AND ALLIED PRODUCTS**

- 3361 Vitreous china plumbing fixtures, and china and earthenware fittings and bathroom accessories.
- 3362 Vitrified china table and toilet articles.
- 3363 Ceramic wall and floor tile.
- 3364 Sanitary ware.

**MAJOR GROUP 35—MACHINERY, EXCEPT ELECTRICAL**

- 3541 Cement, hydraulic.
- 3542 Blast furnaces (including coke ovens).
- 3543 Steel wire drawing and steel wire mills and plants.
- 3544 Innovating and bending machinery and equipment.

**MAJOR GROUP 39—PLASTICS PRODUCTS**

- 3926 Porcelain electrical supplies.
- 3927 Linoleum.
- 3928 Gypsum products.

**MAJOR GROUP 47—MINING EXCEPT METALLIC MINES**

- 4733 Oil field machinery and equipment.
- 4734 Elevators and moving stairs.

**MAJOR GROUP 51—MAQUINERY, EXCEPT ELECTRICAL**

- 5155 Printing trades machinery and equipment.
- 5156 Pumps and pumping equipment.

**MAJOR GROUP 55—ELECTRICAL MACHINERY, APPARATUS & SUPPLIES**

- 5567 Electronic computing equipment.
- 5568 Calculating and accounting machines, except electronic computing equipment.
- 5569 Office machines, n.e.c.
- 5570 Air-conditioning and warm-air heating equipment and commercial and industrial refrigeration equipment.
<table>
<thead>
<tr>
<th>Census classification code</th>
<th>Industry or class of products</th>
<th>Employment size standard (number of employees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAJOR GROUP 36—ELECTRICAL AND ELECTRONIC MACHINERY, EQUIPMENT AND SUPPLIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>361 Power, distribution and specialty transformers</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>362 Switchgear and switchboard apparatus</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>363 Motors and generators</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>364 Control and graphic products</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>365 Electrical industrial apparatus</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>366 Telephone and telegraph apparatus</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>367 Electronic apparatus</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>368 Motor vehicle parts and accessories</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>369 Truck trailers</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>370 Aircraft and space vehicle parts and accessories</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 37—TRANSPORTATION EQUIPMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3711 Motor vehicle and personal service parts</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3712 Aircraft engines and equipment</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3713 Aircraft and parts</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3721 Aircraft engines and equipment</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3731 Shipbuilding and repairing</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3741 Motor vehicle and personal service parts and accessories</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3751 Motor vehicle parts and accessories</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3761 Tank cars and tank components</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>3771 Rail trucks</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3781 Power and distribution transformers</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>3791 Motor vehicle parts and accessories</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 38—MEASURING, ANALYZING AND CONTROLLING INSTRUMENTS, PHOTOGRAPHIC, MEDICAL AND OPTICAL GOODS, CLOCKS AND MACHINERY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3811 Engineering, laboratory, scientific and research instruments and associated equipment</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>3821 Automatic controls for regulating equipment and installations</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>3831 Industrial instruments for measurement, display and control of process variables and related products</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>3841 Special testing andreffing by electronic means</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>3851 Measuring and controlling</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>3861 Photographic equipment and supplies</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 39—MISCELLANEOUS MANUFACTURING INDUSTRIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3911 Refrigeration and air conditioning equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3921 Heating, ventilating and air conditioning equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3931 Industrial process equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3941 Electronic and related equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3951 Electronic equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3961 Electronic equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3971 Electronic equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3981 Electronic equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3991 Electronic equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 40—TRANSPORTATION EQUIPMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4011 Airplanes</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4021 Aircraft engines and equipment</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4031 Motor vehicles and parts</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 41—PETROLEUM REFINING AND RELATED INDUSTRIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4111 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4121 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4131 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4141 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4151 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4161 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4171 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4181 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>4191 Petroleum refining</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 42—MISCELLANEOUS MANUFACTURING INDUSTRIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4211 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4221 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4231 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4241 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4251 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4261 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4271 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4281 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>4291 Matches</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>MAJOR GROUP 43—CHEMICALS AND ALLIED PRODUCTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4311 Alcohols</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4321 Organic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4331 Inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4341 Industrial organic chemicals, n.e.c.</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4351 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4361 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4371 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4381 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4391 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4301 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4311 Alcohols</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4321 Organic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4331 Inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4341 Industrial organic chemicals, n.e.c.</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4351 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4361 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4371 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4381 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4391 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>4301 Industrial inorganic chemicals</td>
<td>1,000</td>
<td></td>
</tr>
</tbody>
</table>

**FEDERAL REGISTER, VOL. 39, NO. 245—TUESDAY, DECEMBER 24, 1974**
RULERS AND REGULATIONS

<table>
<thead>
<tr>
<th>Major Group</th>
<th>Industry or class of products</th>
<th>Standard Industry code</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Blast furnaces (including coke ovens), steel works, and rolling-mills</td>
<td>3211</td>
</tr>
<tr>
<td>33</td>
<td>Electrical equipment, apparatus, and supplies, for industrial use</td>
<td>3311</td>
</tr>
<tr>
<td>34</td>
<td>Steel wire and steel wire products, and rolled steel</td>
<td>3411</td>
</tr>
<tr>
<td>35</td>
<td>Cables and cable products, and electric motors and generators</td>
<td>3531</td>
</tr>
<tr>
<td>36</td>
<td>Primary smelting and refining of metals</td>
<td>3611</td>
</tr>
<tr>
<td>37</td>
<td>Primary smelting and refining of nonferrous metals, n.e.c.</td>
<td>3621</td>
</tr>
<tr>
<td>38</td>
<td>Electric and electronic equipment, n.e.c.</td>
<td>3631</td>
</tr>
<tr>
<td>39</td>
<td>Metal heat treatment</td>
<td>3641</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Group</th>
<th>Industry or class of products</th>
<th>Standard Industry code</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Primary metal products, n.e.c.</td>
<td>3651</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Group</th>
<th>Industry or class of products</th>
<th>Standard Industry code</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Primary industries, except electrical and mechanical</td>
<td>3711</td>
</tr>
<tr>
<td>51</td>
<td>Construction machinery and equipment</td>
<td>3721</td>
</tr>
<tr>
<td>52</td>
<td>Agricultural machinery and equipment</td>
<td>3731</td>
</tr>
<tr>
<td>53</td>
<td>Electrical equipment, n.e.c.</td>
<td>3741</td>
</tr>
<tr>
<td>54</td>
<td>Metal-working machinery</td>
<td>3751</td>
</tr>
<tr>
<td>55</td>
<td>Electrical machinery</td>
<td>3761</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Group</th>
<th>Industry or class of products</th>
<th>Standard Industry code</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>Construction machinery and equipment</td>
<td>3811</td>
</tr>
<tr>
<td>61</td>
<td>Industrial machinery</td>
<td>3821</td>
</tr>
<tr>
<td>62</td>
<td>Industrial equipment</td>
<td>3831</td>
</tr>
<tr>
<td>63</td>
<td>Industrial machinery</td>
<td>3841</td>
</tr>
<tr>
<td>64</td>
<td>Industrial machinery</td>
<td>3851</td>
</tr>
<tr>
<td>65</td>
<td>Industrial machinery</td>
<td>3861</td>
</tr>
<tr>
<td>66</td>
<td>Industrial machinery</td>
<td>3871</td>
</tr>
<tr>
<td>67</td>
<td>Industrial machinery</td>
<td>3881</td>
</tr>
<tr>
<td>68</td>
<td>Industrial machinery</td>
<td>3891</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Group</th>
<th>Industry or class of products</th>
<th>Standard Industry code</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Construction machinery and equipment</td>
<td>3911</td>
</tr>
<tr>
<td>71</td>
<td>Industrial machinery</td>
<td>3921</td>
</tr>
<tr>
<td>72</td>
<td>Industrial machinery</td>
<td>3931</td>
</tr>
<tr>
<td>73</td>
<td>Industrial machinery</td>
<td>3941</td>
</tr>
<tr>
<td>74</td>
<td>Industrial machinery</td>
<td>3951</td>
</tr>
<tr>
<td>75</td>
<td>Industrial machinery</td>
<td>3961</td>
</tr>
<tr>
<td>76</td>
<td>Industrial machinery</td>
<td>3971</td>
</tr>
<tr>
<td>77</td>
<td>Industrial machinery</td>
<td>3981</td>
</tr>
<tr>
<td>78</td>
<td>Industrial machinery</td>
<td>3991</td>
</tr>
</tbody>
</table>
SCHEDULE II—ANNUAL RECEIPTS SIZE STANDARDS FOR PURPOSE OF BIDDING ON PROCUREMENTS FOR CONSTRUCTION—SPECIAL TRADE CONTRACTORS

<table>
<thead>
<tr>
<th>Industry or sub-industry code</th>
<th>Industry, subindustry, or class of products</th>
<th>Annual sales size standard (maximum, in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1741</td>
<td>Plastering, drywall, acoustical, and insulation work</td>
<td>$1</td>
</tr>
<tr>
<td>1742</td>
<td>Terrazzo, tile, marble, and mosaic work</td>
<td>1</td>
</tr>
<tr>
<td>1751</td>
<td>Carpentering and flooring</td>
<td>1</td>
</tr>
<tr>
<td>1752</td>
<td>Floor laying and other floor work, not elsewhere classified</td>
<td>1</td>
</tr>
<tr>
<td>1761</td>
<td>Roofing and sheet metal work</td>
<td>1</td>
</tr>
<tr>
<td>1771</td>
<td>Concrete work</td>
<td>1</td>
</tr>
<tr>
<td>1781</td>
<td>Water well drilling</td>
<td>1</td>
</tr>
<tr>
<td>1791</td>
<td>Structural steel erection</td>
<td>2</td>
</tr>
<tr>
<td>1792</td>
<td>Glass and glazing work</td>
<td>1</td>
</tr>
<tr>
<td>1793</td>
<td>Ramming and foundation work</td>
<td>1</td>
</tr>
<tr>
<td>1794</td>
<td>Excavating and demolition work</td>
<td>1</td>
</tr>
<tr>
<td>1795</td>
<td>Installation or erection of building equipment, not elsewhere classified</td>
<td>1</td>
</tr>
<tr>
<td>1796</td>
<td>Special trade contractors, not elsewhere classified</td>
<td>1</td>
</tr>
</tbody>
</table>

SCHEDULE I—ANNUAL RECEIPTS SIZE STANDARDS FOR CONCERNS PRIMARILY ENGAGED IN CONSTRUCTION (SPECIAL TRADE CONTRACTORS)

<table>
<thead>
<tr>
<th>Industry or sub-industry code</th>
<th>Industry, subindustry, or class of products</th>
<th>Annual sales size standard (maximum, in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1711</td>
<td>Plumbing, heating, (except electric), and air-conditioning</td>
<td>$2</td>
</tr>
<tr>
<td>1721</td>
<td>Painting, paperhanging, and decorating</td>
<td>1</td>
</tr>
<tr>
<td>1731</td>
<td>Electrical work</td>
<td>2</td>
</tr>
<tr>
<td>1741</td>
<td>Masonry, stone setting, and other stonework</td>
<td>1</td>
</tr>
<tr>
<td>1742</td>
<td>Plastering, drywall, acoustical, and insulation work</td>
<td>$1</td>
</tr>
<tr>
<td>1751</td>
<td>Carpentering and flooring</td>
<td>1</td>
</tr>
<tr>
<td>1752</td>
<td>Floor laying and other floor work, not elsewhere classified</td>
<td>1</td>
</tr>
<tr>
<td>1761</td>
<td>Roofing and sheet metal work</td>
<td>1</td>
</tr>
<tr>
<td>1771</td>
<td>Concrete work</td>
<td>1</td>
</tr>
<tr>
<td>1781</td>
<td>Water well drilling</td>
<td>1</td>
</tr>
<tr>
<td>1791</td>
<td>Structural steel erection</td>
<td>2</td>
</tr>
<tr>
<td>1792</td>
<td>Glass and glazing work</td>
<td>1</td>
</tr>
<tr>
<td>1793</td>
<td>Ramming and foundation work</td>
<td>1</td>
</tr>
<tr>
<td>1794</td>
<td>Excavating and demolition work</td>
<td>1</td>
</tr>
<tr>
<td>1795</td>
<td>Installation or erection of building equipment, not elsewhere classified</td>
<td>1</td>
</tr>
<tr>
<td>1796</td>
<td>Special trade contractors, not elsewhere classified</td>
<td>1</td>
</tr>
</tbody>
</table>

[FR Doc. 74-29625 Filed 12-23-74; 8:45 am]
UPPER VOLTA
Republic of Upper Volta

We do not have a legal definition for small industry. However, we usually describe a small industry as a productive center having less than 15 workers, a capital in machines and equipment less than US$100,000, and a yearly turnover around US$10,000. However, enough elasticity is required to define each small industry further [than by] the described parameters.


VIET NAM
Republic of Viet Nam

In the investment law of Viet Nam . . . enterprises whose initial investment expenditures exceed ten million piasters [US$16,528] for agricultural and fishing enterprises, or exploration for minerals, and twenty million piasters [US$33,156] for industrial or other enterprises . . . may be approved to benefit from the incentives prescribed by the law . . . This is a criterion to be used to separate large-scale and small-scale industries in Viet Nam.

Source: Embassy of Viet Nam in the United States.

YEMEN (San'ā')
Yemen Arab Republic

A legally precise definition of small-scale industry, as far as we can determine, does not exist. By comparison to developed societies, or in most cases L.D.C.'s, industry in Yemen is relatively small.

The following statistical tables may be of some use in illustrating the above.

The majority of industrial establishments in the Y.A.R. have less than $6,500 in fixed capital and nine employees. Consequently the industrial sector's contribution to the D.N.P. is around 2.7%.
Number of industrial establishments along with employment in 1971
(Value in 000 riyal - riyal = $.20)

<table>
<thead>
<tr>
<th>Type of Industry</th>
<th>No. of Establishments</th>
<th>No. of Workers</th>
<th>Investment</th>
<th>Value of Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Salt and Stone</td>
<td>16</td>
<td>502</td>
<td>25,855</td>
<td>3,597</td>
</tr>
<tr>
<td>Quarrying</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Salt</td>
<td>1</td>
<td>250</td>
<td>25,000</td>
<td>1,710</td>
</tr>
<tr>
<td>b. Stone</td>
<td>11</td>
<td>216</td>
<td>683</td>
<td>1,418</td>
</tr>
<tr>
<td>c. Gypsum</td>
<td>4</td>
<td>36</td>
<td>172</td>
<td>469</td>
</tr>
<tr>
<td>2-Food Industry</td>
<td>78</td>
<td>550</td>
<td>467</td>
<td>6,332</td>
</tr>
<tr>
<td>a. Bakery</td>
<td>53</td>
<td>362</td>
<td>410</td>
<td>3,632</td>
</tr>
<tr>
<td>b. Confectionary</td>
<td>22</td>
<td>164</td>
<td>30</td>
<td>2,600</td>
</tr>
<tr>
<td>c. Spices</td>
<td>3</td>
<td>24</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td>3-Beverages/Cigarettes</td>
<td>10</td>
<td>402</td>
<td>10,573</td>
<td>8,939</td>
</tr>
<tr>
<td>a. Soft Drinks</td>
<td>3</td>
<td>222</td>
<td>3,384</td>
<td>6,642</td>
</tr>
<tr>
<td>b. Ice</td>
<td>2</td>
<td>25</td>
<td>89</td>
<td>235</td>
</tr>
<tr>
<td>c. Cigarettes</td>
<td>1</td>
<td>121</td>
<td>7,097</td>
<td>1,792</td>
</tr>
<tr>
<td>d. Chewing Tobacco</td>
<td>4</td>
<td>34</td>
<td>3</td>
<td>270</td>
</tr>
<tr>
<td>4-Textiles</td>
<td>16</td>
<td>2,016</td>
<td>23,872</td>
<td>25,352</td>
</tr>
<tr>
<td>a. Ginning</td>
<td>2</td>
<td>192</td>
<td>718</td>
<td>14,808</td>
</tr>
<tr>
<td>b. Spinning/Weaving</td>
<td>2</td>
<td>1,499</td>
<td>23,054</td>
<td>9,518</td>
</tr>
<tr>
<td>c. Hand Looms</td>
<td>12</td>
<td>325</td>
<td>100</td>
<td>1,026</td>
</tr>
<tr>
<td>5-Wood Products</td>
<td>52</td>
<td>396</td>
<td>980</td>
<td>2,260</td>
</tr>
<tr>
<td>6-Printing/Publishing</td>
<td>8</td>
<td>92</td>
<td>1,203</td>
<td>1,042</td>
</tr>
<tr>
<td>7-Cement/Bricks</td>
<td>51</td>
<td>500</td>
<td>821</td>
<td>4,178</td>
</tr>
<tr>
<td>a. Cement, Blocks, Tiles</td>
<td>29</td>
<td>308</td>
<td>623</td>
<td>2,838</td>
</tr>
<tr>
<td>b. Bricks, Clay</td>
<td>22</td>
<td>192</td>
<td>248</td>
<td>1,340</td>
</tr>
<tr>
<td>8-Steel Doors/Windows</td>
<td>25</td>
<td>227</td>
<td>774</td>
<td>1,862</td>
</tr>
<tr>
<td>9-Auto Servicing</td>
<td>63</td>
<td>766</td>
<td>1,445</td>
<td>3,751</td>
</tr>
<tr>
<td>10-Electricity</td>
<td>27</td>
<td>1,126</td>
<td>20,110</td>
<td>9,256</td>
</tr>
<tr>
<td>11-Miscellaneous</td>
<td>5</td>
<td>129</td>
<td>1,728</td>
<td>3,101</td>
</tr>
<tr>
<td>TOTAL</td>
<td>351</td>
<td>6,706</td>
<td>87,828</td>
<td>69,670</td>
</tr>
</tbody>
</table>
### No. of Industrial Establishments
#### By Ownership
1971

<table>
<thead>
<tr>
<th>Ownership</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole Proprietorship</td>
<td>261</td>
</tr>
<tr>
<td>Partnership</td>
<td>49</td>
</tr>
<tr>
<td>Public Company</td>
<td>13</td>
</tr>
<tr>
<td>Cooperative</td>
<td>4</td>
</tr>
<tr>
<td>Government</td>
<td>18</td>
</tr>
<tr>
<td>Government &amp; Public</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>351</td>
</tr>
</tbody>
</table>

### No. of Industrial Establishments
#### By Size of Fixed Capital - 1971
(000 Yemeni riyals)

<table>
<thead>
<tr>
<th>Capital</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 25,000</td>
<td>246</td>
</tr>
<tr>
<td>25,000 - 50,000</td>
<td>32</td>
</tr>
<tr>
<td>50,000 - 75,000</td>
<td>16</td>
</tr>
<tr>
<td>75,000 - 100,000</td>
<td>9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>303</td>
</tr>
</tbody>
</table>

P.S. 48 establishments did not submit requested data.

### No. of Industrial Establishments
#### According to Size of Labor Force
1971

<table>
<thead>
<tr>
<th>No. of Employees</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 9</td>
<td>217</td>
</tr>
<tr>
<td>10 - 14</td>
<td>50</td>
</tr>
<tr>
<td>15 - 19</td>
<td>13</td>
</tr>
<tr>
<td>20 - 24</td>
<td>10</td>
</tr>
<tr>
<td>25 - 29</td>
<td>2</td>
</tr>
<tr>
<td>30 - 34</td>
<td>5</td>
</tr>
<tr>
<td>35 - 39</td>
<td>4</td>
</tr>
<tr>
<td>40 - 44</td>
<td>-</td>
</tr>
<tr>
<td>45 - 49</td>
<td>6</td>
</tr>
<tr>
<td>50 and above</td>
<td>14</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>351</td>
</tr>
</tbody>
</table>

**Source:** Averroes Inc., consultants to the Embassy of Yemen Arab Republic in the United States.
STATISTICAL TABLE
## Per Capita National Income in Market Prices

<table>
<thead>
<tr>
<th>Country or Area</th>
<th>Population (millions)</th>
<th>Per Capita (US$)</th>
<th>No. of Employees</th>
<th>Capital or Fixed Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial Countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>22.12</td>
<td>4,231¹/</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Japan</td>
<td>108.35</td>
<td>2,462¹/</td>
<td>0-300</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>210.40</td>
<td>4,981¹/</td>
<td>0-1,500</td>
<td>*</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>55.93</td>
<td>2,503¹/</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td><strong>Industrial Europe</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>7.52</td>
<td>2,456¹/</td>
<td>0-50</td>
<td>*</td>
</tr>
<tr>
<td>Belgium</td>
<td>9.76</td>
<td>3,286¹/</td>
<td>0-50</td>
<td>*</td>
</tr>
<tr>
<td>Denmark</td>
<td>5.03</td>
<td>3,853¹/</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Germany, Federal Republic</td>
<td>61.97</td>
<td>3,739¹/</td>
<td>0-20</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>54.89</td>
<td>1,987¹/</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>0.35</td>
<td>2,641²/</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Netherlands</td>
<td>13.44</td>
<td>3,159¹/</td>
<td>10-50</td>
<td>*</td>
</tr>
</tbody>
</table>

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>3.96</td>
<td>3,299&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>0-20</td>
</tr>
<tr>
<td>Poland</td>
<td>33.36</td>
<td>1,650&lt;sup&gt;6/&lt;/sup&gt;</td>
<td>0-100</td>
</tr>
<tr>
<td>Sweden</td>
<td>8.14</td>
<td>4,669&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>0-200</td>
</tr>
<tr>
<td>Switzerland</td>
<td>6.44</td>
<td>2,654&lt;sup&gt;4/&lt;/sup&gt;</td>
<td>0-49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td><strong>OTHER DEVELOPED AREAS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>13.13</td>
<td>2,919&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>0-100</td>
</tr>
<tr>
<td>Finland</td>
<td>4.66</td>
<td>2,571&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>0-100</td>
</tr>
<tr>
<td>Malta</td>
<td>0.32</td>
<td>863&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>0-10</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2.96</td>
<td>2,345&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>0-10</td>
</tr>
<tr>
<td>Romania</td>
<td>20.83</td>
<td>1,200&lt;sup&gt;7/&lt;/sup&gt;</td>
<td>*</td>
</tr>
<tr>
<td>South Africa</td>
<td>23.72&lt;sup&gt;x&lt;/sup&gt;</td>
<td>734&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>*</td>
</tr>
</tbody>
</table>

**Total assets not exceeding R 500,000 (US$725,058)**

<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados</td>
<td>0.24</td>
<td>679&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>1-25</td>
</tr>
<tr>
<td>Brazil</td>
<td>101.71&lt;sup&gt;x&lt;/sup&gt;</td>
<td>422&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>0-100</td>
</tr>
<tr>
<td>Colombia</td>
<td>23.21&lt;sup&gt;x&lt;/sup&gt;</td>
<td>426&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>5-24</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1.89</td>
<td>584&lt;sup&gt;1/&lt;/sup&gt;</td>
<td>2-50</td>
</tr>
</tbody>
</table>

**Net worth between $CA 2,500 and $CA 50,000 (US$2,500-50,000)**

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>NO. OF EMPLOYEES</th>
<th>CAPITAL OR FIXED ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>6.73</td>
<td>295&lt;sup&gt;1&lt;/sup&gt;</td>
<td>*</td>
<td>Fixed assets of not more than 1,500,000 sucres (US$59,405)</td>
</tr>
<tr>
<td>Guatemala</td>
<td>5.54</td>
<td>353&lt;sup&gt;2&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Guyana</td>
<td>0.76</td>
<td>333&lt;sup&gt;2&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Honduras</td>
<td>2.78</td>
<td>283&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0-5</td>
<td>Capital of US$10,000 dollars or less</td>
</tr>
<tr>
<td>Jamaica</td>
<td>1.98</td>
<td>714&lt;sup&gt;1&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Mexico</td>
<td>54.30</td>
<td>681&lt;sup&gt;2&lt;/sup&gt;</td>
<td>*</td>
<td>Capital investment of 25,000-25,000,000 pesos (US$2,001-$2,001,601)</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2.01</td>
<td>457&lt;sup&gt;1&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Panama</td>
<td>1.57</td>
<td>689&lt;sup&gt;2&lt;/sup&gt;</td>
<td>5-29</td>
<td>Fixed assets no greater than B/75,000 (US$75,000)</td>
</tr>
<tr>
<td>Peru</td>
<td>14.91</td>
<td>316&lt;sup&gt;2&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>2.92</td>
<td>1,946&lt;sup&gt;2&lt;/sup&gt;</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>St. Christopher-Nevis-Anguilla</td>
<td>0.07</td>
<td>Not available</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>St. Vincent</td>
<td>0.09</td>
<td>Not available</td>
<td>*</td>
<td>Net worth not more than $100,000 E. Caribbean currency (US$49,261)</td>
</tr>
<tr>
<td>Trinidad &amp; Tobago</td>
<td>1.06</td>
<td>682&lt;sup&gt;12&lt;/sup&gt;</td>
<td>0-50</td>
<td>*</td>
</tr>
<tr>
<td>Middle East</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iran</td>
<td>31.30</td>
<td>1,242&lt;sup&gt;9&lt;/sup&gt;</td>
<td>*</td>
<td>Capital invested of not more than Rials 7.5 million in machinery and equipment (US$110,913)</td>
</tr>
</tbody>
</table>

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iraq</td>
<td>10.41</td>
<td>278(^{4/})</td>
<td>0-9</td>
</tr>
<tr>
<td>Israel</td>
<td>3.18</td>
<td>2,007(^{1/})</td>
<td>0-25</td>
</tr>
<tr>
<td>Jordan</td>
<td>2.56</td>
<td>276(^{1/})</td>
<td>0-5</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>8.199</td>
<td>1,000(^{11/})</td>
<td>0-50</td>
</tr>
<tr>
<td>Yemen Arab Republic</td>
<td>6.06</td>
<td>55(^{5/})</td>
<td>0-9</td>
</tr>
<tr>
<td>East and Southeast Asia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>71.61</td>
<td>60(^{9/})</td>
<td>*</td>
</tr>
<tr>
<td>Brunei</td>
<td>0.15</td>
<td>91(^{5/})</td>
<td>0-50</td>
</tr>
<tr>
<td>China, Republic</td>
<td>15.5</td>
<td>467(^{8/})</td>
<td>0-300</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>4.16</td>
<td>1,300(^{8/})</td>
<td>0-200</td>
</tr>
<tr>
<td>India</td>
<td>574.22</td>
<td>110(^{8/})</td>
<td>*</td>
</tr>
</tbody>
</table>

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>124.60</td>
<td>112(^{1/})</td>
<td>1-4 (with power equipment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5-9 (without power equipment)</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>32.91</td>
<td>281(^{1/})</td>
<td>5-300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Varies with type of industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Malaysia</td>
<td>10.95</td>
<td>391(^{1/})</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M $250,000/or less = total capital investment (US$103,305)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M $50,000/or less = proprietor's or shareholder's capital (US$20,661)</td>
</tr>
<tr>
<td>Pakistan</td>
<td>66.75</td>
<td>205(^{2/})</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Punjab &amp; Sind - total assets (ex. land) not exceeding RS. 20 lakhs (US$200,000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NWFP - total fixed assets (including land) not exceeding RS. 30 lakhs (US$300,000)</td>
</tr>
<tr>
<td>Philippines</td>
<td>40.22</td>
<td>254(^{1/})</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total assets of less than $1 million (US$147,126)</td>
</tr>
</tbody>
</table>

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
<th>NO. OF EMPLOYEES</th>
<th>CAPITAL OR FIXED ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>2.19</td>
<td>1,041²/</td>
<td>0-50</td>
<td></td>
<td>Less than S$250,000 in capital, not including land or building (US$100,806)</td>
</tr>
<tr>
<td>Thailand</td>
<td>39.79</td>
<td>193¹/</td>
<td>*</td>
<td></td>
<td>Less than 2,000,000 Baht (US$97,799)</td>
</tr>
<tr>
<td>Viet Nam, Republic of</td>
<td>19.37</td>
<td>174¹/</td>
<td>*</td>
<td></td>
<td>Less than 10 million piasters (US$16,528) for agriculture and fishing enterprises or exploration for minerals and 20 million for industrial or other (US$33,156)</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cameroon</td>
<td>6.17</td>
<td>166³/</td>
<td>*</td>
<td></td>
<td>Fixed capital investment of Eth. $100,000 (US$48,309) or less</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>26.08</td>
<td>75²/</td>
<td>10-50</td>
<td></td>
<td>Capital investment per employee up to US$5,000</td>
</tr>
<tr>
<td>Gambia, The</td>
<td>0.49</td>
<td>118⁴/</td>
<td>0-10</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Kenya</td>
<td>12.48</td>
<td>151¹/</td>
<td>0-50</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Lesotho</td>
<td>0.99</td>
<td>90¹₀/</td>
<td>0-100</td>
<td></td>
<td>Less than US$150,000 in fixed assets</td>
</tr>
<tr>
<td>Libyan Arab Republic</td>
<td>2.16</td>
<td>1,850¹/</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Nigeria</td>
<td>59.61</td>
<td>100¹¹/</td>
<td>0-50</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Senegal</td>
<td>4.23</td>
<td>201³/</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2.86</td>
<td>158³/</td>
<td>0-6</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Somalia</td>
<td>3.00</td>
<td>67⁵/</td>
<td>0-50</td>
<td></td>
<td>Fixed assets of 1 million Somali shillings (US$158,856)</td>
</tr>
</tbody>
</table>

For sources, footnotes, and general note, see end of table.
<table>
<thead>
<tr>
<th>COUNTRY OR AREA</th>
<th>POPULATION (millions)</th>
<th>PER CAPITA NATIONAL INCOME IN MARKET PRICES (US$)</th>
<th>SMALL-SCALE INDUSTRY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan</td>
<td>16.90 × 10^9</td>
<td>109^3/</td>
<td>Fixed capital for machines, land and building of less than £30,000 (US$86,157)</td>
</tr>
<tr>
<td>Swaziland</td>
<td>0.46 × 215^3/</td>
<td>0-50</td>
<td>Giving a material added value requiring an investment less than £50,000 (US$72,505)</td>
</tr>
<tr>
<td>Upper Volta</td>
<td>5.74 × 60^3/</td>
<td>0-15</td>
<td>Capital in machines and equipment less than US$100,000</td>
</tr>
<tr>
<td>Oceania</td>
<td>424^2/</td>
<td>0-20</td>
<td>*</td>
</tr>
<tr>
<td>Fiji</td>
<td>0.55 × 424^2/</td>
<td>0-20</td>
<td>Investment not more than T$100,000 (US$148,743), excluding land, building and working capital</td>
</tr>
<tr>
<td>Tonga</td>
<td>0.09 × 346^3/</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

**Sources, Footnotes, and General Note**

Country or Area

The categorization of countries and areas as "industrial," "developed," or "less developed" is based on the International Monetary Fund's table of Participants' SDR Positions, March 1974.

Countries and areas are listed by their short form name as given in U. S. Department of State, Bureau of Intelligence and Research, Status of the World's Nations, Geographic Bulletin (revised), 1973.

Population


X = designates estimates of questionable reliability.
Y = U. S. Department of State, Background Notes, 1973 estimate.
Per Capita National Income

6/ U. S. Department of State, Background Notes, 1972 expressed in 1971 prices.

Small-Scale Industry Data

* Refer to country definition.

Conversions from national currencies to US dollars were based on the most recent exchange rate (April-September 1974) in International Monetary Fund, International Financial Statistics, November 1974.
<table>
<thead>
<tr>
<th>Country or Area</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>3, 58</td>
</tr>
<tr>
<td>Austria</td>
<td>3, 57</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>4, 60</td>
</tr>
<tr>
<td>Barbados</td>
<td>4, 58</td>
</tr>
<tr>
<td>Belgium</td>
<td>4, 58</td>
</tr>
<tr>
<td>Brazil</td>
<td>5, 58</td>
</tr>
<tr>
<td>Brunei</td>
<td>6, 60</td>
</tr>
<tr>
<td>Cameroon</td>
<td>6, 62</td>
</tr>
<tr>
<td>Canada</td>
<td>6, 57</td>
</tr>
<tr>
<td>China, Republic of</td>
<td>7, 60</td>
</tr>
<tr>
<td>Colombia</td>
<td>7, 58</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>8, 58</td>
</tr>
<tr>
<td>Denmark</td>
<td>8, 57</td>
</tr>
<tr>
<td>Ecuador</td>
<td>9, 59</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>9, 62</td>
</tr>
<tr>
<td>Fiji</td>
<td>9, 63</td>
</tr>
<tr>
<td>Finland</td>
<td>10, 58</td>
</tr>
<tr>
<td>Germany, Federal Republic of</td>
<td>11, 57</td>
</tr>
<tr>
<td>Guatemala</td>
<td>11, 59</td>
</tr>
<tr>
<td>Guyana</td>
<td>12, 59</td>
</tr>
<tr>
<td>Honduras</td>
<td>13, 59</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>13, 60</td>
</tr>
<tr>
<td>India</td>
<td>13, 60</td>
</tr>
<tr>
<td>Indonesia</td>
<td>14, 61</td>
</tr>
<tr>
<td>Iran</td>
<td>14, 59</td>
</tr>
<tr>
<td>Iraq</td>
<td>14, 60</td>
</tr>
<tr>
<td>Israel</td>
<td>14, 60</td>
</tr>
<tr>
<td>Italy</td>
<td>15, 57</td>
</tr>
<tr>
<td>Jamaica</td>
<td>16, 59</td>
</tr>
<tr>
<td>Japan</td>
<td>16, 57</td>
</tr>
<tr>
<td>Jordan</td>
<td>16, 60</td>
</tr>
<tr>
<td>Kenya</td>
<td>17, 62</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>17, 61</td>
</tr>
<tr>
<td>Lesotho</td>
<td>17, 62</td>
</tr>
<tr>
<td>Libyan Arab Republic</td>
<td>18, 62</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>19, 57</td>
</tr>
<tr>
<td>Malaysia</td>
<td>19, 61</td>
</tr>
<tr>
<td>Malta</td>
<td>20, 58</td>
</tr>
<tr>
<td>Mexico</td>
<td>20, 59</td>
</tr>
<tr>
<td>Netherlands</td>
<td>20, 57</td>
</tr>
<tr>
<td>New Zealand</td>
<td>21, 58</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>21, 59</td>
</tr>
<tr>
<td>Nigeria</td>
<td>22, 62</td>
</tr>
<tr>
<td>Norway</td>
<td>22, 58</td>
</tr>
<tr>
<td>Pakistan</td>
<td>23, 61</td>
</tr>
<tr>
<td>Panama</td>
<td>23, 59</td>
</tr>
<tr>
<td>Peru</td>
<td>24, 59</td>
</tr>
<tr>
<td>Philippines</td>
<td>24, 61</td>
</tr>
</tbody>
</table>
APPENDIX
RESPONSE FORM

Return to: Richard Johnston, Research Scientist
International Development Branch
Industrial Development Division
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, Georgia 30332
USA

Respondent's Affiliation: ____________________________________________

Address
______________________________________________________________
______________________________________________________________
______________________________________________________________

Country or Area
______________________________________________________________

Small-Scale Industry Data: (include the following information or attach appropriate literature)

<table>
<thead>
<tr>
<th>No. of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capital investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixed assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>sales</td>
</tr>
<tr>
<td>__________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal definition of small-scale industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational definition of small-scale industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________________________________</td>
</tr>
</tbody>
</table>

Comments
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________

-71-
DIRECTORY OF CONSULTANTS
TO SMALL RURAL INDUSTRIES

Compiled by
Kay Ellen Auciello
and
Richard Johnston

This information document was prepared under
funding provided by the U. S. Agency for
International Development under a 211(d) grant.

Economic Development Laboratory
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
Atlanta, Georgia
October 1975
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>i</td>
</tr>
<tr>
<td>CONSULTANT LISTINGS: ORGANIZATIONS</td>
<td>1</td>
</tr>
<tr>
<td>CONSULTANT LISTINGS: INDIVIDUALS</td>
<td>27</td>
</tr>
<tr>
<td>INDEX</td>
<td>41</td>
</tr>
<tr>
<td>APPENDIX: QUESTIONNAIRE</td>
<td>45</td>
</tr>
</tbody>
</table>
INTRODUCTION

The Directory of Consultants to Small Rural Industries is the first attempt of the Economic Development Laboratory (EDL), formerly the Industrial Development Division (IDD), of the Engineering Experiment Station at the Georgia Institute of Technology to compile a listing of experienced individuals and organizations currently interested and experienced in assisting, on a contract basis, the development of small rural industries in developing countries.

For this purpose, "small rural industries" are defined as agro-industrial establishments of 20 or fewer employees and "assistance" as a systems approach to aspects of technical and managerial assistance.

A questionnaire outlining the appropriate information needed was mailed to readers of IDD's Small Industry Development Network Newsletter. Those individuals and organizations who responded with sufficient data are included in this publication.

The Directory is divided into two sections, Organizations and Individuals. Each entry is arranged alphabetically by the country in which its headquarters are located. Editing of replies occurred primarily in the section referring to project experience. Each entry was limited to five representative projects.

It is hoped that this first listing of small-scale industry consultants will generate interest in the compilation of a more complete directory. Your comments are invited.
CONSULTANT LISTINGS: ORGANIZATIONS
CANADA

FEROCEM INTERNATIONAL CO., LTD.
1105 Normandy Cres.
Ottawa K2R 5A3, Ontario, Canada
Telephone: (613) 224-5-55 Cable: Ferocem Ottawa

Contact: Dr. G. W. Bigg.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 6.

Language Capabilities: German, Dutch, English, Hindustani, Japanese, Malay (Indonesian), French.

Representative Project Experience:

1972/74 - Chittagong, Bangladesh; Ferro-cement Boatyard; boatyard development; CHF/CIDA funded, $300,000.

1973/75 - Trengganu, Malaysia; Ferro-cement Training Program; small-scale industry development (watertanks, cattle trough, boats); locally funded, $20,000.

Fields of Capability: Ferro-cement technology, industry, design and development.
FUNDACION PARA EL FOMENTO DE LA INVESTIGACION CIENTIFICA Y TECNOLOGICA
Carrera 11A, No. 69-75 or
Apartado Aereo No. 27872
Bogota, Colombia
Telephone: 55-15-23/55-16-03 Cable: Ficitec A.A. 27872

Contact: Ing. Guillermo Llinas.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 12.

Language Capabilities: English, Spanish.

Representative Project Experience:

1971 - Cauca; Empaques del Cauca; technological process; $50,000.

1973 - Ibaque; Enciso; agriculture machinery; $150,000.

1973 - Valle; Covalle; garment industry; $300,000.

1973 - Cucuta; Cucuta y Otras Ciudades Intermedias; village technology; $1,000,000.

1974 - Caldas; Fanal; accounting systems; $150,000.

Fields of Capability: Production administration, finance, accounting, marketing, machine design, production techniques, technical information.
COSTA RICA

INSTITUTO NACIONAL DE FOMENTO Y ASESORIA MUNICIPAL
P. O. Box 1439
San Jose, Costa Rica
Telephone: 22-96-50/23-37-77  Cable: IFAM

Contact: Dr. Oscar Padilla-Sellen.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 30.

Language Capabilities: Spanish, English, French.

Representative Project Experience:

1967 - Costa Rica; National Institute of Learning; ₡10,000,000.

1973 - San Isidro; Regional Development of the Valle de El General.

1974/75 - 20 Plans of Local Development in rural areas (General Director).

1975 - Coordination of the National Program for Rural Industries (with other national agencies).

Fields of Capability: Coordination and general management of projects.
ECUADOR

CENTRO DE DESARROLLO INDUSTRIAL DEL ECUADOR (CENDES)
P. O. Box 5833
Guayaquil, Ecuador
Telephone: 307628   Cable: CENDES-Guayaquil

Contact: Dr. Victor Martinez - Servicio de Informacion Tecnica.

Will Work in the Following Areas: Latin America.

Professional Staff Size: 7.

Language Capabilities: Spanish, English.

Representative Project Experience: Experience in the development of information dissemination activities for small industry and implementation of industrial data bank for promotion activities, feasibility studies and industrial development programs.

Fields of Capability: Food technology, chemical industry, industrialization of agricultural projects.
ENGLAND

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP, LTD.
Parnell House
25 Wilton Road, Victoria
London, SW1V 1JS, England
Telephone: 828-5791/4  Cable: IT/DEV London S W1

Contact: D. H. Frost.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 100.

Language Capabilities: English, French, Spanish, major African languages.

Representative Project Experience:

1971/73 - Nigeria; research into establishment of light industry/production training capability and setting up of prototype workshop.

1974 - Pakistan; techno-economic feasibility study of mini-plants for a wide range of products.

1974 - Guyana; survey and report on development of small industries using natural resources/waste products.

1974 - Tanzania; survey and recommendations on possibilities for small industry development.

1975 - Sudan; establishment of ferro-cement boat building production and training programme.

Fields of Capability: Agriculture, building, chemistry and chemical engineering, co-operatives, forestry and forest products, power, textiles, food technology, grass manufacture, ferro-cement, production training.

OVERSEAS DEVELOPMENT GROUP
University of East Anglia
Norwich, NR4 7TJ, England
Telephone: (0603) 57880  Cable: ODG UEA NORWICH

Contact: The Director.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 24

Language Capabilities: English, African languages.

(continued)
ENGLAND (continued)

Representative Project Experience:

1969/71 - Malaysia; Jahor Tenggara Regional Master Plan.

1970/72 - Kenya; research on data collection and applied research priorities for improved agricultural planning procedures.

1970/72 - Saudi Arabia; Western Regional Plan.

1972 - Papua, New Guinea; UNDP/IBRD Mission on Strategies for the Next Development Programme.

1973 - ODA-financed research programme on the impact of road construction on income distribution in Nepal.

Fields of Capability: Development planning, management, finance, regional development, rural development programmes, natural resources use planning, population policies, education and manpower planning, development of industry, tourism, transport, project identification, appraisal and evaluation.
FRANCE

SOCIETE D'AIDE TECHNIQUE ET DE COOPERATION (SATEC)
110 rue de l'Universite
75007 Paris, France
Telephone: 551-49-79 Cable: Cresag Paris Telex: 20-339-F

Contact: J. L. Fabre.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 25.

Language Capabilities: French, English.

Representative Project Experience:

1963/70 - Algeria; Promotion of Small and Medium-Scale Industry.

1967/75 - Cameroon; Development of Small-Scale Industry; $750,000 per year.

1973/75 - Chad; Bureau de Promotion Industrielle du Tchad; UNIDO/FNUD.

1974/75 - Dahomey; Development of Small-Scale Industry; $75,000 per year.

1974/75 - Niger; Development of Small-Scale Industry; $75,000 per year.

Fields of Capability: Agricultural and agro-industrial development (stock breeding, irrigated areas, etc.); promotion of small and medium-sized industrial firms (especially in the fields of food products, building materials and staple goods); development of sea fishing.
GHANA

TECHNOLOGY CONSULTANCY CENTRE
University of Science and Technology
Private Mail Bag
Kumasi, Ghana
Telephone: 5351, Ext. 308  Cable: KUMASITECH

Contact: Dr. B. A. Ntim.

Will Work in the Following Areas: Africa, Asia.

Language Capabilities: English.

Representative Project Experience:

1972 - Ghana; soap manufacture; 100 tons/year; $50,000.
1974 - Ghana; plain cloth weaving on a broadloom; $10,000.
1974 - Ghana; bolts and nuts manufacture; 30,000 sets; $30,000.

Fields of Capability: Bar soap production, production management, fish smoking.
HONDURAS

CENTRO COOPERATIVO TECNICO INDUSTRIAL
Apartado Postal #703
Tegucigalpa, Honduras
Telephone: 22-40 50 22-91 91  Cable: CENTEC

Contact: Dorcas G. de Gonzalez, Director.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 27.

Language Capabilities: Spanish, English.

Representative Project Experience: Much experience on varied investment levels in the following areas: sugarcane industrialization, sisal, ceramics, wood furniture, dry flowers, tinware, saddlery, gold or silver work, fibers or textile work. Various project locations.

Fields of Capability: Mechanical engineering, business administration, industrial engineering, chemical engineering.
INDIA

APPROPRIATE TECHNOLOGY DEVELOPMENT UNIT
Gandhian Institute of Studies
P. O. Box 116
Rajghat, Varanasi, U. P., India
Telephone: Office-62182 Residence-52513 Cable: STUDIES

Contact: M. M. Hoda, Head.

Will Work in the Following Areas: Africa, Asia, Latin America.

Will Not Work in the Following Countries: China, Pakistan, Israel, Spain, Portugal.

Professional Staff Size: 5.

Language Capabilities: English, Hindi.

Representative Project Experience:

1972/75 - India; Development of Appropriate Technologies for Rural Areas; collection of information, preparation of directory, research, collaboration with universities, IIT and research institutions.

Fields of Capability: Rural and small unit technologies, e.g., agro-tools, agro-processing, basic village industries, food preservation, irrigation and water management, soil conservation, material handling and transport, decentralized sources of power and energy, health and hygiene, community living and culture, education and training, building and construction, business and management.

SRI M. K. GARG
C-10/1, River Bank Colony
Lucknow, India
Telephone: 26969 Cable: GARG, C-10/1, River Bank Colony, Lucknow

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 4.

Language Capabilities: English.

Representative Project Experience:

1942/74 - Khurja (Bulandshahr), Chinhat (Lucknow), Phoolpur (Allahabad); manufacture of white-wares or tablewares on cottage scale; about Rs. 10 Lakhs.

1957 - Manufacture of direct consumption sugar on small scale, i.e., mini sugar technology; from one pilot project unit started at Ghosi dist. Azamgarh (India),
this technology has expanded into 2,000 units in India in various states; still carrying on consultancy work throughout India.

1962/66 - Lucknow; Development of Bio-gas for Rural Areas; research carried out for increasing the efficiency of these plants with a budget of about Rs. 1 Lakh.

1962/67 - Lucknow; development of bullock-driven water lift device and agricultural implements; Rs. 1 Lakh.

1966/72 - Mohanlalganj dist. Lucknow; manufacture of portland cement on small scale; Rs. 20 Lakhs.

M. S. IYENGAR & ASSOCIATES (P) LTD.
D. 11/4, N.P.L. Quarters
Dr. K. S. Krishnan Road
New Delhi - 110060, India
Telephone: 584018  Cable: IYCON

Contact: Dr. M. S. Iyengar.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 10.

Language Capabilities: English.

Representative Project Experience:

1964/73 - Design and development of various industrial processes for rural areas; $3 million.

Fields of Capability: Feasibility studies, project design and engineering, commissioning of plants, training of personnel for the following fields: agro-industries, cement, paper, building materials, chemicals, pharmaceuticals, medicinal plants, food processing.
IRELAND

IRISH MANAGEMENT INSTITUTE
Sandyford Road
Dublin 14, Ireland
Telephone: 983911

Contact: Gerald F. Smyth.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 6.

Language Capabilities: English, Spanish.

Representative Project Experience:
1970/75 - Ireland; developing managers in small firms.
1970/75 - Ireland; training potential entrepreneurs.
1970/75 - Nairobi, Kenya; training entrepreneurs.
1970/75 - Ireland and Africa; in-company development work.

Fields of Capability: Food and co-operatives, distributive trades, transport, engineering, printing, construction.

KILKENNY DESIGN WORKSHOPS
Castle Yard
Kilkenny, Ireland
Telephone: 056-22118

Contact: W. H. Walsh, Executive Chairman.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 12.

Language Capabilities: English, French, Spanish.

Representative Project Experience:
1973 - Colombia; industrial design.

Involved in establishing 10 small manufacturers who have branched off from the workshops into the surrounding district; they include jewelers and silversmiths, pottery, graphic studio, candlemaking, stone cutting and polishing.

Fields of Capability: Small skill-dependent industries with design content, export and marketing.
KOREA

TECHNO-ECONOMICS GROUP
Korea Institute of Science and Technology
39-1, Hawolkok-dong, Sungbuk-ku
Seoul, Korea
Telephone: 97-8801  Cable: KISTROK  Telex: KISTROK K27380

Contact: Seong Jae Yu.

Will Work in the Following Areas: Asia, Latin America.

Will Not Work in the Following Countries: Communist countries.

Professional Staff Size: 20.

Language Capabilities: English, Korean.

Representative Project Experience:

1973 - Taejon, Korea; feasibility study on the processing of chestnuts; $20,000.

1974 - Korea; feasibility study on making sweet potatoes into feedstuff; $6,000.

1975 - Western Sumatra; feasibility study on the fermentation of cassava as alcohol in Indonesia; $8,000.

Fields of Capability: Production management, marketing management and survey, financial analysis and feasibility study, product mix and selection, diagnosis and guidance on management, plant site selection and layout.
MEXICO

CENTRO DE INVESTIGACIONES Y ASISTENCIA TECHNOLOGICA DEL ESTADO DE OAXACA
Carlos Ma. Bustamante Esq. con Burgoa (interior)
Oaxaca, Mexico
Telephone: 6-30-55

Contact: Ing. Joaquin Enrique Gomez Alvarez.

Language Capabilities: Spanish, English.

Representative Project Experience:

1975 - Oaxaca, Mexico; Small Canning Plant; agro-industrial; $2,800,000.

Fields of Capability: Engineering services - food technology, chemical engineering, mechanical and electrical engineering; laboratory services - mineralogy, microbiology, bromatology, edafology; information services - basic data center.

CENTRO NACIONAL DE PRODUCTIVIDAD
Nazas 23-902
Mexico 5, D. F., Mexico
Telephone: 535-10-40 Cable: CENAPRO

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 8.

Language Capabilities: Spanish, English.

Representative Project Experience:

1973 - Tlaxcala; Plan Tlaxcala; potential for different levels for rural industries.

Many programs referring to industry potential.

Fields of Capability: Food technology administration, rural industry planning, farm management.
DEPARTMENT OF MARKETING
University of Nigeria
Enugu, Nigeria
Telephone: 3081, Ext. 12

Contact: Dr. J. O. Onah.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 4.

Language Capabilities: English.

Representative Project Experience:

1973 - Nigeria; Management Practice in Developing Countries; $10,000.

1974 - Nigeria; Marketing Management Cases; $5,000.

1974 - Nigeria; A Survey of Management Development and Training; $20,000.

1975 - Nigeria; Petrol Marketing; $20,000.

Fields of Capability: Marketing management, food marketing, marketing research, agricultural marketing, public relations, advertising.
CENTRO NATIONAL DE PRODUCTIVIDAD (CENIP)
Jr. Zepita 423 - 5 Piso
Lima, Peru
Telephone: 3100070 Cable: P. O. Box 5442

Contact: Ing. Paolo de Lorenzi Sussana, Jefe General.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 6.

Language Capabilities: Spanish.

Representative Project Experience:

1973 - Lima; industrial activities of the country in urban and rural areas, model of rural industrialization, effects of rural industrialization on the available manpower, migration and rural industrialization, rural and agrarian industrialization; the region of Valle de Ica, political and legislative measures for the promotion of rural industrialization.

Fields of Capability: Productivity studies of industrial sectors and agricultural technical assistance, finance.
DEPARTMENT OF AGRICULTURAL ENGINEERING
International Rice Research Institute (IRRI)
P. O. Box 933
Manila, Philippines
Cable: Ricefound, Manila Telex: 7425365 via ITT 2456 via RCA

Contact: A. U. Khan.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 3.

Representative Project Experience:

1967/present - Los Banos, Laguna, Philippines; IRRI Machinery Development Project; development of small farm machines for local manufacture in the LDC.

Fields of Capability: Agricultural machinery design, development and production.
UNITED STATES

ACCIÓN INTERNATIONAL TECNICA (AITEC)
10C Mount Auburn Street
Cambridge, Massachusetts 02138
Telephone: (617) 492-4930 Cable: ACCIONUSACAMBRIDGEMASS

Contact: John C. Hammock.

Will Work in the Following Areas: Africa, Latin America.

Professional Staff Size: 8 plus approximately 10 short-term consultants.

Language Capabilities: Spanish, English.

Representative Project Experience:

1969/present - Venezuela; Centro de Estudios Sociales; manpower training for small business employees; $20,000.

1970/72 - Colombia; ACCION en Colombia; small business/cooperative development; $40,000.

1973/present - Guayas Basin, Ecuador; Agribusiness Development; establishment of wholesale marketing and transportation system; rationalization of food production/distribution system; promotion of rural cooperatives; $240,000.

1973/present - Recife, Brazil; Uniao Nordestina de Assistencia a Pequenas Organizacoes (UNO); promotion of micro-industries through extension of credit and technical assistance; $200,000.

1975/present - Colombia; FICITEC; technical assistance to FICITEC in training and evaluation components of small business development; $63,000.

Fields of Capability: Production management, manpower training, marketing, transportation systems, supervised credit, evaluation, cooperativism, applied research, appropriate technology. Provides technical assistance and serves a resource broker/coordinator function to rationalize the maximum use of available resources.

DEVELOPING WORLD INDUSTRY AND TECHNOLOGY
919 18th Street, N. W., Suite 800
Washington, D. C. 20006
Telephone: (202) 296-4680 Cable: DEWIT

Contact: Dr. Jack Baranson.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 3.
Language Capabilities: English, Spanish, Portuguese, French.

Representative Project Experience:

The following projects were performed during 1972/74.

Sao Paulo, Brazil; National Academy of Sciences; advise USAID Mission on a proposed scheme for utilizing a technology fund in support of economic development.

Washington, D.C., U.S.A.; National Academy of Sciences, Board on Science and Technology for International Development; need and feasibility for an International Industrialization Institute for the benefit of developing countries, appropriate technologies for developing economies, and the role of financial institutions in technological support of economic development.

Rio de Janeiro, Brazil; Government of Brazil, Ministry of Planning, Studies and Projects Agency (FINEP); role of state enterprises in advancement of domestic capital goods industry.

Karachi, Pakistan; World Bank Economic Survey Mission to Pakistan; role of technology in industrial sector development.

Mexico City, Mexico; Mexican Government, National Council of Science and Technology (CONACYT); formulating policy studies in the technology transfer field.

Fields of Capability: Technology acquisition policy and planning, industrial technology, export promotion, zone management systems, industrial investment, sector development programs.

DEVELOPMENT ALTERNATIVES, INC.
1823 Jefferson Place, N. W.
Washington, D. C. 20036
Telephone: (202) 833-8140  Cable: DEVALT

Contact: Donald R. Mickelwait, President.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 8.

Language Capabilities: English, Spanish, French, Thai, Lao.

Representative Project Experience:

1974/75 – 12 countries in Africa and Latin America; Research on Determinants of Local Involvement; examination of 81 rural projects and sub-projects (AID). (continued)
UNITED STATES (continued)

1973/76 - Latin America; Information Systems; design of information systems (allocation, monitoring, evaluation) for rural industry projects.

Fields of Capability: Project design, project organization, project planning, project implementation and local involvement. Information systems to support and improve rural industrial projects.

ECONOMIC DEVELOPMENT LABORATORY
(INDUSTRIAL DEVELOPMENT DIVISION)
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, Georgia 30332
Telephone: (404) 894-3800 Cable: ENGEXPSTAT

Contact: Ross W. Hammond, Director.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 44 (175 total in Engineering Experiment Station).

Language Capabilities: English, Spanish, Portuguese, Chinese.

Representative Project Experience:

1970/71 - Venezuela; Technical Assistance to the University of Carabobo; assistance in developing economic development programs; $51,207.

1971/73 - Paraguay; Regional Development Program for Paraguay (USAID); assistance in establishing regional programs of industrial development in small communities in Paraguay; $98,000.

1965/present - Atlanta, Ga, U.S.A. ; Industrial Development Internship Program (USAID); 12-week international training course for Latin Americans; trained 120 people to date; $144,000.

1973/present - Brazil, Korea, Ecuador, Nigeria, Philippines; Employment Generation Through Stimulation of Small-Scale Industry; applied research, education and training, conferences and seminars, assistance to counterpart institutions; $800,000/5 years.

1974/present - Korea, Brazil, Nigeria (1975); A Program of Small Industry Development (USAID); technical assistance in establishing and implementing small-scale industry development; $850,000/5 years.

Fields of Capability: Adaptive technology, audiovisual productions, community and area development, engineering, feasibility studies, housing, information systems, land utilization, manpower resources, market analysis, production control, quality control, technical assistance to industry, training programs, transportation, water resources.
UNITED STATES (continued)

MISSISSIPPI RESEARCH AND DEVELOPMENT CENTER
Post Office Drawer 2470
Jackson, Mississippi 39205
Telephone: (601) 982-6464 Telex: 810 966-2615

Contact: Wade H. McKoy, Assistant Director.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 115.

Language Capabilities: English, Spanish, French, German, Arabic, Greek, Gaelic.

Representative Project Experience:

1973 - Madison County, MS, U.S.A.; Market Information for Pottery Operation; cash flow and financial analysis, marketing information and location assistance provided to individual; help in obtaining loan; $1,500.

1973/74 - Prairie, MS, U.S.A.; New Venture - Plant to Produce Electrolytic Chromium Metal; prepared feasibility study and gave financial assistance to individual to assist in securing needed capital for new venture; $6,330.

1974 - Charleston, MS, U.S.A.; Expansion - Cotton Gin; financial planning and loan assistance for replacement gin; cash flow and financial analysis given to assist in application for Farmers Home Administration loan; $2,400.

1974/75 - Blue Springs, MS, U.S.A.; Expansion - Furniture Plant; furnished plant layout and material flow analysis for expansion of existing upholstered furniture plant; $2,200.

1974/75 - Olive Branch, MS, U.S.A.; New Venture - Manufacture of Automated Carton Sealers; individual requested assistance in obtaining loan to purchase building in which to manufacture automated carton sealers; provided feasibility study and assisted the individual with loan applications; $2,370.

Fields of Capability: Financial management, wood processing industries, food processing, brick and concrete products, furniture manufacture, plastics, production management, marketing research, film industry, purchasing, government procurement, marketing management, product development.
UNITED STATES (continued)

PARTNERSHIP FOR PRODUCTIVITY
P. O. Box 170
Annandale, Virginia 22003
Telephone: (703) 256-3444  Cable: PARTPROD (Wash. D.C.)

Contact:  David H. Scull, President.

Will Work in the Following Areas:  Africa, Asia, Latin America.

Professional Staff Size:  8.

Language Capabilities:  Various.

Representative Project Experience:

1970/present - Kakamega, Kenya; varied rural small business; $125,000.

1973/present - Yekepa, Liberia; varied rural small business; $150,000.

Fields of Capability:  Programs deal with general, across-the-board management problems. Various staff members have specialized skills in certain industries, changing from time to time. Most of available staff is in Africa at any given time, and especially suited for relatively brief consulting service elsewhere in Africa.

SAVE THE CHILDREN FEDERATION
48 Wilton Road
Westport, Connecticut 06880
Telephone: 226-7272  Cable: SAVCHILD

Contact:  David L. Guyer, Executive Director.

Will Work in the Following Areas:  Africa, Asia, Latin America.

Language Capabilities:  Various.

Representative Project Experience:

1932/present - Community self-help programs in various countries.

Fields of Capability:  Food technology, agriculture, nutrition education, cooperatives (including food and crafts).
SEATON INTERNATIONAL TRADE CORPORATION
801 Wisconsin Street
Neodesha, Kansas 66757
Telephone: (316) 325-2402  Cable: SEATEX

Contact: Frederick D. Seaton, President

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 2.

Language Capabilities: English, Portuguese, Spanish, Russian, French.

Representative Project Experience:

1964/65 - Brazil; School Construction; design, plan and construction of two elementary schools by local groups using cinva-ram brick; $15,000.

Fields of Capability: Milling, baking, grain storage and handling, accounting, foundry organization, welding, production management.

RALPH STONE AND COMPANY, ENGINEERS
10954 Santa Monica Boulevard
Los Angeles, California 90025
Telephone: 478-1501

Contact: Richard Kahle, Vice President.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 35.

Representative Project Experience:

1948 - Shaoyang, China; Demonstration Fertilizer Plant; designed, helped construct compost and chemical plant; $200,000.

1948 - Shaoyang, China; Meat Packing; designed, helped construct; $250,000.

1951 - Valle de Cauca, Colombia; Sugar Mill; designed pollution control equipment; $350,000.

1973 - Costa Rica; Industrial Waste Plant; designed and supervised construction; $900,000.

1968 - Costa Rica; Dye Plant; designed, supervised construction, $450,000.

Fields of Capability: Food technology, textiles, fertilizers, steam power, water and waste treatment, meat packing, dyeing, fisheries, iron and steel, petrochemicals, housing.
UNITED STATES (continued)

SYSTEM PLANNING CORPORATION
1500 Wilson Blvd.
Arlington, Virginia 22209
Telephone: (703) 527-6709

Contact: Dr. Robert A. Summers.

Will Work in the Following Areas: Africa, Asia, Latin America.

Will Not Work in the Following Countries: Soviet bloc.

Professional Staff Size: 5 (in this general area).

Language Capabilities: English, French, Spanish, German.

Representative Project Experience:

1974 - Bolivia, Kenya, Botswana, Thailand; Economic Evaluation of the Utility of ERTS Data for Developing Countries, for AID; case studies and assessment.

1975 - Chile, Bolivia, Lesotho; Grant-supported Pilot Projects for ERTS Data Utilization in Developing Countries, for AID; administer and monitor grants, provide technical assistance.

1975 - Geological Evaluation of ERTS Imagery of Rwanda, for AID, Rwanda; image interpretation, on-site correlation.

Fields of Capability: Application of satellite imagery to natural resources management, economic evaluations, geology-mineral resources, hydrology-water resources, multidisciplinary studies.

VOLUNTEERS IN TECHNICAL ASSISTANCE (VITA)
3706 Rhode Island Ave.
Mount Rainier, Maryland 20822
Telephone: (301) 277-7000

Contact: Dr. Michael P. Greene.

Will Work in the Following Areas: Africa, Asia, Latin America.

Professional Staff Size: 5,000 volunteers, 17 staff.

Language Capabilities: English, French, Spanish, others.

Representative Project Experience:

Numerous technical projects worldwide.

1975/present - Small-Scale Lime and Cement Production; Solar-Powered Ice Maker.

Fields of Capability: All technical fields. Consultation principally by mail.
CONSULTANT LISTINGS: INDIVIDUALS
J. CHANDER  
National Research Council of Canada, M-55  
Ottawa KIA 053, Canada  
Telephone: (613) 993-1753

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English.

Representative Project Experience:

1973 - Bolivia; Technical Information; Organization of American States.
1974 - Guatemala; Metallurgy; Organization of American States.
1974 - Honduras; Metal Working; Organization of American States.

Fields of Capability: Metal working and forming, foundry, forging, technical information, metal industries.

GEORGE H. CLEMENT  
Information Sciences  
International Development Research Centre  
Box 8500  
Ottawa K1G 3H9, Canada  
Telephone: (613) 996-2321 Cable: RECENTRE Telex: 053-3753

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Spanish, French, Malay (Indonesia).

Representative Project Experience:

1968/70 - Chile; Institute of Food; F.A.O. Project, formation of I.F.S.T., project manager.
1972 - Iran; I.L.O. Project, survey, pre-project.
1973 - Southeast Asia; Technonet-Asia (I.D.R.C.); transfer of technology to small-scale industries; $1,180,000.
1973/74 - Latin America; Pilot Project for Transfer of Technology (PPTT); Joint O.A.S./I.D.R.C. Project.
1975 - Indonesia; Institute of Food Technology; World Bank Project; $3,000,000.

Fields of Capability: Food technology, production management, technology transfer, information services.
DENMARK

FREDE HVELPLUND
Handelshojskolen i Arhus Fuglesangsalle 4
8210 Arhus V, Denmark
Telephone: (06)139144

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, French, Spanish, German.

Representative Project Experience:

1970 - Turkey; feasibility studies for industries in Turkey; $2,000.
1972 - India Gujarat; appropriate technology; study at a dairy in Ahmadabad; $2,000.
1973 - Quebec; work on a handbook in appropriate technology; Brace Research Institute in Quebec; $4,000.

Fields of Capability: Adaptive technology.
ENGLAND

DR. DAVID GIBBON
School of Development Studies
University of East Anglia
Norwich, England
Telephone: Norwich 56161, Ext. 254

Will Work in the Following Areas: Africa, Asia, Latin America.

Representative Project Experience:

1971/74 - Botswana; Dryland Farming Research Project; crop-water relation, farming systems, farm workshop, production of culwater implements for minimum tillage system using animal draft.

Fields of Capability: Development of appropriate technology in culwater systems.

JOAN LEE
28 Kingswood Road
London SW2, England
Telephone: London 727-8532

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: French, German, Maghreb Arabic.

Representative Project Experience:

1966/67 - Moknine, Tunisia; Furniture and Signpainting Workshop; manufacture of simple furniture and signs, and training in the basic skills.

1974 - London; Journal of Appropriate Technology; planning and publishing of new magazine to spread information on technologies adapted to rural situations.

Fields of Capability: Design and production of simple furniture, basic carpentry, calligraphy, newspaper and magazine publishing using stencils or handmade blocks, sewing, community development.
ETHIOPIA

GITINET WOLDE GIORGIS
P. O. Box 1900
Addis Ababa, Ethiopia
Telephone: Office - 151188, Residence - 158395  Cable: AIDBANK

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: Amharic, English, French.

Representative Project Experience:

1969/72 - Ethiopia; assisting small-scale industries in preparing feasibility studies.

1973/74 - Ethiopia; Small-Scale Industry Fund; initiating, organizing and drafting a special small-scale industry loan fund to be administered by my division; $300,000.

Fields of Capability: Feasibility studies and production management.
GHANA

DR. DAVID ARDAYFIO
Faculty of Engineering
University of Science and Technology
Kumasi, Ghana

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English.

Representative Project Experience:

1973/75 - Kumasi, Ghana; Development and Design of Medium Technology of Hand-Operated Agricultural Implements, Food-Processing Equipment; adaption of technology to rural or village level manufacturing, using locally available materials and skill.

Fields of Capability: Agriculture implements, food processing equipment.
LIBERIA

GEORGE P. BUTLER
Partnership for Productivity Foundation
c/o LAMCO - YEKEPA
Roberts International Airport, Liberia
Telephone: Lamco Yekep 267  Cable: PFP-Lamco-Yekepa-Liberia
Telex: LAMCO-Liberia

Will Work in the Following Areas:  Africa, Asia, Latin America.

Representative Project Experience:

1962/67 - 3 regions of Nigeria; Small Industry Development Program; Ford Foundation; assist in development of Nigerian entrepreneurship; $150,000.

1967/68 - Ethiopia; Attract Overseas Investors; USAID; conduct feasibility studies; $40,000.

1969 - Zaire; Feasibility Studies (2 U. S. corporations); conduct feasibility studies for 2 U. S. private corporations; $35,000.

1971/73 - Kakamega, Western Kenya; PFP/Kenya; Small Enterprise Development.

1973/present - Nimha County, Liberia; PFP/Liberia; small-enterprise development in and around mining concession.

Fields of Capability:  Mechanical repairs, heavy equipment operation and maintenance, all building trades at non-sophisticated levels; management training-conducting courses, seminars; banking, managing loan funds; administering to needs of development staff; African government relations; plant layout; some agriculture, especially rice, maize and poultry; irrigation layout surveying; some food processing (i.e., rice, maize and flour milling); general feasibility study and economic planning.
PHILIPPINES

BHAVANI DHUNGANA
5 Mayaman, U. P. Village
Quezon City, Philippines

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English.

Representative Project Experience:

Nepal; Industrial Estates Development.

Nepal; Project Analysis and Management.

Nepal; Tax Policies for Promotion of Small-Scale Industries.

Fields of Capability: Industrial estates, management, industrial promotion, project analysis.

HERMINIA ROSALES-FAJARDO
University of the Philippines
Institute for Small-Scale Industries
Virata Hall, Diliman
Quezon City, Philippines
Telephone: 99-70-76 to 79 Cable: INSMACIND

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Spanish.

Representative Project Experience:

1970/73 - Philippines; project evaluation of miscellaneous industrial projects in the rural areas.

1971/72 - Davao City; Coco-charcoal Project.

1972/74 - Novaliches, Rizal; Construction Brick and Tile Project.

1974/75 - Marikina, Rizal; Shoe Industry.


Fields of Capability: Production management, project preparation and development, extension services, quality control, small-scale industries.
SRI LANKA

D. DON SEKARAGE
Technical Services Manager
Building Material Corporation
Chartered Bank Building, First Floor
Colombo 1, Sri Lanka
Telephone: 27939, 26701, 26702

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Sinhala, Tamil.

Representative Project Experience:

1959/64 - Ceylon and abroad; training; apprenticeship, engineering, various fields related to industry.

1967 - Ceylon; Industrial Development Board; development of small-scale industries in mostly rural sectors in Ceylon.

1974 - Divisional Development Programme; implementation of light engineering unit.

1974 - 76 Pilot Projects (mostly tools and implements); draft and implement small-scale industrial projects. Each provides employment for 30 to 50 personnel.

Fields of Capability: Production management, mechanical engineering, industrial projects (tools and implements), technical training.
UNITED STATES

FRANKLIN J. AHIMAZ
Assistant Dean of Engineering
Cornell University
180 Uris Hall
Ithaca, New York 14850
Telephone: (607) 272-3834 or 256-6484

Will Work in the Following Areas: Africa, Asia, Latin America.

Representative Project Experience:

1946/66 - Selection of sites for small-scale hydro-power generation for small-scale industries in the rural area, Afghanistan.

1964/66 - Afghanistan; a rural brick-making plant for building out-patient wards for the Medical Ambulance Program in rural Afghanistan.

1969/71 - Industrial park study for Kahil that was later funded by Asian Development Bank.

1969/71 - Afghanistan; centrifugal pump manufacturing at Jaugalak in Afghanistan.

Fields of Capability: Hydraulic machinery selection and installation, pumping machinery selection, manufacture and testing, training programs for unskilled workers from rural areas.

MARIO J. DEL FA
906 C. Eagle Heights
Madison, Wisconsin 53705
Telephone: (608) 231-2167

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Spanish, Italian.

Representative Project Experience:

1963/64 - Argentina; ADECAR; packing plants owned by local livestock producers; Federal project created, funded and supervised by the Argentine Meat Board; total budget, m$N. 800,000,000, only m$N. 45,000,000 of which was spent in the two-year period.

Fields of Capability: Marketing, legal structure of firms.
THEODORE G. MARKOW
4229 Everett Street
Kensington, Maryland 20795
Telephone: (301) 933-5991

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Spanish, French.

Representative Project Experience:

1964/67 - Technical responsibility for planning and implementation of AID's Latin American regional projects in support of private enterprise/industrial development.

1968/71 - Asuncion, Paraguay; USAID Mission; private-enterprise development program in cooperation with the government of Paraguay and the Paraguayan private sector, including management development, investment and export promotion; advisor to the subsecretary of industry and commerce on area economic development.

1971/73 - Washington, D. C.; training programs in the field of business and public administration and industrial processes and techniques for groups of businessmen and individuals from developing countries.


Fields of Capability: Organization, coordination and supervision of industrial, commercial and management training program; financial and technological advisory services to industry; area economic development; management investment and export promotion.

DR. C. C. MURRAY
Emeritus: Regents' Professor, Dean of Agriculture, University of Georgia and Director of International Affairs, University System of Georgia
236 Westview Drive
Athens, Georgia 30601
Telephone: (404) 543-6214

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English.
UNITED STATES (continued)

Representative Project Experience:

1968 - Indonesia; Workshop on Food; NAS project.


1968 - Consultant to AID; member of research review teams in Afghanistan and Pakistan; made surveys in Cambodia, Vietnam and Bangladesh.

Fields of Capability: Production and processing of food crops, feed grains, forage, livestock and poultry.

RAYMOND J. PENN
114 Vaughn Court
Madison, Wisconsin 53705
Telephone: (608) 263-4790 or Cable: LANTENCEN Telex: 910-286-2778
233-2070 (University of Wisconsin, for Land Tenure Center)

Will Work in the Following Areas: Africa, Asia, Latin America.

Language Capabilities: English, Spanish.

Representative Project Experience:

1966 - AID mission to Dominican Republic to evaluate rural development program; "Agrarian Reform in the Dominican Republic: The Views of Four Consultants," Land Tenure Center Paper No. 42.

1970 - Served as member of a United Nations Development Programme team asked to evaluate agricultural development plans and potential in northern Malawi.

1972 - Assisted AID in evaluation of Lesotho's joint credit proposal to the International Development Association and the Agency for International Development; in Lesotho in March, consultations continuing.

1972 - Consulted in Venezuela with officials of Simon Bolivar University and FUDECO on land resource research program.

1973 - Agricultural member of an OAS team on employment opportunities in Jamaica.

Fields of Capability: Land economics, land-use planning, land tenure, natural resources, agricultural development.
J. L. SANDERS
College of Engineering
The University of Wisconsin-Madison
Madison, Wisconsin 53706
Telephone: (608) 263-2191 or 263-1612  Telex: UMECHENG MDS 910-286-2749

Language Capabilities: English, Spanish.

Representative Project Experience:

1966/68 - Mexico; Consultation to Industry in Northern Mexico; variety of topics.

1970/72 - Arizona; Consultation to Cattle Feeding Firm; optional feeding and buying strategies.

Fields of Capability: Applications of operative research and decision theory to agricultural decision problems.
INDEX
# INDEX OF ORGANIZATIONS

<table>
<thead>
<tr>
<th>Organization</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accion International Tecnica</td>
<td>20</td>
</tr>
<tr>
<td>Centro Cooperativo Tecnico Industrial</td>
<td>11</td>
</tr>
<tr>
<td>Centro de Desarrollo Industrial del Ecuador</td>
<td>6</td>
</tr>
<tr>
<td>Centro de Investigaciones y Asistencia Tecnologica del Estado de Oaxaca</td>
<td>16</td>
</tr>
<tr>
<td>Centro Nacional de Productividad (Mexico)</td>
<td>16</td>
</tr>
<tr>
<td>Centro Nacional de Productividad (Peru)</td>
<td>18</td>
</tr>
<tr>
<td>Developing World Industry and Technology</td>
<td>20</td>
</tr>
<tr>
<td>Development Alternatives, Inc.</td>
<td>21</td>
</tr>
<tr>
<td>Ferocem International Co., Ltd.</td>
<td>3</td>
</tr>
<tr>
<td>Fundacion Para el Fomento de la Investigacion Cientifica y Tecnologica</td>
<td>4</td>
</tr>
<tr>
<td>Gandhian Institute of Studies, Appropriate Technology Development Unit</td>
<td>12</td>
</tr>
<tr>
<td>Garg, Sri M. K.</td>
<td>12</td>
</tr>
<tr>
<td>Georgia Institute of Technology, Economic Development Laboratory (Industrial Development Division)</td>
<td>22</td>
</tr>
<tr>
<td>Instituto Nacional de Fomento y Asesoria Municipal</td>
<td>5</td>
</tr>
<tr>
<td>Intermediate Technology Development Group, Ltd.</td>
<td>7</td>
</tr>
<tr>
<td>International Rice Research Institute, Department of Agricultural Engineering</td>
<td>19</td>
</tr>
<tr>
<td>Irish Management Institute</td>
<td>14</td>
</tr>
<tr>
<td>Iyengar, M. S., and Associates (P), Ltd.</td>
<td>13</td>
</tr>
<tr>
<td>Kilkenny Design Workshops</td>
<td>14</td>
</tr>
<tr>
<td>Korea Institute of Science and Technology, Techno-Economics Group</td>
<td>15</td>
</tr>
<tr>
<td>Mississippi Research and Development Center</td>
<td>23</td>
</tr>
<tr>
<td>Overseas Development Group</td>
<td>7</td>
</tr>
<tr>
<td>Partnership for Productivity</td>
<td>24</td>
</tr>
<tr>
<td>Save the Children Federation</td>
<td>24</td>
</tr>
<tr>
<td>Seaton International Trade Corporation</td>
<td>25</td>
</tr>
<tr>
<td>Societe d'Aide Technique et de Cooperation</td>
<td>9</td>
</tr>
<tr>
<td>Stone, Ralph, and Company, Engineers</td>
<td>25</td>
</tr>
<tr>
<td>System Planning Corporation</td>
<td>26</td>
</tr>
<tr>
<td>University of Nigeria, Department of Marketing</td>
<td>17</td>
</tr>
<tr>
<td>University of Science and Technology, Technology Consultancy Centre</td>
<td>10</td>
</tr>
<tr>
<td>Volunteers in Technical Assistance</td>
<td>26</td>
</tr>
</tbody>
</table>
# INDEX OF INDIVIDUALS

<table>
<thead>
<tr>
<th>Individual</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahimaz, Franklin J.</td>
<td>37</td>
</tr>
<tr>
<td>Ardayfio, David</td>
<td>33</td>
</tr>
<tr>
<td>Butler, George P.</td>
<td>34</td>
</tr>
<tr>
<td>Chander, J.</td>
<td>29</td>
</tr>
<tr>
<td>Clement, George H.</td>
<td>29</td>
</tr>
<tr>
<td>Del Fa, Mario J.</td>
<td>37</td>
</tr>
<tr>
<td>Dhungana, Bhavani</td>
<td>35</td>
</tr>
<tr>
<td>Fajardo, Herminia Rosales</td>
<td>35</td>
</tr>
<tr>
<td>Gibbon, David</td>
<td>31</td>
</tr>
<tr>
<td>Giorgis, Getinet Wolde</td>
<td>32</td>
</tr>
<tr>
<td>Hvelplund, Frede</td>
<td>30</td>
</tr>
<tr>
<td>Lee, Joan</td>
<td>31</td>
</tr>
<tr>
<td>Markow, Theodore G.</td>
<td>38</td>
</tr>
<tr>
<td>Murray, C. C.</td>
<td>38</td>
</tr>
<tr>
<td>Penn, Raymond J.</td>
<td>39</td>
</tr>
<tr>
<td>Sanders, J. L.</td>
<td>40</td>
</tr>
<tr>
<td>Sekarage, D. Don</td>
<td>36</td>
</tr>
</tbody>
</table>
Appendix

QUESTIONNAIRE
Name of Individual or Organization

Person to Contact

Mailing Address

Telephone

Cable

Telex

. Willing to work outside your country to assist the development of small industries in rural areas: yes no

. Willing to work in the following areas: Africa yes no

Asia yes no

Latin America yes no

. Will not work in the following countries:

Professional staff available (no.):

Language capabilities of staff:

Project experience relating to development of small industries in rural areas:

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Title</th>
<th>Location</th>
<th>Project Activities and Budget</th>
</tr>
</thead>
</table>

Attach additional sheets if necessary.

Fields of capability (food technology, production management, etc.):
EMPLOYMENT GENERATION THROUGH STIMULATION OF SMALL INDUSTRIES

TESTING AND EVALUATION OF DOW CHEMICAL'S SOLAR STILL

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332
U.S.A.
TESTING AND EVALUATION OF
DOW CHEMICAL'S SOLAR STILLs

by
Kermit C. Moh

Office of International Programs
Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY
November 1977
# Table of Contents

Summary  
INTRODUCTION  
DOW CHEMICAL'S ANALYSIS OF THE PERFORMANCE OF ITS SOLAR STILLS  
DESCRIPTION OF APPARATUS  
PROCEDURE AND SET-UP  
RESULTS  
CONCLUSIONS AND RECOMMENDATIONS  
APPENDIX: HISTORY OF SOLAR DISTILLATION  

* * *

## Tables

1. Water Output from Stills Using Trycite  
2. Data from Stills; Trycite on Still A, Clear Flexible Vinyl on Still B  
3. Data from Stills; Polyethylene on Still A, Tyril on Still B  
4. Data from Stills; Clear Flexible Vinyl on Still A, Tyril on Still B  
5. Bacteriological and Chemical Results  
6. Solar Stills in Australia
Summary

In July 1977, the Office of International Programs, Georgia Institute of Technology, began to monitor the operation of two solar stills which had been constructed by Dow Chemical, U.S.A.

The purpose of this monitoring was to determine the performance of both the still and the plastic films supplied by Dow Chemical.

Four different types of plastic films were tested -- two from Dow Chemical and two from other companies. It was found that the Tyril by Dow Chemical produced the highest quantities of water but was extremely brittle. As a result, it was vulnerable to heavy rains and moderate to heavy winds.

The solar stills require some modification in design but are suited for local manufacture in LDCs.

Chemical and bacteriological tests were performed on the water going into and coming out from the stills. It was found that highly polluted water was put into the stills, and although the stills did not produce completely pure water, they did produce safe, drinkable water.

It is Georgia Tech's understanding that Dow Chemical is presently developing a film which produces the amount of water that Tyril does and yet is as flexible as a polyethylene film.

When developed, Georgia Tech would like to have the opportunity to test it along with a modified solar still. If successful, a demonstration project could be set up in one of OIP's counterpart organizations which are located in Africa, Latin America, and the Far East.
INTRODUCTION

In July 1977, the Office of International Programs (OIP), Georgia Institute of Technology, began to monitor the operation of two solar stills which had been constructed by Dow Chemical, U.S.A.

The purpose of this monitoring was to determine the performance of both the still and the plastic films supplied by Dow Chemical. In doing so, the stills were tested so as to determine how long they could remain in operation without requiring an operator's attention. Four different types of plastic films were tested: two from Dow Chemical, one from the Starrtex Co., and one from Union Carbide.

Monitoring of these stills was terminated October 7, 1977. During the time in which they were in operation, water output from each still was measured and the interior and ambient temperatures from each unit were recorded. Chemical and bacteriological tests were conducted on water going into and that coming out from the stills.

In order to manufacture the stills, Dow Chemical claimed that each solar still required from $12 to $15 of locally available material, $0.50 of U.S.-made solar plastic wettable film, and one to two man-days of local labor.¹/

The plastic films which Dow Chemical manufactured for these stills are covered by issued patents, while a patent on the still itself is pending. If Dow should obtain patent rights for this particular type of still, it intends to make the rights available at reasonable cost so as to encourage local enterprise to manufacture them.¹/

¹/ Letter dated July 15, 1977, from W. E. Walles of Dow Chemical to R. W. Hammond, OIP, Georgia Tech.
DOW CHEMICAL'S ANALYSIS OF THE PERFORMANCE OF ITS SOLAR STILLs

Before the Georgia Institute of Technology became formally involved in the monitoring of Dow Chemical's solar stills, Dow had already performed tests of its own.

From these tests, it postulated that in Australia, with a December insolation of 6,500 Kcal/m²/day (7,560 W hr/m²/day), a still with a surface area of 1.16 m² would produce 7.0 liters (28 cups) of distilled drinking water per day. At this production level, one still was expected to serve about four people, depending upon what other food they consumed. It was also found that the temperature inside the stills reached and maintained pasteurization temperatures. Storms, winds, and other natural forces were expected to cause the need for two to four film changes per year.¹

In conclusion, Dow stated that good quality drinking water could be made from sea water, contaminated well water and/or bacterially polluted water.¹

¹/Letter dated July 15, 1977, from W. E. Walles of Dow Chemical to R. W. Hammond, OIP, Georgia Tech.
DESCRIPTION OF APPARATUS

The solar stills which Georgia Tech monitored for Dow Chemical were of the dimensions 1.45 m x 1.00 m. The roof of the stills sloped in two opposite directions at an angle of approximately 23 degrees. Total surface area of the roof was 1.47 m² (1.47 m x 1.00 m). Therefore, the total amount of plastic film required per still was 1.83 m² (1.83 m x 1.00 m, allowing for the quantity needed to clamp the plastic on the still). There were 14 pans which made up the basin on each still. These pans were painted a dull black and held the water being put into the still. A door was on each side of the still which facilitated the replenishing of water to each pan.

When in proper operation, water from the basins would evaporate, condense onto the plastic film, and flow down into an aluminum trough which fed into a plastic tube. This tube extended out from the still and emptied its contents into a storage container. There was a container on either side of the still.

A temperature-compensated dial scale made by the Metro Equipment Corporation was used to weigh the distillate. Thermometers were used to record the interior temperature of each still and the ambient temperature.

Four different types of plastic films were tested. They were Trycite and Tyril, both plastics having a wettable surface and made by Dow Chemical; polyethylene, a plastic with no wettable surface from the Starrtex Co.; and clear, flexible vinyl which has a wettable surface and is made by Union Carbide.
PROCEDURE AND SET-UP

Upon receipt of the two solar stills from Dow Chemical, personnel from Georgia Tech and Dow set up these units on the roof of one of Georgia Tech's office buildings.

The stills faced south so that the maximum amount of sunlight would fall on them. They were supported by 4x4's and were about 30 cm off the ground so as to allow the distillate to be easily collected. As the roof of this office building was 21 stories high, some rather strong winds were expected. As a result, the stills were protected by a windbreak.

From July 12 through August 9, only the water output from each still was monitored. This was done to determine whether further testing of the stills was justifiable. Upon determining that further testing was necessary, the interior temperature of each still and the ambient temperature were recorded for the duration of the tests. When possible, all monitoring of the stills was done on a daily basis. However, they were not monitored during periods of rain, during the time when there was damage to the stills, or on some weekends. All monitoring took place at approximately 13:00 hours.

During this test period, the Solar Energy Lab at Georgia Tech recorded the total daily insolation readings. These readings were later compared with the daily water output from each still to obtain correlations between water output and total daily insolation.

Brackish water was used as input for the stills. The only exception occurred when bacteriological and chemical tests were conducted on water going in and coming out from each still. For these tests, the filthiest, most polluted nearby source of water was used as input for the units.

When measured, each still had the same surface area and, therefore, both required the same amount of plastic film. In order to test the different films, the following schedule was used:

- **July 12 - August 8:** Trycite (Dow Chemical) used on both stills.
- **August 9 - September 1:** Trycite used on Still A; clear, flexible vinyl (Union Carbide) on Still B.
- **September 2 - September 9:** Clear, flexible vinyl on Still A; Tyril (Dow Chemical) on Still B.
September 10 - September 18: Polyethylene (Starrtex Co.) on Still A; Tyril on Still B.
September 19 - October 7: Clear, flexible vinyl on Still A; Tyril on Still B.
RESULTS

All the data obtained from the two solar stills have been tabulated in Tables 1-5.

In Table 1, Trycite was tested on both stills. This plastic film was one of the earlier ones manufactured by Dow Chemical. It contained streaks in its structure which were not water wettable, and, as a result, water output was impaired. An average of 7.6 pounds of water (15.2 cups) was produced daily, with the high being 10 pounds of water (20 cups) when the total daily insolation was approximately 7,400 W hr/m$^2$. The film was rather brittle and required frequent changes during periods of heavy rains and/or moderate to heavy winds.

In Table 2, Trycite was tested on Still A, and clear, flexible vinyl on Still B. During the days in which the stills were in operation, the still with the vinyl covering had an average daily output of 4.8 pounds (9.6 cups) of water to Trycite's 3.9 pounds (7.8 cups), almost a one pound difference in output. During most of the test period, temperatures in both stills reached and maintained the pasteurization temperature (140°F or 60°C) and on several days even exceeded it. (This occurred with all the plastic films tested.)

The brittleness of the Trycite continued to be a major problem, causing several film changes. Dow Chemical was informed of this as well as the non-wettable streaks in the film. As a result, another plastic film (Tyril) was received from this company for testing.

Table 3 compares polyethylene to Tyril. The Tyril appeared to perform well, with an average daily output of 5.0 pounds (10 cups) of water. The maximum amount of water produced in one day was 7.1 pounds (14.2 cups) and this occurred when the total daily insolation was approximately 6,000 W hr/m$^2$. However, for all practical purposes, the polyethylene film on the other still produced no water at all. The water in the still would evaporate, condense onto the film and fall back into the basin. Thus, after eight days of testing, this film was removed and the vinyl from Union Carbide was reinstalled.

Table 4 shows the results of the flexible vinyl when compared to Tyril. Tyril produced a significantly greater amount of water than the vinyl did. Its high was 9.9 pounds (19.8 cups) of water versus the vinyl's 4.8 pounds (9.6 cups) of water. This occurred when the total daily insolation was
approximately 6,500 W hr/m². The daily average of the clear, flexible vinyl and the Tyril was 4.5 pounds (9 cups) and 7.7 pounds (15.4 cups), respectively. However, Tyril continued to have the same problem that Trycite had; that is, it was easily damaged by the forces of nature. From September 18 to October 7, the Tyril was replaced four times, while the vinyl was never replaced.

In Table 5, the results of the chemical and bacteriological tests are shown. Result #5 is the outcome of tests performed on a sample of the water being put into the stills. Results #1 and #2 are samples of water which were distilled by Still A, while results #3 and #4 are samples of the type of water which Still B distilled.

In summary, Table 5 shows that highly polluted water was put into the stills, and although the stills did not produce completely pure water, they did produce safe, drinkable water. The stills killed all the coliform that was in the feedwater, drastically reduced the amount of bacteria, and reduced the amount of dissolved solids in the water by at least 4.5 times. Turbidity and the color in the water were reduced, thus giving the distillate a clearer and more transparent appearance.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Still A (lbs.)</th>
<th>Still B (lbs.)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/11</td>
<td>13:50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/12</td>
<td>13:20</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7/13</td>
<td>13:15</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7/20</td>
<td>13:15</td>
<td>12</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>7/27</td>
<td>13:00</td>
<td>4</td>
<td>5</td>
<td>Output from 7/26, 13:25 hrs.</td>
</tr>
<tr>
<td>8/2</td>
<td>13:15</td>
<td>4</td>
<td>5</td>
<td>Output from 8/1, 14:00 hrs.</td>
</tr>
</tbody>
</table>

* Output measured to nearest pound.
Table 2
DATA FROM STILLS
TRYCITE ON STILL A, CLEAR FLEXIBLE VINYL ON STILL B

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water Output (lbs.)</th>
<th>Temperatures (°C)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Still A</td>
<td>Still B</td>
<td></td>
</tr>
<tr>
<td>8/9</td>
<td>14:15</td>
<td>2.9</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8/10</td>
<td>13:40</td>
<td>3.8</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>8/11</td>
<td>13:09</td>
<td>5.2</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>8/12</td>
<td>13:28</td>
<td>4.6</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>8/15</td>
<td>13:45</td>
<td>10.0</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>8/16</td>
<td>13:04</td>
<td>3.1</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>8/17</td>
<td>13:17</td>
<td>3.0</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>8/19</td>
<td>13:10</td>
<td>2.3</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>8/22</td>
<td>13:26</td>
<td>8.4</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>8/23</td>
<td>13:25</td>
<td>3.9</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>8/24</td>
<td>13:07</td>
<td>3.5</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>8/25</td>
<td>13:31</td>
<td>4.3</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>8/26</td>
<td>13:57</td>
<td>2.9</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>8/29</td>
<td>13:20</td>
<td>16.4</td>
<td>17.2</td>
<td></td>
</tr>
<tr>
<td>8/30</td>
<td>12:54</td>
<td>3.8</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>8/31</td>
<td>13:22</td>
<td>5.8</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>9/1</td>
<td>13:45</td>
<td>4.9</td>
<td>5.5</td>
<td></td>
</tr>
</tbody>
</table>
Table 3
DATA FROM STILLS
POLYETHYLENE ON STILL A, TYRIL ON STILL B

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water Output (lbs.)</th>
<th>Temperatures (°C)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Still A</td>
<td>Still B</td>
<td>Still A</td>
</tr>
<tr>
<td>9/11</td>
<td>9:50</td>
<td>0.7</td>
<td>7.1</td>
<td>32</td>
</tr>
<tr>
<td>9/12</td>
<td>15:04</td>
<td>0.4</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>9/13</td>
<td>11:38</td>
<td>0.4</td>
<td>2.8</td>
<td>33</td>
</tr>
<tr>
<td>9/14</td>
<td>13:09</td>
<td>-</td>
<td>4.1</td>
<td>48</td>
</tr>
<tr>
<td>9/15</td>
<td>13:21</td>
<td>-</td>
<td>6.1</td>
<td>54</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water Output (lbs.)</th>
<th>Temperatures (°C)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Still A</td>
<td>Still B</td>
<td>Still A</td>
</tr>
<tr>
<td>9/22</td>
<td>13:08</td>
<td>5.0</td>
<td>9.0</td>
<td>66</td>
</tr>
<tr>
<td>9/23</td>
<td>13:16</td>
<td>5.4</td>
<td>9.2</td>
<td>61</td>
</tr>
<tr>
<td>9/27</td>
<td>13:10</td>
<td>2.4</td>
<td>3.5</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>6.4</td>
<td>60</td>
</tr>
<tr>
<td>10/4</td>
<td>13:05</td>
<td>4.8</td>
<td>9.9</td>
<td>54</td>
</tr>
<tr>
<td>10/5</td>
<td>13:00</td>
<td>4.5</td>
<td>8.3</td>
<td>54</td>
</tr>
<tr>
<td>10/7</td>
<td>13:20</td>
<td>4.8</td>
<td>-</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Still A (Output)</td>
<td>Still B (Output)</td>
<td>Input to Stills</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 1 (Output)</td>
<td>No. 2 (Output)</td>
<td>No. 3 (Output)</td>
<td>No. 4 (Output)</td>
</tr>
<tr>
<td></td>
<td>9/21/77</td>
<td>9/21/77</td>
<td>9/21/77</td>
<td>9/21/77</td>
</tr>
<tr>
<td>Total Aerobic Plate Count (No./ml)</td>
<td>310</td>
<td>3,000</td>
<td>650</td>
<td>17</td>
</tr>
<tr>
<td>Total Coliform (MPN/100ml)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Color (Color Units)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Conductance (mmhos/cm)</td>
<td>20</td>
<td>16</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: Letter from Southeast Laboratories, Inc. dated September 27, 1977.
CONCLUSIONS AND RECOMMENDATIONS

The principle of solar distillation is a good one. Using this "free" energy to produce drinkable water is something that people all over the world require.

What Dow Chemical has manufactured is a still made out of locally available material and of very simple construction. However, some changes in the still design are required. One large pan should be used as the basin for the still instead of 14 small ones. This basin would contain baffles so as to reduce water disturbance within the still. Filling of the still should be very simple. Instead of reaching inside the still and filling each pan, a plastic or rubber tube which runs inside the unit could be connected to a container of water which is slightly higher than the still. The water level within the unit could be controlled manually by use of a clamp on the tube or automatically by using a simple metering device within the still to turn a valve on or off. For best results, automatic control of the water is recommended. This would reduce the probability of the still running dry (unless the outside container runs out of water) and also could keep the water at an optimum level. (Studies have indicated that a greater amount of water is distilled if relatively shallow depths of water are kept within a basin.)

The most important part of the solar still is the plastic film. Past tests have shown that without the right type of film, there would be no water output from the still. What is ideally required is a film which holds up to the forces of nature, does not deteriorate with time, and which absorbs the most infrared rays from the sun so as to produce a maximum amount of distillate. In the films that were tested, Union Carbide's vinyl was extremely durable but produced only about half of the distillate that Dow Chemical's Tyril did. However, Tyril is an extremely brittle film and is highly susceptible to wind and rain damage.

In conclusion, modifications are required on the stills before they can be introduced into a consumer market. No plastic film which was tested was suitable for use on a solar still. Either the water output was too low, or the film was easily damaged by the forces of nature. This does not imply that a film suitable for a solar still is not available. It simply means that such a film was not tested. Some films which might be of future interest for testing
are Du Pont's Weatherable Mylar, Tedlar, and Aclar. It is also Georgia Tech's understanding that Dow Chemical is presently developing a film which produces the amount of water that Tyril does and yet is as flexible as a polyethylene film.

If this type of film is developed, Georgia Tech would like to have the opportunity to test it. If successful, this film and a modified solar still could be used as a demonstration project in one of OIP's counterpart organizations which are located in Africa, Latin America, and the Far East.
APPENDIX
HISTORY OF SOLAR DISTILLATION

In order to obtain a perspective view of solar distillation, a brief history of its development is presented.

Over the centuries, man has used solar energy in distillation processes which have included the extraction of perfumes and medicines from flowers, herbs, grasses, etc. However, the earliest, most significant solar distillation plant on record was constructed in Las Salinas, Chile, in 1872. It was designed by Mr. Charles Wilson and was of the greenhouse type, i.e., it contained a shallow rectangular pool of salt water beneath a transparent glass cover which sloped downward in two directions. The still contained 64 separate water basins that were constructed of wood planking and had a framework made from timber with sloping glass covers. The total glass area was 51,200 ft$^2$ and the total water surface area was about 48,000 ft$^2$. When new, the still was reported to have produced approximately 6,000 gallons of fresh water daily, which was used primarily for the watering of mules. With the coming of the railroad, the purpose of the still was eliminated and, as a result, it no longer exists today.

No further significant work was noted until the years 1926-1930, when it was reported that studies were being conducted on simple glass-covered solar stills.

In 1952, with the creation of the Office of Saline Water (OSW), a great deal of interest was stimulated in the need to plan for future desalination. Several institutions and foreign nations became involved in this challenge.

One of the foremost people in the area of solar distillation has been Dr. Maria Telkes. She began her work at MIT in late 1942, and during World War II invented a small, inflatable solar still for use on life rafts. Eventually, more than 200,000 units were produced as standard equipment for life rafts on aircraft and ships. After World War II, Dr. Telkes continued her

---

research on small glass-covered solar stills and eventually proposed two
different designs -- one for the tropics and another for the temperate zones.
The tropic design had a symmetrical roof with glass sides which were sloped
at 45 degrees. In the temperate design for the northern hemisphere, the side
facing the south was made of glass and the north side of the roof was made of
a thin reflecting material which was tilted to best reflect the sun's rays
into the basin. From the studies done on these stills, Dr. Telkes concluded
that:

1. An insulated base was beneficial.
2. The efficiency increases with ambient air temperature.
3. Wind velocity does not have an appreciable influence on still
   productivity.
4. Shallow water layers in the basin were most desirable (less
   than 1/2 inch recommended).
5. Large solar distillers may use a continuous feed of seawater.
6. The glass surface could be used to catch rainwater.

She also had experimented with tilted wick stills sponsored by the OSW.
The still had a black fabric surface saturated with saline water. Plastic or
glass was used to cover this fabric and the whole still was tilted at a fixed
angle to best intercept the solar energy.

Many other people, institutions, and nations deserve to be mentioned, due
to the work that has been accomplished. A list of names and locations, fol-
lowed by brief explanations of what they accomplished, is presented below.

**Virgin Islands**

During 1948-1949, a small solar still was constructed in order to test
water output. This still was supposed to be a forerunner of a much larger
1,000-gallon-per-day (gpd) still. However, the proposed still was never built.
The smaller still was similar in design to some of those designed by Dr. Telkes
and, indeed, was constructed with her assistance.

**University of California**

Experimentation with solar stills has been going on since 1952. Major
emphasis has been placed on a small still which would provide enough water for
one family. However, some work also has been done on the tilted tray still and
has been continued by Horace McCracken.

-16-
University of Wisconsin

Research work on solar stills was begun in 1952. At first, research was done on a solar still made up of two horizontal eccentric tubes. The outer tube was inflated to reduce heat losses. The inner tube was nearly filled with saline water which was dyed black. Air was blown over this water so that the water vapor was carried to a condenser.

Later work involved designing several plastic-covered solar stills for the South Pacific islands and elsewhere. A typical still had a 12-foot-long by 2- to 5-foot-wide basin lined with butyl rubber, wooden or concrete distillate troughs, and a wooden framework covered with weatherable Mylar or Tedlar which was held in place with long plastic sandbags.

A study of the worldwide distribution of solar energy also was published by this university.

Battelle-Columbus

The Battelle Memorial Institute, Columbus, Ohio, has been involved in solar still research since 1953. They initiated their study by first conducting an investigation for the OSW concerning the multiple-effect evaporation of saline waters, using solar energy to generate steam. Then, in 1958, they operated a solar distillation research station at Daytona Beach, Florida, for the Office of Saline Water. This was the first station where different types of stills could be tested and their performance predicted. The station was in operation for seven years and during this time period tested 40 different types of plastic films. The most durable films lasted for four years and were Tedlar, weatherable Mylar, and Aclar. However, the exposure conditions were considered less severe than those of an actual solar still because of lower operating temperatures and lower-velocity winds.

After all these tests, the research station concluded that glass-covered basin stills were the most satisfactory of all those evaluated, taking into consideration every factor, i.e., construction methods, first cost, performance, and maintenance.

In 1967, Battelle conducted a brief study to determine if plastics costing less than one cent per square foot could produce water more cheaply than glass-covered stills. It was found that just the opposite was true.
In 1968, Battelle compiled a manual concerning the state of the art of solar distillation and it was published in April 1970.

George O. G. Löf

Dr. Löf began his work with solar stills in 1953. He served as a consultant to OSW and investigated several different methods for solar distillation. Among these were survival stills, basin-type stills, tilted-type stills, solar evaporators with external condensers, multiple-effect stills with membranes or plates, and focusing-type solar collectors for steam generation. He also designed a 12-inch-deep, basin-type solar still with interconnected bays which covered a total area of about 5,000 ft². It was originally designed for a site near San Diego, California, but was never built. However, a smaller scale of this still (2,450 ft²) was built at Battelle's Daytona Beach facility under OSW sponsorship. At a radiation level of 2,000 Btu/ft²-day, the average productivity was approximately 0.08 gal./ft²-day or 200 gpd for the whole unit.

Dr. Löf played a major role in evaluating solar desalting research and proposals in Spain, and in 1965 assisted the OSW in a cooperative program for building a solar still at Las Marinas, Spain. The design was similar to the one built at Daytona Beach and covered an area of 9,500 ft². A shallow basin was used (a depth of approximately 4 inches of salt water), but water output remained essentially the same.

Australia

In 1953, the Commonwealth Scientific and Industrial Research Organization (CSIRO) began to investigate solar stills as a way in which brackish water could be purified in remote areas. At first, tests were made of small 5 ft² Telkes-type stills. Emphasis was later placed on large, low-cost units. These units consisted of an asbestos-cement (Transite) tray measuring about 4 x 6 feet with a glass cover at a 10-degree angle to the horizontal and insulated on the bottom.

In 1963, CSIRO developed a bay-type, glass-covered solar still with each bay being 3.5 feet wide by 128 feet long. The bottom was lined with black polyethylene sheet with a thickness of 8 mils. Table 6 gives the locations where these stills were built.
Table 6
SOLAR STILLS IN AUSTRALIA

<table>
<thead>
<tr>
<th>Location</th>
<th>Date Built</th>
<th>Evaporating Area, ft²</th>
<th>Projected Glass Area, ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muresk I</td>
<td>Dec. 1963</td>
<td>4,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Northam</td>
<td>Dec. 1964</td>
<td>4,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Perth</td>
<td>Dec. 1966</td>
<td>?</td>
<td>5,400</td>
</tr>
<tr>
<td>Muresk II</td>
<td>Nov. 1966</td>
<td>4,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Coober Pedy</td>
<td>Nov. 1966</td>
<td>34,000</td>
<td>38,000</td>
</tr>
<tr>
<td>Caiguna</td>
<td>Dec. 1966</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Hamelin Pool</td>
<td>Dec. 1966</td>
<td>6,000</td>
<td>6,800</td>
</tr>
<tr>
<td>Griffith</td>
<td>Aug. 1967</td>
<td>4,450</td>
<td>5,000</td>
</tr>
</tbody>
</table>


Algeria

In 1953, Cyril Gomella began developing several types of tray-type stills in Algeria. Eventually, 20 stills of 10 different designs were tested around the country. From these tests, a small unit consisting of a molded asbestos-cement tray, set on insulation and covered with glass, was put to wide use. The tray area was 33 ft², and the still was unique due to the fact that the glass covers were inclined only 10 degrees to the horizontal.

Italy

Under the direction of Dr. Giorgio Nelbia, the University of Bari in Italy initiated development work on solar stills in 1953. Most of the stills were of the small shallow-basin, tray-type design with a 45-degree roof. At first acrylic plastic (plexiglas) was used to make the entire still. Later, glass covers with wood, concrete, and other materials were used to make the stills. In 1958, a "vertical" solar still was built. It had four horizontal trays (one above the other) and was enclosed in glass. All the glass walls acted as condensing surfaces, thus giving a high water yield per unit of ground area.
In 1954, Bjorksten Laboratories built several types of large plastic-covered stills for the OSW. The intention was to develop a still which would be applicable to large-scale distillation plants. Tubular designs were also constructed and tested. Later a vertical-wick solar still was developed and evaluated at Battelle's Daytona Beach facility. Unfortunately, no useful data were obtained, due to wind damage and poor wettability of the wick material.

South Africa

As of 1954, South Africa has reported working on solar stills. There is much interest in the development of solar stills on farms and in small communities. Also, small-scale pilot plants have been constructed to evaluate existing designs.

Cyprus

During the summers of 1954 and 1955, several experiments were conducted on the north of Cyprus with small solar stills. These stills were of the shallow-basin type with 45-degree glass covers. Productivity in each unit was increased by completely sealing the stills to prevent vapor leaks and by using a reflector to concentrate the sun's rays.

Chile

Since 1955, research work at the Universidad Tecnica Federico Santa Maria in Valparaiso, Chile, has been conducted on solar energy. The idea was to use solar energy to both generate electric power and distill water. Solar ponds with concentration gradients were to be used to produce heated saline water for the system. The heated water would pass through a vacuum evaporator and the resultant steam would drive a turbine to produce electricity. The steam would then be condensed and distilled water would be produced. Further work on this system will depend on the availability of funds.

U.S.S.R.

During 1956, the Solar Energy Laboratory at the Krzhizhanovsky Power Institute in Moscow began to investigate the use of solar stills for supplying water to arid and semiarid lands. In doing so, it was found that only the
boundary layers within the stills circulated and contributed to the process of heat and mass transfer. The remaining volume remained relatively stagnant.

From 1961 to 1965, five experimental stills were tested at the experimental station of the Physics and Engineering Institute of Turkemenian S.S.R. Academy of Sciences to determine the optimum design for solar stills. From these results, a 25,800 ft$^2$ still was designed and construction was begun in 1969 at Ashkabad, Turkemia. When completed, this unit will distill water and collect rainwater. It will also be supplemented by well water which will use a pump run on solar energy. The sun's energy will be collected through the use of photovoltaic cells. Thus, this watering system for karakul sheep will be a total solar energy unit.

**France**

In 1956, the Laboratory of Solar Energy, National Commission for Scientific Research, Montlouis, France, combined the functions of a solar still with that of a hothouse to provide water and the appropriate climate for the growing of plants. A much larger unit was planned for the Sahara, but it is not known if it ever was constructed.

**Senegal, West Africa**

In 1956, experiments were conducted in Senegal on a small solar still being mass-produced by the Radiosol Company.

However, during the early 1960's, work at the University of Dakar, Dakar, Senegal, shifted from simple solar stills to solar energy systems producing electric power and fresh water. The vapor-generating plants used solar energy to heat water which, in turn, vaporized another heat-transfer fluid that drove a turbogenerator. The power generated was used to drive a pump which produced fresh water. The overall efficiency of this system was below one percent.

**India**

Work on tray-type solar stills began in 1957 at the National Physical Laboratory, New Delhi, India. Five different still designs were tested to determine the performance of various materials and the glass covers. A design was formulated for a 4,000 ft$^2$ still to be installed in a remote Rajasthan village, using wood frames, glass covers, and stabilized soil for the basin, but funds have not become available.
Iran

In 1957, three small glass-covered, basin-type solar stills were tested in Tehran, Iran. Double- and single-sloped glass covers were used, and one design had a cemented glass cover over the east, south, and west sides. Water-cooled copper coils were installed on two of the units to serve as the condensing surface.

Georgia Institute of Technology

From 1958 to 1961, the Georgia Institute of Technology, under contract with the OSW, studied both natural and forced convection solar still designs. Depending on the design and operating conditions, the productivities of the forced-convection stills were approximately double those of the standard, natural-convection stills. Several different ideas were tried so as to increase the rate of evaporation. Among these were: Orlon wicks, brine-spray nozzles, elevated brine trays, double covers, storage of the condenser cooling water for use at night in the basin, and multiple-depth trays within a single unit.

Spain

In 1958, two 20 ft² tray-type solar stills were constructed in Spain. In 1960, the testing of the stills was expanded to 10 different types. It was found that a conventional glass-covered still and a low-inclination cover was the most efficient design. In November 1963, Las Marinas was chosen as the first large-scale solar distillation plant in Spain. This installation was designed to provide water to 300 people. The 9,350 ft² still was completed in March 1966. Maximum distillate output approached 1,000 gpd, and rainwater also was collected. The water was sterilized and slightly mineralized before being drunk.

Franklin Institute

In 1958, work was begun for the OSW to determine a means of producing permanently hyrophylic surfaces on plastic films for use as solar still covers. A continuous dip-coating technique was developed for applying a titanium dioxide coating, and samples were run with cellulose acetate, Mylar, and Tedlar.
Sunwater Company

In the late part of 1959, Horace McCracken began selling solar stills commercially. These step-inclined-tray stills used a porcelain-enameled steel tray and a glass cover. The available sizes ranged from 1/2 to 3 gpd. Currently, portable, residential, and commercial types are available which range in size from 1/2 gpd to 100 gpd and which have been installed at various locations in the southwestern United States, Mexico, and the Caribbean.

Egypt

In 1960, several small stills were tested by the National Research Centre, Cairo, Egypt. The first still was of wooden construction with a single glass pane as a cover. Later, stills had concrete basins for durability, with the largest one being 215 ft$^2$ in area.

Richard Hummel

In 1960, a design for a large-scale still producing 10 million gpd of fresh water was presented by Hummel and Rudd. The design consisted of two layers of wire-reinforced plastic covers. The lower covers were air inflated and covered bays 50 to 100 feet wide by one mile long. The elevated upper cover was stretched flat and covered an area of one square mile. Drainage of rainwater and high winds appeared to be some of the problems facing this design.

University of Arizona

In the spring of 1961, the University of Arizona, Tucson, Arizona, began developing a distillation system using solar energy to preheat the saline water for a humidification-dehumidification cycle. In this system, the heating of the saline water, the evaporating of a portion of it, and the condensing of the vapors were performed in three separate components. This was not an ordinary solar still, as solar energy was used to warm the saline water to a final temperature of 150°F before it was circulated through an evaporation chamber. The total area of the solar absorbers was 10,400 ft$^2$, and when tested in Mexico, they produced over 5,000 gpd.

McGill University

In 1961, the Brace Research Institute (BRI) of McGill University began to develop solar stills on several West Indies islands. Most of these stills were of the small tray type.
Taiwan

In 1961, Taiwan Normal University reported that research was being done on several small tray-type stills. The units were used on surrounding islands by troops and fisherman and had roof-type glass covers.

Japan

In 1961, an "earth-water collector" was developed in Japan. This unit was essentially a solar still without a brine basin. Water vapor was extracted from the soil and condensed on the cover. Tests were conducted at Tokyo, Mt. Mihara, Mt. Fuji, and on a desert in Pakistan to study productivity of various types of soils. It was found that at night distillation continued, but at a reduced rate. The average productivity of this type of still in Tokyo was one-fifth that of a conventional solar still.

Tunisia

Since 1962, the Solar Energy Group of the Tunisian Atomic Energy has been actively studying solar distillation. Stills ranging from very small (for use by two people) to large (14,000 ft² for the use of 2,000 people) have been constructed.

Tunisia hopes that by providing fresh water to the people, the people will, in turn, become more vigorous. The usually available drinking water is high in salt content (6,000 ppm or more) and it is felt that the energy required by the liver and kidneys to remove the salt greatly reduces the strength of an individual.

Aqua-Sol Inc.

Currently, Aqua-Sol Inc. is developing a small, portable solar still to produce 3 to 5 gpd. A new semirigid type of material has been developed for the cover.

Greece

In 1964, several solar stills were constructed on the island of Symi. Since that time, large solar stills have been constructed on the islands of Aegina (16,000 ft²), Salamis (4,200 ft²), Patmos (93,000 ft²), Kimolos (27,000 ft²), and Nisiros (22,000 ft²). Plastic covers for stills of this
size do not seem to last for any length of time. As a result, glass covers have been widely used and the stills with plastic covers were either replaced with glass or abandoned.

Cape Verde Islands

In 1965, an inflated, plastic-covered still was built on the island of Santa Maria do Sal in the Cape Verde Islands. Reynold Eckstrom of Aqua Sol, Inc. built the still to supply water to a hotel. Recent reports concerning this still state that it is operating well and the blowers for inflating the still need to be actuated each evening for only a few minutes.

Ethiopia

A 1965 report describes the design of a small solar still developed in Ethiopia at the Haile Selassi I University. The glass cover was single-sloped at 12 degrees and mounted over an insulated metal tray painted a dull black.

U.S. Water Conservation Laboratory

The U.S. Water Conservation Laboratory in Phoenix, Arizona, developed a simple desert-survival still in 1965. The still uses solar energy to distill water from soils and plants. The still is made by digging a shallow hole in the ground about 3 feet in diameter and covering it with a plastic film weighted in the center to form a conical shape. A container is placed below the center weight to catch the condensate water dripping from the plastic film to increase the amount of water from the soil.

Harold R. Hay

In 1961, Harold Hay developed the use of weighted V-covers for plastic-covered stills. In this design, some of the problems of the inflated plastic cover can be overcome. However, the valleys of the V-covers tend to collect rainwater and debris, and the plastic may be damaged by the movement of the pipes that are used as weights.

Mr. Hay also obtained a patent on an elaborate solar still concept. This still comprised a plastic cover draped over ridge beams and weighted in the valleys, movable and stationary brine trays, and a distillate reservoir built beneath the brine trays.
Pakistan

Since 1967, the Atomic Energy Commission has been investigating the feasibility of using solar stills to provide water for the arid Makran coastal regions. When funds become available, the proposed still will be similar to the one on Patmos, Greece, with a capacity of 18,000 gpd.

Solar Sunstill Inc.

In 1969, a plastic-covered solar still was marketed commercially by Solar Sunstill Inc., Setauket, Long Island, New York. The unit was of pyramid shape with a plastic cover and a square basin with a total surface area of 64 ft².

In summary, solar stills are presently going through a development phase and have yet to be accepted as established technology.
PROCESSES, MECHANISMS AND AGENTS OF TRANSFER
TO SUPPORT TECHNOLOGICAL DEVELOPMENT

PRESENTED AT PACIFIC SCIENCE ASSOCIATION THIRD INTER-Congress
July 18-22, 1977, Bali, Indonesia

by

Ross W. Hammond, Director
Economic Development Laboratory
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, Georgia 30332, USA
Talking to a group of one's peers about a complex subject like technological development is, at best, a difficult matter for the speaker. Hence, were it not for this beautiful setting in Bali and the opportunity to interchange ideas with the Congress participants, I would just as soon be back in Atlanta, Georgia, working away at domestic and international development projects.

The concept of technology transfer is simple. It is in the implementation of transfers where the complexity arises.

Reduced to simplistic terms, technology transfer which leads to technological development can be thought of as having three main elements -- reservoirs of technological information, a variety of delivery systems, and a universe of technology users.

As one examines these elements, however, the complexities of the transfer become more apparent. The reservoirs of knowledge are scattered all over the world -- in the minds of people, in libraries, in laboratories, in industries, in computers, and so on. One of the most persistent, vexing challenges about the reservoirs of knowledge is knowing where the technology is located so it can be retrieved. An essential characteristic of a good technology delivery system is knowledge about locations of and access to centers of technological information.
Often it is not knowledge that is needed so much as "know-how," the ability to translate technical information into a useful tool to accomplish some function. "Know-how" implies a certain pragmatic "how-to-do-it" ingredient based on analysis and experience. "Know-how" frequently resides more in the minds of men than in the written word.

On the other end of the technology transfer process is the universe of potential users of technology. There are millions of potential users of technology, and the scope and diversity of their technological needs is seemingly endless. As a member of an organization which strives to respond to all inquiries, regardless of their source or content, I can attest to the fact that Georgia Tech rarely receives a repetitious request for information. Since it is manifestly impossible with limited resources and people to know everything about everything, the importance of knowing where information is stored looms very large in such an operation.

Suffice it to state that tens of thousands of reservoirs of technology exist and that there are millions of potential users of some aspects of the technology. The problem is getting the technology which can be helpful moved out of storage and transmitted to the potential user in a useful form. This is where the technology delivery system comes into play and it is a critical aspect of technology transfer. The title of this presentation is "Processes, Mechanisms and Agents of Transfer to Support Technological Development" -- in short, delivery systems for technology.

What must an ideal delivery system do? First, it must identify the problem or fill the need. Second, it must identify and locate the technology which may solve the problem or fill the need. Third, it must deliver the technology to the user. Fourth, it must adapt, modify, and/or interpret the
technology for the user and assist in its utilization. Fifth, it must follow up to insure correct usage and continuing viability of the technological application. Finally, it must consistently repeat this process as often as required.

Obviously, there are few, if any, technology delivery systems which achieve this ideal consistently. They are less than ideal for any number of reasons.

Let us examine the ideal delivery system a little more closely.

**Identifying the Problem or Need**

Basic to technology transfer is an adequate and specific identification of the technological problem or need. Let me use two examples of requests we have serviced recently. The first of these was a request from a Korean manufacturer for information on the process of inside flocking of gloves. Flocking in this case is fastening of short cotton fibres on the inside of gloves to form a velvety surface. Our information scientists found some literature on the subject and got in touch with a flocking manufacturers association in the U.S. which was able to provide additional information for the manufacturer. This type of inquiry is specific enough that a search for appropriate information can be conducted and a response provided.

Another inquiry from a developing country came to Tech through the U.S. embassy there. It was simply a request for information on manufacturing processes for rubber products. This was a generalized question on a broad sector involving literally thousands of unidentified products about which countless publications exist. Such an inquiry has to be much more narrowly defined if an appropriate transfer of technology can take place. Inquiries generated by contacts in the field should be discussed in sufficient detail.
with the inquirer to insure specificity and an adequate description of the problem or need.

Location of the Technology

It is incumbent upon any organization that seeks to act as an information transfer center not to restrict its activities to those subjects about which it is expert, and to actively search out and establish communication with any and all information centers which it may have to tap. Every enterprise which is knowledgeable in one particular field must maintain a broad current awareness of what is happening in that field and what others are doing.

It is especially essential in the technology transfer field to have a knowledge of sources of information, data centers, and other organizations and individuals that can provide answers.

This requires a sustained effort of some size, a consistent networking program, and an allocation of persons and resources of some magnitude. For example, at the Economic Development Laboratory at Georgia Tech where we have established a technical referral information service, one seventh of the staff devote their time to this activity, approximately the same number of people that UNIDO is understood to have in a similar capacity in Vienna. These staff people have much larger back-up informational support from the Georgia Tech staff of 2,000 persons, from the largest scientific and engineering library in the southeastern United States, and an on-line computer network data base with more than 14,000,000 citations which can be searched for information. With all of this structure, the laboratory still has to go outside the system to obtain some answers, as happened in the previously cited case of the Korean glove manufacturer.
The point I wish to make is that the establishment of a viable technology information system is not a thing to be done casually -- it requires continuing allocation of usually scarce resources and a staff of qualified and well-motivated people.

Transfer of Technology

Assuming that the technological information has been found to respond to an inquiry, the question now arises -- how is the technology to be transferred to the user in a timely manner? There are, of course, many ways to transfer technology, ranging from the simplistic to the complex. The choice of delivery methods depends on what kind of technology we are trying to transfer -- is it printed technical information, patents, trade secrets, journals, reports and analyses, machinery, equipment, or know-how?

Printed technical information, patent descriptions, reports and analyses may be mailed to the potential user. Though widely used, this simple approach to technology transfer is less productive than other techniques. The continual provision of technical information in specific subject areas at periodic intervals also can be achieved by mail. Obviously hardware, such as imported machinery, equipment, and spare parts, requires different delivery methods.

In Georgia Tech's experience, the most effective transfer system for information is to provide the relevant information along with auxiliary services, information adaptation and modification, or interpretation directly to the potential user in a person-to-person interchange. This cannot always be done in the case of international technology transfer because of distance and expense and the frequent lack of an informed individual to effect the transfer to the potential user of the technology.
In Georgia this problem has been overcome by establishing a series of industrial extension field offices around the state manned by technology transfer professionals. One of the functions of these offices is to contact business and industry, ascertain the problem and information needs, and refer the problems and information requests to the main office, which then re-searches the inquiries. When answers are found, they are forwarded to the office originating the inquiry. Field people from that office then go to the business or industry which occasioned the action to deliver the required information, explain it where necessary, show how it can be useful to the business or industry, and provide any assistance that may be required after the technology has been utilized. Some proportion of the identified problems or technology requests never are sent to the main office because solutions can be provided at the field office level and continuously monitored thereafter.

This system has been highly successful in Georgia, achieving a much higher frequency of effective technology transfer than through simple provision of literature or other types of technology transfer. The system has been a major factor in company expansion, diversification, and employment generation.

In one African country, the national government has established a similar network with industrial extension offices in a number of cities of the country. In that country, the typical small businessman or industrialist who has problems or technical needs had no one to turn to prior to the establishment of these government offices. There are no equipment salesmen visiting the entrepreneur periodically, no manufacturers' representatives to provide technical advice, no one, in general, in the area who can or will help.

With the opening of the government offices, some assistance seemed in
the offing. A major problem then developed, since none of the people in the
government assistance offices had been provided with vehicles which would
permit all the area businesses and industries to be visited. On the other
hand, the small businessman or industrialist frequently had no means of
transportation and, indeed, any knowledge of the existence of the government
offices. Thus, only a small proportion of businesses and industries could be
reached and these were primarily in the immediate area of the government
offices. This technology transfer system has serious deficiencies which may
be overcome in the future, but this example highlights the need for more
careful planning and development of technology transfer systems.

An interesting example of technology development, transfer, utilization,
and diffusion originated in Ghana. Up until recent years, all the paper glue
and adhesives had been imported into that African country.

Scientists at the University of Science and Technology in Ghana devel-
oped a process and formula for taking quantities of plantain skin ash and
cassava starch in an aqueous solution and producing a first-rate paper glue.
This process utilized locally available products.

The technology was then imparted by a University unit, the Technology
Consultancy Centre, to a local entrepreneur who began producing the glue ac-
cording to the specifications provided by the University. In a short time,
the entrepreneur had obtained government and other contracts that enabled
him to corner the market for paper glue in Ghana. Thus, a virtually total
import substitution took place.

Then an apprentice of the entrepreneur with knowledge of the process
left him and established a similar production plant. Soon other competitors
appeared. The market for paper glue in Ghana became saturated.
The entrepreneur then looked outside the country and proceeded to establish plants in two nearby countries to serve the paper glue markets there. Again an import substitution is occurring and soon, perhaps, there will be a proliferation of competitors in the field.

In this case the University scientists who developed the process were the reservoir of knowledge and the Technical Consultancy Centre was the delivery system which imparted the knowledge and provided continuing assistance to the entrepreneur, or user of the technology. A considerable diffusion of the technology also occurred, first through establishment of competitive producers in Ghana, and then through establishment of paper glue plants in other countries.

To use an example closer to home, consider the various types of rice machinery which have been researched and designed at the International Rice Research Institute in the Philippines. In general, the machines are simple in design, use locally available components and materials, and are low in cost compared with similar competitive machines.

In this instance, the designs have been developed by an international organization and are available to interested manufacturers. What is the process for disseminating knowledge about these rice machines and for encouraging manufacture of them?

The design drawings are available to a would-be manufacturer, and a manufacturer could immediately start to produce these machines. He would be foolish to do so, however, without knowing the answers to a great many other questions, such as the following: What is the extent and nature of the market, which machines should be produced, what adaptations are needed by virtue of different country conditions, what kinds of competition exist? Since
small manufacturers seldom have the experience or staff to evaluate such questions, the International Rice Research Institute (IRRI) offers limited services to answer these and other questions for the manufacturer. In Thailand and Pakistan, IRRI has established offices to demonstrate the machines, investigate the markets for them, and to encourage the manufacture of selected rice machines. It is anticipated that other extension offices will be established in additional countries. This, then, will be an organization which designs machinery appropriate for use in rice-growing countries, which adapts and modifies the machinery to suit soil and crop conditions of various kinds in different countries, and which provides continuing assistance to manufacturers of the machines, to insure that manufacturers remain viable and profitable. It is, in my opinion, a very effective technology transfer mechanism. There are many other international groups involved in technology transfer mechanisms of various kinds.

The large role of the private enterprise sector as a mechanism for technology transfer for development has not been mentioned. The transfer of patented and other technology by private enterprise usually is done through one of several mechanisms, such as licensing, mergers, working agreements, satellite new ventures, or the contractual provision of know-how. It is usually thought of as a flow of technology from the developed to the developing countries, but is not always so. It may flow intracountry as well as intercountry.

Public and private sector research institutes provide another set of vehicles for technology transfer, as well as being depositories of technical information and expertise.

Education is the process of delivering knowledge and know-how to students, and in a long-term sense, education is a fundamental transfer process.
To the extent that an educational program has a technological thrust, it must be considered supportive of technological development.

The rapidly burgeoning communications and information science fields, such as satellite communications and linked computer data bases, show great promise as mechanisms for delivering technology to the user, to supplement the literature (reports, journals, periodicals, etc.).

It was never an intention to mention or list all of the processes, mechanisms, and agents of transfer to support technological development. Such a compilation would be tedious, boring, and not of great value. I have chosen rather to mention some specific approaches and to cite some examples for illustration purposes.

To this end, a few color slides can illustrate some of the mechanisms and processes which have been discussed.

(SLIDE PRESENTATION)

The thesis of this presentation is that in the transfer of technology from one location to another, the technology delivery system is a critical element. If well designed and if the system has adequate resources and is staffed with skilled, well-motivated people, the probability of successful technology transfer is greatly enhanced. Conversely, if the delivery system is incomplete in its design and implementation, it is likely to fail or enjoy only limited success. The various processes, mechanisms and agents of transfer must be carefully analyzed in the design of systems to transfer technology and those elements selected and utilized which provide the most promise of success. Finally, delivery systems must be compatible with the development objectives of countries such as employment, equitable income distribution
and self-sufficiency and with the social, cultural, and institutional structures of the countries.
EMPLOYMENT GENERATION THROUGH STIMULATION OF SMALL INDUSTRIES

ANALYSIS OF SMALL INDUSTRY DEVELOPMENT METHODS AND TECHNIQUES

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332
U.S.A.
ANALYSIS OF SMALL INDUSTRY DEVELOPMENT
METHODS AND TECHNIQUES

A Review of Selected Techniques
For Industrial Development

Prepared for
Agency for International Development

by
David E. Fyffe
Ross W. Hammond
Richard Johnston
John R. Kaatz
Nelson C. Wall

Georgia Institute of Technology
Atlanta, Georgia 30332
February 1978
# Table of Contents

Foreword ........................................................................................................... i

SMALL INDUSTRY DEVELOPMENT METHODS AND TECHNIQUES:

INSTITUTIONAL APPROACHES ........................................................................ 1-1

Industrial Development Centers ....................................................................... 1-2

General .................................................................................................................. 1-2

Kenya Industrial Estates ...................................................................................... 1-3

Industrial Development Center of Ecuador ....................................................... 1-6

Institute for Small-Scale Industries, University of the Philippines .................. 1-8

Industrial Development Centers in Nigeria ....................................................... 1-12

Productivity Centers ............................................................................................ 1-14

General .................................................................................................................. 1-14

Europe .................................................................................................................... 1-15

Asia ........................................................................................................................ 1-15

Latin America ....................................................................................................... 1-17

Conclusions .......................................................................................................... 1-18

Industrial Development Centers ....................................................................... 1-18

Productivity Centers ............................................................................................ 1-20

* * *

TECHNOLOGY TRANSFER SYSTEMS ................................................................ 2-1

The Nature of Technology Transfer Systems ..................................................... 2-1

Comparison of Environments for Technology Transfer ..................................... 2-2

Existing Techniques of Technology Transfer ..................................................... 2-4

Indirect Transfer Techniques .............................................................................. 2-4

Direct Transfer Techniques ................................................................................ 2-6

Technology Transfer Techniques for the Future ................................................ 2-8

Stumbling Blocks in Technology Transfer ........................................................... 2-9

Conclusion ............................................................................................................. 2-10

Figure

1. The Technology Transfer System ................................................................... 2-1

* * *

INDUSTRIAL EXTENSION FIELD OFFICES ...................................................... 3-1

Introduction .......................................................................................................... 3-1

Assistance Needs of Small Companies ............................................................... 3-1

Information ............................................................................................................ 3-2

Analysis and Recommendations to Correct Problem Situations ....................... 3-3
INDUSTRIAL EXTENSION FIELD OFFICES (continued)

Assistance Needs of Small Companies (continued)

Special Skills and Know-how
Techno-economic Analysis
Education

Industrial Assistance -- Objectives and Concepts

The Agricultural Sector Model -- Cooperative Extension Service

1862 Morrill Act
1890 Morrill Act
1887 Hatch Act
1914 Smith-Lever Act

Industrial Extension Field Offices in the United States

Georgia Tech's Industrial Extension Service

Assistance to Local, Area, and State Economic Development Groups
Technical Assistance to Small Companies

Industrial Extension Field Offices in Developing Countries

The Philippines: Institute for Small-Scale Industries
The Philippines: Small Business Advisory Centers
Nigeria: Industrial Research and Development Unit, University of Ife
Indonesia: Development Technology Center, Institute of Technology Bandung

Summary and Conclusions

Figures

1. The Role of an Adaptive Agent in Industrial Assistance
2. The Agricultural Extension Assistance Triad
3. Organization for Industrial Extension at Georgia Tech
4. Confidential Manufacturers Data Sheet Used by Georgia Tech Industrial Extension Service
5. Interview Card Used by Pilot Extension Office, UP/ISSI
6. Technical Assistance Activity Record Used by Pilot Extension Office, UP/ISSI

* * *

FINANCIAL INCENTIVES FOR INDUSTRIAL DEVELOPMENT

The Economics of Financial Incentives
Specific Tax Incentives
Tax Holiday
Tariff Policy
Accelerated Depreciation

The Effectiveness of Tax Incentives
FINANCIAL INCENTIVES FOR INDUSTRIAL DEVELOPMENT (continued)

Financial Incentive Programs in Less-Developed Countries

Brazil 4-8
Korea 4-10
Nigeria 4-11
The Philippines 4-11

References 4-17

Figure

1. Employment Effects of Changes in Capital Intensity and Output Level 4-2

* * *
Foreword

This report deals with selected methods and techniques utilized by various organizations to stimulate industrial development in a number of developing countries and the United States.

During the five-year period of the U.S. Agency for International Development's 211(d) grant to the Georgia Institute of Technology, the Georgia Tech staff has been able to observe the different approaches used in a number of countries by government, educational institutes, and other organizations. Obviously, a variety of techniques and approaches are being used worldwide. This report does not attempt to cover them all, but rather to focus on a selected few, which, in some cases, involves counterpart linkage institutions.

The first section of this report is a description of organizational approaches to stimulation of small industries, mainly various country systems of industrial development centers and an earlier version of these, productivity centers.

Since technology transfer, either through training or direct assistance, is the primary concern of many such centers, a discussion of technology transfer systems follows.

A third section deals with industrial extension field offices, a technique which has shown fruitful results in many places.

Finally, a fourth section deals, from the economist's point of view, with financial incentives for industrial development. Four countries are used as examples.

Obviously, when one considers the spectrum of factors which impact on industrial development potentials, the four subject areas are only part of the picture. However, they relate to organizing for industrial development, methods for transferring technology, and financing plans for industry, three very important considerations. There are lessons to be learned from the descriptions of methods and techniques included herein. More important, these techniques may have applicability in areas where they are presently not being utilized.

During the five-year period of the 211(d) grant, it has been of interest to observe the pronounced trend of developing country governments toward
increased emphasis on industrial development (and to a large extent, small-scale industry). Many factors are at work in this trend -- burgeoning populations and the need for employment generation, the smallness of enterprises associated with rural areas, the need for labor-intensive activities, the recognition that manufacturing is one of the better employment and income producers, the appropriate technology thrust, among others. Whatever the reasons, more and more national development plans seem to be stressing the need for small-scale industrial development. Some, but not all, of the international funding agencies are responsive to these initiatives.

Ross W. Hammond, Director
Office of International Programs
One of the critical challenges facing developing nations in the decades ahead is industrialization. Increases in the areas of population, food production, and mobility combine to create an overwhelming demand for new jobs, improved income distribution, and better urban-rural balance. This demand can only be met through better utilization of existing resources, and effective industrialization certainly offers an essential part of the total solution.

In the field of industrial development, the practitioners have for many years lived with what still must be regarded as tentative conclusions:

1. The contribution of industrialization to the fulfilling of the national goals of LDCs is at best complex, requiring a deep understanding of individual factor endowments (natural resources, capital, labor, and many others).

2. The existing knowledge of the industrial development process is very limited, unsystematic, and too localized to provide an adequate technical basis for effective transfer as an "industrialization policy."

3. There continues to be a need for an international institution to examine, evaluate, research, and illuminate those forces and values used in the development of small-scale industries as a technique of "industrialization" in a less-developed country (LDC).

At present, some 60 countries in Asia, Latin America, and Africa, representing well over 60% of the world's population, are entering the industrialization process as defined by the World Bank. The vast majority of these nations are newly independent and wish to define modes and strategies leading to the industrialization goals they have established. These LDCs have in general recognized the fact that the so-called "green revolution" has raised rural incomes, but it cannot by itself overcome the lack of productive jobs or increase wages to acceptable levels. The most promising solution available to them is that of industrialization.

In seeking to develop the industrial sector—and particularly the establishment and growth of small and medium-scale industry—LDCs have used a
number of types of institutional approaches. Typical of these approaches are two general categories of institutions: (1) industrial development centers and (2) productivity centers.

**Industrial Development Centers**

*General.* Industrial development centers (IDCs) often play an important role in the industrial development of a country, and they may have a particularly significant influence on the establishment and development of small and medium industry.

This section describes four industrial development centers in terms of their objectives, organization, and activities, together with other pertinent comments which might provide an insight into their reasons for success or failure. The centers described are located in the countries of Kenya, Nigeria, Ecuador, and the Philippines.

These four IDCs all have one paramount objective—the promotion of small and medium-scale industry. Other objectives include indigenous industrialization, import substitution, and employment generation.

Although their organizational structures vary, they share the common activities of training, conducting feasibility studies, securing finances for industry, and providing extension services, including management and technical assistance.

Other activities performed by some but not all of these centers include entrepreneur selection, shop services, technical information services, industrial park programs, research, publication, and regional cooperation responsibilities.

Kenya Industrial Estates (KIE) works to establish industries in industrial estates. The Industrial Development Center of Ecuador (CENDES) works as a formal autonomous organization to provide direct assistance to industry. The Institute for Small-Scale Industries of the University of the Philippines (UP/ISSI) is a university-spawned institution primarily providing academic course work to train competent people to be able to assist small-scale industries, but also providing direct industrial extension assistance. The Industrial Development Centers (IDCs) in Nigeria were created primarily to enable more Nigerians to enter private business and industry by providing entrepreneurs with technical and financial assistance.
A detailed examination of the four organizations, as they describe themselves, reveals interesting contrasts and similarities in modes of operation.

**Kenya Industrial Estates.** Founded by the government of Kenya in 1967, Kenya Industrial Estates (KIE) was commissioned to promote small and medium-scale industries in that country. It thus helps to put into practice a vital part of the government's development policy whose main aims are:

1. To facilitate the entry of indigenous people into the sphere of industrial production;
2. To raise the level of industrial output so as to provide suitable substitutes for manufactures that have hitherto been imported as well as increase the country's exports;
3. To impart managerial and technical know-how to the local industrialists by providing suitable training; and
4. To increase industrial employment opportunities.

KIE is currently working in two major industrial development areas, formally identified as the Industrial Estates Programme and the Rural Industrial Development Programme. The former deals with setting up industrial estates in the large towns and initiating and implementing industrial projects on the estates. The latter, on the other hand, involves the establishment of Rural Industrial Development Centres (RIDCs) in the smaller towns, with a view to raising the level of existing "grass roots" industry and starting off new industrial projects in the rural areas. By means of the rural program, KIE is helping to reduce the gap that exists between the towns and the countryside in employment and income.

Under the Industrial Estates Programme, KIE:

1. Makes available to local industrialists suitable factory premises for reasonable rents;
2. Conducts market surveys and feasibility studies for selected industrial projects free of charge to the industrialists;
3. Selects suitable entrepreneurs for the projects;
4. Assists selected entrepreneurs to obtain up to 100% loans for the purchase of machinery at reasonable interest rates so that the entrepreneurs raise only working capital; and
5. Provides technical extension services, such as the manufacture of dies and tools and repair services, on a no-loss basis.

Under the Rural Industrial Development Programme, KIE:

1. Provides a variety of extension services, including managerial and technical assistance and repair facilities, to the entrepreneurs;
2. Provides on-the-job training for entrepreneurs in the use of machines, and undertakes temporary production for demonstration purposes;
3. Identifies new rural industry, prepares feasibility studies, and selects suitable entrepreneurs who are provided with the necessary training; and
4. Recommends the extent of government participation in the projects, and follows up the projects according to plan.

The activities of KIE have continued to grow over the life of the project. Several industrial estates and Rural Industrial Development Centres have been established, and many projects have been formulated and implemented.

The following summary indicates the expenditure on different industrial estates and Rural Industrial Development Centres on building and civil works as of June 30, 1975, and the number of industrial units or approved projects under each estate's jurisdiction.

<table>
<thead>
<tr>
<th>Estate</th>
<th>Expenditure</th>
<th>Units or Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nairobi Industrial Estate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td>4,498,874.95</td>
<td>52</td>
</tr>
<tr>
<td>2. Nairobi Industrial Estate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase II</td>
<td>5,104,481.25</td>
<td>-</td>
</tr>
<tr>
<td>3. Nakuru Industrial Estate</td>
<td>6,699,654.95</td>
<td>21</td>
</tr>
<tr>
<td>4. Kisumu Industrial Estate</td>
<td>2,610,000.00</td>
<td>8</td>
</tr>
<tr>
<td>5. Mombasa Industrial Estate</td>
<td>2,935,420.00</td>
<td>17</td>
</tr>
<tr>
<td>6. Rural Industrial Development Centres</td>
<td>8,366,949.00</td>
<td>65</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Kshs 30,215,380.15</strong></td>
<td><strong>163</strong></td>
</tr>
</tbody>
</table>

Through June 1975 KIE had invested 30.2 million Kenyan shillings (Kshs)$^{1/}$ on infrastructure and buildings and advanced loans amounting to Kshs 15.3

$^{1/}$9.7 Kenyan shillings equalled US$1.00 in 1977.
million to entrepreneurs at Nairobi, Nakuru, and Kisumu industrial estates and Ksh 1.1 million to entrepreneurs at the four RIDCs in Nyeri, Kakamega, Embu, and Machakos.

In addition to investing funds in the construction of factory premises to house various types of industries, KIE also helped entrepreneurs to obtain loans for machinery and equipment for the manufacture of various items. With more industrial units being established in the several industrial estates, the investment in machinery and equipment increased steadily. Entrepreneurs were also very active in obtaining working capital necessary for running their businesses, and the local banks showed a readiness to come to the aid of the small manufacturers by providing financial support.

Despite the difficulties created by the unstable economic conditions in the world economy, the units in the estates recorded a steady growth and continued to offer more employment opportunities to the local people. At the close of the year, the 38 units that were reported to be in full production at the Nairobi Industrial Estate employed some 582 persons. The seven units whose implementation was completed by the end of the year, including such big units as canvas manufacturers, expect to create employment for well over one hundred persons.

Employment at the Nakuru Industrial Estates showed a remarkable improvement. The seven units in production created jobs for 162 people. More job opportunities were opened in the few units which were started at Kisumu Industrial Estate.

The products manufactured in the industrial estates vary widely from steel windows to wooden cloth pegs to zipper fasteners.

KIE achieves its assignment to promote small and medium-scale industry by being an economic catalytic agency that provides the essential services of market surveys, feasibility studies, selection of entrepreneurs, provision of capital loans, acquisition of factory premises, on-the-job training, technical extension, advice on machinery selection, and repair services. The level of KIE activity is shown by the establishment and successful operation of 163 different units or projects. The Kenyan program of industrial development assistance provides an excellent example of the use of industrial estates in the promotion, development, and growth of small and medium industry in a developing country.
Industrial Development Center of Ecuador. Since its creation in July 1962, Centro de Desarrollo Industrial del Ecuador (CENDES) has been the official institution in charge of providing technical assistance to new or existing enterprises, developing a wide range of industrial promotion activities, and preparing feasibility and prefeasibility studies in accordance with the priority requirements of Ecuador. CENDES, an autonomous legal entity, has its own patrimony and resources and operates as an organism ascribed to the Ministry of Industries, Commerce and Economic Integration.

The specific functions of CENDES include the following:

1. Carry out studies of industrial projects which are considered of high priority for the development of the country in order to obtain a better use of natural resources, local raw materials, and labor.
2. Identify investment opportunities and prepare studies for the installation of industrial projects directed so as to take advantage of both the regional and subregional integration as well as the world market possibilities.
3. Promote the establishment of new manufacturing plants, channeling national savings and foreign investment towards industrial activities.
4. Provide technical and administrative assistance to enterprises to stimulate their development and increase their productivity.
5. Act as a consulting firm in the study and implementation of investment plans for industrial entrepreneurs and promoters.
6. Compile, select, and disseminate technical information related to industry through a specialized service.
7. Implement the Conglomerates and Industrial Parks Programs as a means to achieve a balanced development of the country.
8. Cooperate with other public and private institutions in the performance of policies which favor industrial growth.

CENDES maintains permanent and close contact with all of the national institutions involved in the economic development of the country. This interaction is seen in the constitution of its Board of Directors—the main body—which is presided over by the Minister of Industries, Commerce and Economic Integration and includes the President of the National Planning Board, the General Manager of the Securities Commission-National Financial Corporation, the General Manager of the National Bank for Development, a representative of
the Chambers of Industry of the Coastal region, a representative of the Chambers of Industry of the "Sierra" or Inter-Andean region, and the Executive Director of CENDES.

The Executive Director is the legal representative of the Center. He is responsible for the main technical and administrative activities. There is also an Assistant Director-Technical Coordinator and a Regional Assistant Director who has his office in Guayaquil (Coastal region).

CENDES has Technical Divisions for Promotion, Project Studies, Agro-Industries, and Technical Assistance to Industry. It also has Working Units in charge of Conglomerates and Industrial Parks Programs, Industrial Demonstration Workshops, and a Technical Information Service (SIT).

The Promotion Division fosters the implementation of new industrial projects in the country, particularly those assigned to Ecuador within the Andean Subregional Integration Process, as well as those included in the Five-Year Plan for Transportation and Development, and encourages the active participation of local and foreign investors.

The Project Studies Division carries out prefeasibility and feasibility studies of projects that are considered of high priority to the development of the country, in accordance with national plans and programs.

The Agro-Industries Division performs prefeasibility and feasibility studies on integrated agro-industrial projects, involving raw material production of vegetable or animal origin, as well as the respective industrial processes, in accordance with national priority requirements.

The Technical Assistance to Industry Division, with the cooperation of the United Nations Industrial Development Organization (UNIDO) and through its Project ECU-533, provides an integrated consulting service to Ecuadorian industry in the following fields: business administration, managerial and cost accounting, production engineering, industrial engineering, quality control and standardization, technical information, and marketing. This service is provided by United Nations international experts and the CENDES technical staff.

The Conglomerates and Industrial Parks Unit prepares and carries out Conglomerates and Industrial Parks Programs. Under these programs, entrepreneurs are provided with basic infrastructure, buildings, public services,
technical assistance, and other services, under favorable financial conditions, to install their industries within these industrial parks. CENDES is also a shareholder in the Industrial Park Corporations.

Industrial Demonstration Workshops Unit, through a technical assistance service, promotes the installation of pilot industrial workshops in various zones of the country in order to improve the level of business organization of the artisan sector. The Industrial Demonstration Workshops operate as training and production centers which furnish new techniques concerning business organization, production and marketing systems, use of credit mechanisms, and other additional technical services.

The Technical Information Service (SIT) provides a permanent scientific and technical information service to industry to facilitate the accomplishment of projects and an adequate operation of the industrial plants. SIT offers a "Question-Answer Service" on industrial matters for interested entrepreneurs, publishes a monthly "Technical News Bulletin" with selected articles on a number of industrial subjects, and gives information on available patents and the transfer of foreign technologies.

CENDES has been highly successful in its program, which differs from the Kenyan program in that CENDES works directly with industry rather than exclusively through industrial estate activities. Through its various programs, activities, and services CENDES fulfills its obligations to small and medium-scale industry in all areas of Ecuador.

Institute for Small-Scale Industries, University of the Philippines. In cognizance of the need to accelerate the first stage of development and the promotion of local small-scale industries, the Republic of the Philippines and the Royal Kingdom of the Netherlands concluded on March 2, 1966, a bilateral agreement creating the Institute for Small-Scale Industries within the University of the Philippines (UP/ISSI). The collaboration of the two governments in the establishment and operation of the Institute was defined by a "Plan of Operation" pursuant to Article 2 of the bilateral agreement.

On March 10, 1966, the National Economic Council and the University of the Philippines concluded a Memorandum of Understanding delegating to the University the task of implementing the terms of the bilateral agreement. On March 25, the Memorandum of Understanding with the National Economic Council was confirmed by the Board of Regents of the University of the Philippines.
The major purposes of the University of the Philippines in the establishment of the Institute for Small-Scale Industries are to train competent people up to a level where they will be able to assist existing small-scale industries to increase productivity and to develop and promote new ones, to provide consultancy and extension services to existing small-scale and medium-scale industries, to conduct research on plant operations and make the results of such research available to interested parties, and to assume leadership in overcoming the various problems of small-scale and medium-scale industries needing the advice, stimulation, and assistance of consultancy.

Republic Act 6041, approved by the President of the Philippines on August 4, 1969, redefined the objectives of the Institute in the following vein:

1. To undertake continuous conduct of consultancy training courses, periodic seminars, and technical studies in the field of medium and small-scale industries with emphasis on Philippine industries;
2. To undertake technical studies and researches on request of various government agencies concerned with industrial development, interested private industries, and those concerned with industry;
3. To undertake study programs and research studies for the promotion of small-scale industries;
4. To undertake the publication of studies, monographs, research papers, articles, and other written works on small and medium-scale industry, with emphasis on those related to the Institute's objectives, for distribution to government agencies, private industry, and other interested parties; and
5. To perform all other acts as may be necessary for the achievement of its objectives and functions in accordance with the rules and regulations of the University, including the granting of research awards, prizes, scholarships, and fellowships.

To fulfill the Institute's objectives effectively, the operational units are divided into five functional groups:

1. Training Program
2. Research and Consultancy Program
3. Entrepreneurship Development Program
4. Industrial Technology Program
5. Regional Program
Directed towards small industries, these five programs offer the following services:

1. Training
   a. Management and technical services (short- and long-term)
   b. Seminars for selected industries
   c. Seminars on entrepreneurship

2. Research
   a. National surveys
   b. Provincial surveys
   c. Industry profiles
   d. Industry studies

3. Extension Services
   a. General information
      1) Regular publication of a journal on small industries
      2) Handouts and reports
      3) Library facilities
   b. General management consultancy
   c. Direct plant assistance
   d. Project feasibility studies
   e. Industrial and entrepreneurship promotion on the regional level

The stimulus provided by the regional dispersal and the rural industrialization schemes of the government inspired the Institute to establish a pilot extension project in Region VIII with offices on the UP College of Tacloban campus. Financial assistance to this pilot extension project is being given by the Georgia Institute of Technology under a USAID small industry grant. Region VIII is in the central southeastern part of the Philippines, and Tacloban City is the location of a branch unit of the University of the Philippines.

The pilot project is a three-year program aimed at stepping up rural industrialization efforts in Region VIII and enabling small industrialists and entrepreneurs in that area to avail themselves of UP/ISSI services and assistance. This helps lessen the industrial imbalance that exists between the different regions of the Philippines and the Greater Manila Area, where most of the industries are concentrated.
The most significant aspect of the pilot project is the experience that will be gained from it. It provides guidance for the planners in assisting similar programs or projects in the future. More of these extension institutes are to be set up in each region over the next 10 years. UP/ISSI will either draw upon the assistance of the different branch units of UP or, in areas where there are no existing units of UP, the support of established and recognized schools in the areas will be sought.

The Institute conducts a series of courses based upon the operational activities of each of the five functional groups:

- The Management Consultancy Course is a seven-month course to develop suitable management consultants for small and medium industries.
- The Regional Industrial Development Course teaches technical assistance in the field of regional development through advanced professional education, dissemination of knowledge, and practical training through supervised field work.
- The Low Cost Factory Automation and Advanced Production Management Course is designed to meet the need to maximize productivity in small and medium industries. The concept is introduced to train managers and engineers with the aid of demonstration projects in the low-cost automation laboratory and actual in-plant assignments in various industries.
- The Entrepreneurship Development Program promotes the development of small enterprises in the rural areas, generates self-employment schemes for potential entrepreneurs, encourages and develops the processing of local materials into salable goods, promotes the use of modern technology in small-scale manufacturing to enhance higher productivity, and develops entrepreneurial qualities and attitudes among potential entrepreneurs.
- The Manager's Course for Small and Medium Industries accommodates the request of industrialists for a part-time management course which provides the manager with a broad view of the functions of the industrial enterprise as well as the problems of industrial administration and affords the participants a chance to interact with fellow managers.
There are also special programs which supplement the more formal course work of UP/ISSI. These seminars deal with marketing, management, finance, and production.

The industrial development center concept embodied in the approach used by the Institute for Small-Scale Industries at the University of the Philippines is a comprehensive one that capitalizes on the teaching and extension capabilities of a large, multi-campus university. In addition to research, information dissemination, and direct service to industry, the UP/ISSI program is particularly concerned with education and training, with emphasis on industrial development through the upgrading of skills of entrepreneurs, managers, and foremen of small-scale industrial enterprises.

Industrial Development Centers in Nigeria. The Industrial Development Centers (IDCs) in Nigeria are a section of the Small-Scale Industry Division of the Federal Ministry of Industries. The most active IDC is the one at Owerri, which was established in 1962 by what was then the Eastern Nigerian Ministry of Trade and Industry (before the Civil War). In its early years, the Owerri IDC only operated in the Eastern Region, assisting small-scale enterprises with technicians provided by USAID/Nigeria, the International Labour Organization, and the Netherlands. The activities of the Owerri IDC were interrupted during the years of the war, and most of the buildings and facilities were severely damaged.

In 1971, the Federal Military Government again opened the IDC at Owerri as part of the National Development Plan. Some of the facilities have been restored since then, and the Owerri IDC is at present working with small-scale industries in the area. They have a staff of about 100, classified as technical officers, management/commercial officers, technicians, and support/administrative staff.

At present, the Owerri IDC is providing services to small-scale industries in Rivers State, East-Central State, and South Eastern State. The Center is headed by a director, and he was assisted until 1977 by a team of foreign consultants provided by the Ford Foundation. The IDC is made up of four divisions, each of which is divided into departments which may perform assistance or training as required. The following outline identifies the divisions and departments by functional title:
A. Technical Services Division (Non-Engineering)
   1. Leathercraft
   2. Textiles
   3. Ceramics
   4. Chemical

B. Technical Services Division (Engineering)
   1. Automotive
   2. Electronics and Electrical
   3. Metal
   4. Woodwork

C. Management Services Division
   1. Industrial Management and Training
   2. Economic Survey and Information

D. Administration Division
   1. General Administration
   2. Library
   3. Stores
   4. Accounts

The principal functions of the Industrial Development Center at Owerri are the following:

1. Technical appraisal of applications for loans.
2. Provision of industrial-technical services.
3. Training of entrepreneurs and staff.
4. Applied research into industrial products, involving the design of industrial products for small-scale industries, and management training.

Expansion plans for 1977-78 called for the staffing of new IDCs at Zaria and Igshogbo, but to date these are yet not operational. In 1976 the Federal Military Government, through the States Decree, redivided Nigeria into 19 states, and it was anticipated that eventually each state would have an IDC. This great expansion had not taken place at the end of 1977.

Nevertheless, the IDC at Owerri—although limited in its funding—has been by far the most successful small-scale industry development effort implemented in Nigeria.
Productivity Centers

General. The national productivity centers first came into being in Europe as a result of the post-World War II efforts to rebuild the continent. At that time, Europeans became aware of the considerable differences between the efficiency of their own production units and those of the United States. During the 1950s, the Marshall Plan to a great degree assisted in establishing the original productivity centers in Europe, and later this successful concept was duplicated in both Asia and Latin America.

Three principal ideas were prevalent in the original productivity centers established in Europe:

1. Mass production as a prime requisite for productivity growth.
2. Use of productivity techniques whose scope and cost were not proportionate to outlays; in other words, productivity without investment.
3. Establishment of a climate of cooperation and integration of groups in the form of unions and individuals in the economic and social system.

In a very general manner, the productivity centers soon became aware of the need for an individual productivity policy which would take into account the economic situation prevailing in the country as a whole and which could then be adapted as needed at the different levels of the economic structure. Over the years, the productivity centers have evolved to their present position within the national structure, which is between the government authorities (those responsible for national programming and research and others at the macro-economic level) and the private sector (individual firms, trade associations, and trade unions). The productivity centers, therefore, have access to certain sources of micro-economic information and, at the same time, exert influence on those who are responsible for the implementation of national planning objectives.

As a result of this evolution, a majority of the productivity centers have recognized that a better integration of productivity policies into the national development process as a whole can be obtained by extending the basic objectives of the national development centers and by playing a dual role with the national planning groups to include: (1) assistance or cooperation in the elaboration of national plans and (2) serving as a practical implementor of the fundamental objectives of these plans.
Europe. Generally speaking, the European productivity centers have the following characteristics:

1. Small centers, with very decentralized activities.
2. A "pioneer" role in developing new ideas and questioning traditional concepts.
3. Liaison with employer associations and trade unions.
4. A check and balance position between the different political groups.

Two basic types of productivity centers are identified: (1) those that are an integral part of existing public administration (Denmark, France, Spain, and Czechoslovakia) and (2) those considered to be independent organizations with varying degrees of commitment to industry, ministries, or others. In the past few years, nearly all productivity centers in Europe have been subject to a reevaluation of their role as a result of three trends: (1) the proliferation of "intermediary" service bodies, both public and private; (2) the increasing pressure of the future; and (3) the considerable mass of research being conducted on the efficient functioning of these types of organizations.

As a result of this "reevaluation" of the productivity centers in Europe, three developments have been identified to date:

1. Involvement of the negative elements into the centers (i.e., position on the Board or others).
2. Hiring of younger persons as staff members and allowing these to serve as "advisories" to the Board or Council.
3. More interaction with secondary groups, both public and private.

Asia. The position of the Asian productivity centers is not as clear as that of the sister organizations in Europe. The main factor may be the fact that the economies of the nations in Asia are mostly in the "development stage," while in Europe they are "developed." By and large, the productivity centers in Asia are considered to be independent institutions, but nearly all of them are under government authority and depend on government for subsidies and financial support. As a general rule, it can be said that the productivity centers in Asia operate at the micro-economic level, and very few have engaged in broad studies of productivity by economic sectors. The following country briefs are representative of the overall picture.

- Ceylon. The Management Development and Productivity Center has been supported by the United Nations Development Programme (UNDP) since
it started in 1969 or 1970. The center is under the administration of the Industrial Development Board of the Government of Ceylon. This organization replaced a private group that operated the Productivity Association and was concerned with different productivity improvement projects.

- **China.** The China Productivity and Trade Center (CPTC) has been sponsored in the past by the International Executive Service Corps, the Indo-Pacific Council, and others. At one time, the Volunteers for International Technical Assistance, Inc. (VITA) was providing staff support to the CPTC. The Center has been active in training programs and has worked closely with the Chinese Institute for Engineers, Chinese Society for Quality Control, and the Chinese Packaging Institute.

- **Hong Kong.** As early as 1967, the Hong Kong Productivity Centre was operational and was involved in several programs with the Asian Productivity Organisation. The Centre has conducted many training programs on specific techniques, such as methods study, quality control, plant layout, personnel management, and operations research, to mention a few.

- **India.** The National Productivity Council of India has training as its principal objective, followed by consultancy, productivity research, surveys, and promotion. In training, many programs related to industrial engineering have been offered in the past by this organization.

- **Iran.** In this country, the Industrial Management Institute has the responsibility for "productivity." The Institute started an extension service sometime in the late 1960s or early 1970s as part of the Fourth Economic Plan. Most of the assistance offered by this group to local enterprises has been in the area of management and finance.

- **Korea.** The Korean Productivity Center (KPC) has always been very much oriented to the government policy of export expansion and price stabilization through quality improvement and cost control. By 1969-1970, the KPC had installed the first electronic data processing system to be used in Korea.
Nepal. Several organizations are active in the field of productivity, such as the Ministry of Economics, Nepal Industrial Development Corporation, and others, but there is no productivity center per se.

Pakistan. Two organizations are active in this country, the Management Development Centre and the Pakistan Industrial Technical Assistance Centre. Most of their activities are in the area of training and development of skills.

Philippines. The Productivity and Development Center, sponsored by the National Economic Council, is responsible for the growth of productivity in this country. The Center provides training and gathers information for the entire region.

Latin America. It is difficult to provide a consistent overall view of productivity centers in Latin America due to the fundamental differences between them. Productivity centers in Latin America are very diverse, ranging from government agencies to independent private companies, from organizations that promote ideas and offer training programs to groups that act as direct consultants to private firms, from centers with staffs of over 300 persons to those with less than 10 employees.

There are 18 productivity centers in Latin America affiliated with the Interamerican Productivity Association; of these nine are of a joint nature (made up by both the official and public sectors), four are independent private agencies, and five are government agencies. They are closely associated with the executive authority and are either under a department of the government or have the status of legal bodies organized under civil law; all are nonprofit and are somewhere between a government organization and a technical institution.

The fundamental activities of these productivity centers in Latin America may be highlighted as follows:

1. All provide vocational training, but this may also include executive training or be limited to crafts and skills.
2. About half of them have programs to provide direct technical assistance to local companies. In some cases, this may include industrial sector studies, sectoral forecasting, and development of action programs. (The most advanced centers are those in Mexico, Peru, Venezuela, and Chile.)
3. About one third of the existing centers are greatly involved in the area of small-scale industries (Chile and Ecuador are at the top of the list) and are active in investment promotion, productivity measurement, and appropriate technology.

4. Nearly all of the productivity centers are very active at the regional level, and some have set up regional offices to conduct specific programs.

In summary, it may be said that the actions generated by productivity centers in Latin America have been of a positive nature, but restricted to certain areas. Most of the centers are, in general, uninformed of the changes in productivity that have been generated by present economic development. There continues to be no clear integration policy within the regions of Latin America.

Conclusions

This section has presented two types of institutional approaches common to LDCs which, in general, try to provide the methods and techniques required in the development of small-scale industries in different parts of the world.

Industrial Development Centers. The IDCs are oriented to serve and assist in carrying out the industrial development objectives and needs of a particular set of people. Unfortunately, these objectives and needs often are not clearly defined by the IDC. These institutions vary greatly in size, location, funding, and purpose, but most appear to have an interest in small to medium-size industries. The majority of IDCs appear to follow the guidelines suggested by Eugene Staley\footnote{\textit{Eugene Staley, The Role of Small and Medium Industry in Development}, paper presented at the U.N. Conference, Geneva, Switzerland, February 4-20, 1963.} a decade and a half ago:

1. Despite "economies of scale," manufacturing is not always more economical in large than in small establishments, and a country will achieve the most productive industrial structure by developing a well chosen combination of large and small manufacturing units. Development leaders in countries striving to accelerate the rate of industrial advancement will do well to give attention to the constructive possibilities in modernization and growth of small and medium industry. It is important, however, to stress selectivity in the choice of product lines and efficiency in production and business operations.
2. As a country moves through the transitional stages from a traditional toward a modern economy, the outlook is for household industry to be replaced (except for special functions) and for artisan industry to be transformed into modern service trades. The small but modern factory will rise in importance. Such factories, if well managed, have distinctly favorable prospects in the newly industrializing countries.

3. Some product lines and some situations offer opportunities for efficient small-scale manufacturing and others do not. Therefore, continuous research to provide up-to-date analysis of changing markets, production methods, costs, and other economic and technical factors is advisable in a program of small and medium industry development. It is also necessary to have some type of communication system, such as an industrial advisory service or industrial extension service, to carry to existing or potential entrepreneurs the information on which they can base sound investment decisions. Such a service should also encourage a progressive outlook among small entrepreneurs and keep feeding them improved ideas on the economic, technological, and management problems of their enterprises. These ideas should be based on the best modern techniques of production and management, suitably adapted to smaller-scale operations. Significant help could be given in the advancement of the newly developing economies by devoting more scientific and technological effort to the search for methods of increasing the efficiency of comparatively small-scale production units.

4. Among the practical measures which should be considered in designing a positive program to improve the efficiency and promote the growth of small and medium industry are: (1) industrial advisory or counseling services, (2) industrial training services, (3) industrial research services, (4) measures to improve small industry financing, (5) industrial estates, (6) marketing aids, (7) aid in procurement of materials and equipment, and (8) fostering interfirm assistance and industrial self-help.

5. A development program for small and medium industry should be reasonably comprehensive. Usually it does little good merely to set up an institution for making capital and credit more readily available without, for example, doing anything to improve techniques of production and management. Which factors are most strategic in the circumstances of a particular country should be determined in a preliminary survey. Valuable ideas can be had by studying the experience of other countries—for example, India, which has the best planned and most comprehensive small industry program among the less industrialized countries. However, it should be stressed that no system worked out in one country can be recommended in its entirety for another. Each country requires a set of measures tailor made in general approach and in detail to its own situation.
The four examples presented all appear to be developing well within their limitations and, in some cases (Nigeria), the IDCs are the only pragmatic, professional group providing a real service to the small-scale industry sector.

**Productivity Centers.** This institutional approach appears to be more formally structured and defined than IDCs, but less specifically focused on the development of small-scale industry within LDCs. Centers in the three geographical areas discussed (Europe, Asia, and Latin America) have the following common characteristics:

1. Attempts are made to define industries which should be given priority in their national development plan.
2. Critical surveys are made of the use of means of production. They are involved in planning and in the analysis of results.
3. Most concentrate on the training of human resources (including vocational and managerial training and the development of trainers) and on general dissemination of information.
4. Attempts are made to bridge the existing gaps of knowledge of existing techniques and how they are utilized.
5. Most serve as pressure groups that are constantly "preaching productivity."
6. Most participate in a loose network throughout the world of productivity centers, thus having access in some degree to the exchange of information and experience.
The Nature of Technology Transfer Systems

Technology transfer may be thought of as the movement of technical knowledge and information from one location to another with whatever adaptation that is needed to make it relevant to the new location. Such a generalized statement needs some modification, however, when technology transfer is considered in the international development sense. Here, technology transfer is generally viewed as the flow of technological knowledge and information from the developed countries to the developing countries. While there are many examples of such flows from one developing country to another, there is little doubt that the bulk of technology transfer at present stems from the developed countries and flows to the less developed countries.

Reduced to its simplest form, technology transfer can be thought of as having three main elements: centers of technical information, systems for delivering information, and a variety of users of the technology. Graphically, such a system may be diagrammed as shown in Figure 1. This figure is very deceiving, however, in that it does not portray the complexities of the technology transfer process, the multiplicity of centers of technical information, the difficulties of physical transfer and adaptation of technology, the potentially great numbers of end users, and the variety of their problems which the technology must address.

![Figure 1. The Technology Transfer System](image-url)

The centers of technical information are very numerous and are housed in many kinds of organizations and individuals. Industries, research centers, educational institutions, trade associations, libraries, governmental units, financial institutions, and a variety of other organizations may all be centers
of knowledge, as well as individuals with broad and specialized backgrounds and specific know-how competencies.

Technical information may be divided generally into (1) knowledge in the public domain, which in theory, if not in practice, is available to everyone and (2) private sector information, which is usually transferable through patents, licensing, trade secret sales, joint ventures, and like processes and hence is not readily available to every interested party.

Comparison of Environments for Technology Transfer

The great differences that exist in information flow and receptivity internally in the developed countries and in the developing economies add further restraints to an already difficult transfer process. Some of the readily discernable differences between the developed and developing countries that impact on technology transfer follow.

In developed countries, 30% of the labor force may be engaged in manufacturing and only 5% to 10% 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 are not as knowledgeable about manufacturing. It is not a common thing and they tend to think in agricultural-related terms.

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

In the developed countries, relatively high per capita income levels exist, as well as a large middle class. LDCs are characterized by 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 nonexistent. 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, developed country education systems are 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 Philip-
pines, for example, literacy is high but development is relatively slow,
especially when compared with South Korea where similar high literacy prevails.

In the developed countries, a high proportion of industry, large or small,
is indigenously owned. In the developing countries, the large companies are
frequently foreign owned or managed. Only the smaller industries tend to be
indigenously owned and operated. As recognition of this pervades nationalis-
tically oriented LDC governments, a greater interest develops in stimulating
the small industrial sector, for this is the home-owned sector of the economy.

Management problems are quite similar in nature in developed and develop-
ing countries, varying in degree with the different orders of scale found in
the developing countries. However, management advice and assistance is avail-
able from many sources, public and private, in the developed economies. In the
developing countries, it is much more difficult to obtain and is often beyond
the financial capabilities of those companies that may need it most.

Capital is more available in developed countries, less so in the develop-
ing 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. The traditionally low per capita incomes in LDCs provide in-
adequate 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).

In most developed countries there is a broad range of industrial sophisti-
cation, from low technology to extremely high technology. In developing coun-
tries, the range is characteristically low to medium technology, with primitive
often representative of the low side.

The average size of industrial enterprises is much larger in developed
countries. With smaller industries characteristic of developing economies,
there are fewer internal problem-solving staff positions in industry and thus a
greater need for technical information and assistance from outside. Technical
information and assistance is available in the developed countries from educa-
tional 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.

Many technology alternatives are available from a variety of 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. Inadequate systems of information transfer in most developing countries make the delivery of technology difficult and/or non-existent. The LDC entrepreneur really has relatively few technology alternatives to consider.

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

Existing Techniques of Technology Transfer

Indirect Transfer Techniques.

1. Mail response to inquiries and areas of interest. Indirect technology transfers fall into a number of categories, of which the simplest, most used, and perhaps the least effective is the use of mail services to transfer technological information. This technique has a number of drawbacks, including the danger of incorrectly interpreting the request which generates the transfer, the frequent inability of the user to adapt the technology to his specific needs, and the unreliability of the mail service in many of the developing countries. Moreover, since most technological information is written for a knowledgeable scientific or engineering audience, it may be difficult for the layman to understand and utilize. Sometimes, the language in which the technical information is produced poses problems to the user, who may not have fluency in that language.

In this written communication approach, requests for technological information are usually responded to by published materials which relate as specifically as possible to the inquiry. Most international technology transfer centers utilize this technique for transfers. The National Technical Information Service (NTIS) provides U.S. government documents to potential users, utilizing mail services as the delivery vehicle (it also uses representatives
in various countries to deliver and explain the materials). The Intermediate Technology Development Group in London utilizes the same delivery system for its documents, reports, and communications. The Office of International Programs at the Georgia Institute of Technology does the same both domestically and internationally. Citing these few examples is misleading, however, since almost every data center relies on postal services to respond to inquiries for technological information.

Another approach to this mail-response technique is to ascertain the general nature of technology interests of the user and to provide materials to the user on a continuing basis as they appear in the literature. Since such a procedure attempts to cover generally the users' areas of interest, it may or may not be useful to the potential user who has a very specific problem. It is a relatively time-consuming and expensive procedure as well. As an example of this kind of activity which can be cited was the effort made by the Georgia Institute of Technology to disseminate information on new processes, techniques, and products to the metalworking companies in Georgia. This involved a continuing search of all relevant literature, excerpting appropriate materials and incorporating these in a periodic bulletin to all of the metalworking companies in the state. This was well received by the companies, but examples of usage of the materials incorporated in the bulletins were never obtained, and it is doubtful if this type of approach is economically justifiable except under unusual circumstances or as a service of a professional or trade organization.

2. Newsletters and similar publications. Newsletters may be particularly useful as an intermediate step in the technology transfer process. Their greatest value is in providing answers to technology users as to where certain types of information may be obtained. In this way, the forwarding of inquiries or requests for information may be expedited. Newsletters, of course, are subject to the same disadvantages as other mail-response techniques, as mentioned above.

3. Use of intermediate transmitters. Frequently the source of an inquiry or request for technology is not the end user but an intermediate individual or organization that is aware of the need of the user and of the potential source of information. The intermediary forwards the inquiry or request to the information source, receives the reply, and relays it to the potential user of the technology. While this transfer may be done in person, most often it is done by mail, especially in the case of international technology transfers.
This technique has the disadvantages previously mentioned in connection with technology transfer by mail. In addition, it introduces a third party in the transfer. This may be good or bad, depending on the role the intermediary plays in (a) clarification of the request, (b) selection of the right information center, and (c) manner of delivery of the technology to the ultimate user. If, for example, the intermediary is capable of explaining the technology or how it might be utilized or adapted by the user to overcome the problem, the probability of a successful transfer is greatly enhanced. Successful examples can be cited involving research institutes, government organizations, universities, and a variety of other organizations as the intermediary in technology transfer.

**Direct Transfer Techniques.**

Direct transfer occurs when the holder of the technology has direct personal contact with the potential user. This permits a back-and-forth interchange of ideas, questions and answers, and a better understanding of the technology and its usage.

In this area, a number of different techniques are used. Some of these and their relative advantages and disadvantages are given below.

1. **Technology demonstrations.** An extremely useful way to illustrate the way a technology can be utilized is through demonstrations to the appropriate audiences. For example, in Pakistan and Thailand, offices of the International Rice Research Institute (IRRI) were established to further the utilization of research findings. One of the activities included encouraging the manufacture of IRRI-designed rice machinery. In order to demonstrate the utilization of these machines, audiences of farmers, industrialists, and government officials in Pakistan and Thailand were invited to observe field demonstrations of the equipment. These demonstrations successfully stimulated interest in the manufacture and marketing of various types of rice machinery.

The advantages of this technique are obvious. The potential manufacturer and user can observe operation of the machines, discuss the design, manufacture, and operation with knowledgeable personnel, and evaluate performance on the spot. Hence, this is a relatively effective technology transfer technique.

Two disadvantages are (a) it is time consuming and relatively costly to mount demonstrations in the field, and (b) an organizational framework must exist for promoting utilization of the technology.
2. Industry presentations. Closely allied to the demonstrations method described above are industry presentations. In this approach, a technology which can be useful to an entire industry sector can be demonstrated to representatives of companies in that industry sector.

When the mobile home industry in Georgia was first rapidly expanding, all of the companies were invited by Georgia Tech to an industry presentation on the use of gangnails in the assembly of roof trusses for mobile homes. Gangnail assembly of roof trusses was a new approach at the time and appeared to promise a better construction technique at an overall cost savings. This method was shown to approximately 20 mobile home companies, many of which subsequently adopted the technique.

3. Conferences, seminars, and group meetings. Meetings which involve both the holders and users of technology take many forms. They can be large conferences, seminars, symposia, workshops, or small group meetings. The major characteristic of these meetings is that they tend to relate to generalized subject areas (e.g., food, energy, transportation, etc.). As a consequence, they may provide valuable knowledge about the subject area and can create a state-of-the-art awareness, but they rarely provide solutions to the specific problems of the technology user. Hence, as an educational medium, such meetings can be useful, and they frequently result in an interchange of information between sources of technology and the potential user, perhaps after the meeting, which is helpful in the technology transfer process and problem solving. However, such meetings require preparation and various arrangements which can be costly and time consuming.

4. Direct technical assistance. Perhaps the most successful technique in achieving technology transfer occurs when face-to-face communication occurs directly between the source of the technology and the potential user. This type of contact permits a dialogue between the two parties and a better understanding of the nature of the problem and the conditions surrounding the problem. Explanation of the technology in question is also facilitated, and any needed adaptation can be discussed and implemented more easily.

Although this type of transfer is carried out in both the public and private sectors, it is perhaps done successfully most often in the private sector. Multinational companies, for example, have the organizational infrastructure and personnel to permit a transfer of either proprietary or public technical
information or know-how from one company location to another. Use of company personnel to perform the face-to-face transfer mentioned above is relatively easy and effective.

Face-to-face technology transfer through public sector organizations is not as well organized nor are there always public sector organizations which are staffed, skilled enough, or motivated to effect viable technology transfers to the user.

Technology Transfer Techniques for the Future

Obviously the existing mechanisms and techniques for technology transfer need further development, and new methods for technology transfer must be developed and implemented.

There are a number of approaches which are technically feasible and which have worked well in certain instances. They need further refinement and utilization where appropriate.

First, the use of computerized data bases has grown rapidly in the developed countries. These systems, which may contain millions of citations and abstracts in a variety of fields of endeavor, have considerable promise in the technical information search field. As the use of these data banks is extended both through advanced communications (satellites, etc.) and through establishment of new information systems in developing countries, we can expect a favorable impact on the technology transfer process.

Second, the concept of satellite "teleconferencing" seems intuitively to hold much promise. This involves the transmission of images and verbal communications via satellite from one part of the world to another. The audience can be large at either end of such a conference "call," or it may be one individual talking to another. Such a technology provides instantaneous communication, retains the face-to-face transfer characteristics, and is technically feasible in many parts of the world today.

Third, the use of industrial extension systems, modeled in part after the agricultural extension systems which have been successful in a number of countries, seems to be a trend which has merit. In the United States, the field office extension system of Georgia Tech has been successfully replicated by a number of universities. A number of Georgia Tech counterpart institutions in
developing countries have successfully established field offices within their own social and cultural context, notably in Nigeria, the Philippines, and Indonesia. In these field office systems, industrial extension activities are carried out at the grass roots level by professionals and other staff members in residence where the field offices are located.

Such extension activity requires two basic components: (1) a strong central unit which can be supportive of the field station personnel and (2) the outreach industrial extension field offices. Assuming that the field offices are staffed by knowledgeable, well motivated individuals who can obtain information, advice, and assistance from the central unit, the ingredients are then present for an aggressive, dynamic industrial extension effort. However, the field office staffs must be active in the promotion of their services, cannot be desk bound in their offices, and must be active in interviewing users of technology to determine how they can be assisted.

Stumbling Blocks in Technology Transfer

In addition to the complexities of technology transfer when long physical distances are involved, there are a number of pitfalls to be avoided.

Transfer without adaptation. All too frequently, technology is transferred unchanged from a developing country to an undeveloped area without regard to social, cultural, economic, political, and infrastructure differences. Sometimes such transfers work well, but frequently they fail because some minor adaptation of the technology to better suit conditions was not made. For example, one cannot transfer wetland rice machine designs to a dryland farming area without some modification of the machine designs.

Transfer without supporting services. An essential feature of successful technology transfer is the availability of maintenance services and spare parts. In some countries, agricultural equipment lies rusting in the fields for lack of such support activities. Numerous examples exist around the world of this type of problem in many fields of endeavor.

Lack of industrial extension infrastructure. Because industrial extension organizations charged with technology transfer are costly and require good staff people, they are sometimes established without all necessary support functions. In one developing country, extension offices were established by the government in major cities to serve industry needs. However, these offices were not
provided with vehicles. The result was that only nearby industrialists were able to visit these offices to obtain assistance. Those further removed from the office locations received little or no assistance. One must categorize such a situation as an incomplete technology transfer function.

Conclusion

There are a number of techniques and methodologies which can be utilized in the technology transfer process. The large variances in budgets, staffing, support, commitment, and other essentials in technology transfer make it impossible to generalize about the techniques and methodologies most appropriate for universal use. The individual situation must be examined, and the technique must be selected which is best suited to the circumstances and conditions surrounding the potential technology transfer.

Experience has indicated, however, that certain basic features are characteristic of most successful technology transfer systems. The system itself must be based on a comprehensive center of pertinent technical information, the delivery of technology must be as personalized as conditions will permit, and the individuals involved in transferring technology must be capable of discerning the particular needs and capabilities of the users of technology. In general, the most effective technique for achieving technology transfer involves face-to-face communication between the source of the technology and the potential user, institutionalized in a fully equipped industrial extension system with a strong central unit and strategically located field offices. Regardless of the system or techniques employed, however, successful transfers of technology are not likely to be made on a continuing basis -- particularly in a less developed country -- unless those responsible are sensitive to the level of infrastructure development, to the availability of essential supporting services, and to the social, cultural, economic, and political environment in which the technology is to be used.
Introduction

Small companies are a vital segment of the industrial base of every country. In the United States, for example, 97% of existing businesses (9.7 million) qualify as "small." They provide some 58% of private sector employment. Similarly, well over half of Japanese industrial workers are employed in small enterprises. Statistics for developing countries are not readily available, but small companies are certainly no less important and quite likely represent an even greater proportion of their industrial bases. The well-being of these small enterprises is essential to the industrial health of the country not only because of their direct contribution to the economy, but also because they are a necessary part of the infrastructure which supports larger enterprises.

In this section, the role of the industrial extension field office in small industry development is examined. Industrial extension activities in the U.S. are discussed and compared with similar activities in developing countries with which the staff of Georgia Tech's Office of International Programs has had direct contact. It is beyond the scope of this study to present a comprehensive analysis of industrial extension services throughout the world.

Assistance Needs of Small Companies

There appears to be widespread agreement that small companies need managerial and technical assistance not generally required by large firms. Although the technological level of the assistance may be different, the need exists in both industrialized and developing countries since, in both environments, it is generally true that small companies

1. do not possess the managerial and technical skills found in large companies,
2. do not have research capability to obtain answers to managerial and technical problems,
3. are unfamiliar with or have no access to reservoirs of managerial and technological expertise and information, and
4. are less capable of adapting off-the-shelf technology to their specific needs.

Managers of small companies are likely to view most of their problems as financial (i.e., inability to obtain adequate financing) since problems of every kind eventually affect cash flows. The real causes of the difficulties, however, may lie in managerial practices and/or inappropriate technology which company management cannot or will not recognize. What the company really needs is help in seeking out improvement alternatives and in coordinating a program of change. Obviously, the assistance needs in small companies are varied, but they generally fall into one of the following categories:

- Information needs
- Analysis and recommendations to correct problem situations
- Special skills and know-how
- Techno-economic analysis
- Education

Information. As pointed out by Bass,¹ most companies first seek outside help when they are faced with a technical problem and suspect that information is available somewhere to help them. The problem may pertain to product design, manufacturing methods, suppliers of equipment, standardization and standards, processes, or raw materials. They want an immediate solution to an immediate problem. In an industrialized country the problem may require advanced technology. For the most part, however, the needed assistance is not based on state-of-the-art technology, but rather on practical expertise and adaptation of relatively well-known technology. The following specific examples illustrate the types of information which are commonly requested:

1. Technical information
   - Information on systems to remove fumes and heat from a plant
   - Uses of wood waste

Alternative methods for generating CO₂
Modern technology in furniture manufacturing

2. Market information

- Users of commercial sand and quantity of sand used by each
- Markets for small forgings

3. Wage and salary information

- Survey of wages and salaries paid for comparable jobs in the labor area
- Information on the "overlay concept" for evaluating management

Analysis and Recommendations to Correct Problem Situations. Requests for information are often really introductions to the need for further assistance in problem analysis, evaluation, and adaptation of available methods or technology to suit the specific situation. The types of problems are varied and any classification scheme is likely to be inadequate. However, for convenience of discussion, the following is acceptable:

1. Profit improvement

The company is basically sound but with inefficiencies in operations and/or management controls which prevent the achievement of profit objectives. Typically, assistance efforts proceed by first examining expense items and then designing or improving systems to reduce costs and/or increase productivity. Profit improvement programs may also focus on quality, service, product development, or sales if these are roadblocks to better profit performance.

2. Organizational and personnel problems

Organization is a dynamic process and organizational problems may involve interpersonal conflict, organization structure, and more. Small businesses also may need assistance with wage policies, incentive programs, and personnel training.

3. Product development, marketing, and distribution problems

This category includes problems related to marketing and selling. Many medium-sized and even large companies do not have internal skills needed to conduct market studies in order to identify customer needs and sales opportunities. Small companies certainly do not have such capability.
4. Planning problems

Planning involves establishing business objectives and the policies and programs of actions that will achieve these objectives. Along with planning there must be an information system and controls to measure and guide the fulfillment of the plans. Planning without a control system will accomplish nothing. As Fuchs\(^1\) states, "Most companies grow like Topsy, carried along by a hard-driving entrepreneur, an inventive genius, a unique product, good timing, or sheer luck. But few of these make the big time without some planning."

Planning is required for virtually every major business activity and includes market planning, production planning, manufacturing planning, financial planning, and personnel planning.

5. Production-related problems

Many problems for which management seeks assistance are production related. For example, "Orders are being shipped late, back orders are increasing, customers are shouting for goods, inventories are high, what can we do?" Clearly what is needed in this instance is improvement in production planning, scheduling, and inventory management. Other problems include plant layout, material handling, quality, work methods, and technical processes. Each of these requires special expertise which is not usually found in a small company.

6. Management control systems

In order to remain effective, management control systems must change as the company grows and as goals are modified. Every company is dedicated to delivery of a quality product, on time, at a competitive price, and with costs which permit an acceptable profit. In order to achieve these goals, many facets of production, inventories, and costs must be continuously monitored and controlled. Obvious control needs are costs (material, labor, waste, capital, etc.), quality, production activities, and inventory levels. The relative importance of control needs and the design of specific control systems are determined only after thoroughly studying and understanding the operations and objectives of the company.

---

Special Skills and Know-how. Inevitably, occasions arise in any company when highly specialized knowledge or skill is needed and must be obtained from outside the company. Such needs may be either technical or managerial and may include process design, plant design, methods improvements, equipment design, job evaluation and rating, incentive systems design, accounting systems, and market analysis. There is invariably a need for training to accompany the installation of techniques and systems. In fact, there are two reasons why training is absolutely essential. First, teaching and training during the adaptation of new techniques and systems remove some of the fear of change and help to obtain acceptance and endorsement of the change. Second, training is necessary to ensure that the improved system will be effectively continued after the installation is completed. There is virtually no chance of this if the company personnel do not understand the technique or system and remain unconvinced of its benefits.

Techno-economic Analysis. Techno-economic analyses are concerned with evaluating the technological feasibility and the economic consequences of technological alternatives. Every investment decision should be preceded by such an analysis. Even equipment replacement decisions should involve an economic comparison of alternatives. As the amount of the investment increases, the depth of the analysis should be increased. Large projects such as new ventures, plant expansions, and new product introductions should not be undertaken without a feasibility study to evaluate the cost of plant and operations and the projected returns from sales. Such studies not only provide a profitability estimate, but, if they are well done, also result in a project plan.

Education. Each of the preceding types of assistance is concerned with the needs of an individual company. In every case there is an implied need for education and/or training of company personnel along with the needed information, problem analysis, systems design, or techno-economic analysis. In addition to this education and training which should (and inevitably will) accompany other forms of assistance, there is a need for continuing education to upgrade the business knowledge of managers of small companies.

At the beginning of this section it was stated that managers of small companies do not generally possess the managerial and technical skills found in large companies. This is particularly true in developing countries. In
Nigeria, for example, surveys conducted by Aluko\(^1\) revealed that "... out of 27,350 industries investigated only three university graduates were proprietors while up to 98 percent of the proprietors were either drop-outs from primary, secondary schools or teacher training institutions, and very few were literates in the modern sense. Consequently, the level of performance, technological and managerial, was low and static. Very few even know how to keep accounts, deal with banks, insurance or other financial institutions or keep abreast with modern relevant technology and industrial techniques." Clearly there is a need to provide managers of small businesses with knowledge of good managerial practices. This need cannot be met economically by the individualized assistance discussed earlier. There is, therefore, a need for group educational programs and courses.

**Industrial Assistance -- Objectives and Concepts**

The problem of providing managerial and technical assistance to small firms is well recognized. It is reasonable to think that the industrialized nations would have solved this problem and that the need would exist principally in developing countries, but this is not true. It is true that in most industrialized countries there are a complex of sources, both public and private, for technical and managerial assistance to small firms. It appears, however, that these efforts are inadequate or, at least, not completely effective. Pearson\(^2\) contends that the United States is weak in technology commercialization programs, and he compares U.S. technology utilization with that of European nations to support his contention.

In developing countries there is even a greater need for effective technical assistance to small companies, since most of their enterprises are in this category and, as pointed out previously, do not have the capability to locate and utilize managerial and technical information. The report of an ad hoc

---


advisory panel of the Board of Science and Technology for International Development[^1] states that:

Village level industry is important in many developing countries because it is labor intensive and capital saving. However, little of the scientific and technical information from developed countries is directly applicable to village industries; and, in any event, local customs often hinder the acceptance of improved technologies. Therefore, the information-assistance approach will differ from that for more advanced industries. Primarily, it must emphasize the development and adoption of technologies appropriate to the skills, resources, and attitudes of villagers.

Industrial extension field offices are the most frequently suggested approach for responding to industrial assistance needs. Pearson[^2] advocates an industrial technology extension service to serve as a local advisor to general industry in the U.S. and lists the following five interactive operating elements as important to success:

1. University affiliation
2. Experiment station
3. Resident experts
4. Local advisors
5. A coordinated education and training program

In their report on scientific and technical information for developing countries, the Ad Hoc Advisory Panel of the Board of Science and Technology for International Development recommends establishment of "Village Technology Centers" staffed entirely, or largely, by indigenous personnel. The principal function of the center would be to "identify technological needs, adapt available technologies as required, and introduce and disseminate appropriate technologies." Likewise, the report of an inter-agency team financed by the United Nations Research and Development Foundation emphasizes the importance of a "Technology and Development Center".

---


[^2]: Pearson, op. cit.
Nations Development Program and organized by the International Labour Office maintains that "if infrastructure, technical assistance, and credit were made available simultaneously and jointly, they would be many times more effective in the promotion of small and medium-sized enterprises than would be the sum of these services provided separately," and proposes the establishment of industrial technical assistance centers in the Philippines. The function of these centers would include the following:

- assistance in preparing project proposals and loan applications
- assistance in dealing with government agencies
- accounting and legal advice
- skill development
- adaptive technology development
- assistance in marketing
- assistance in product design
- collection and transmission of data

The general concept seems to be that a delivery system for industrial assistance should function as an "adaptive agent" as indicated in Figure 1.

---

Figure 1. The Role of an Adaptive Agent in Industrial Assistance

---

The role of the adaptive agent is to locate, interpret, adapt, and demonstrate general knowledge and research results for use in a specific situation. The adaptive agent also serves as a link between the small company and the generators of new knowledge by observing and correctly perceiving the needs of small businesses and transmitting them as research needs. It is interesting to note that these concepts for industrial assistance delivery systems emphasize technology and tend to overlook the equally important need for management assistance.

The Agricultural Sector Model -- Cooperative Extension Service

Virtually all proponents for industrial extension centers cite the United States Cooperative Extension Service (often called Agricultural Extension Service) as a model for industrial extension. This national system has foundations more than a century old and has existed in its present form for over 60 years. Its history can be traced through a sequence of legislative acts which surely include some of the most profound legislation enacted in the nation's history.

1862 Morrill Act. The first Morrill Act (introduced by Vermont Congressman Justin Smith Morrill) provided a number of 30,000-acre land grants to each state equivalent to the number in each state's congressional delegation at the time. These grants were to be used for at least one college in each state "... where the leading object shall be, without excluding other scientific or classical studies, to teach such branches of learning as are related to agriculture and the mechanic arts." The educational institutions established under this act are known as "land-grant colleges" and include some of the largest and most renowned educational institutions in the United States. The act was signed by President Lincoln only a few weeks after he signed the Organic Act creating the United States Department of Agriculture.

1890 Morrill Act. The second Morrill Act provided additional endowment funds for the land-grant colleges.

1887 Hatch Act. The Hatch Act provided for Agricultural Experiment Stations at one land-grant college in each state. A fundamental and widespread capability in agricultural research was thereby established throughout the country.
1914 Smith-Lever Act. Agricultural extension activities were a natural result of the agricultural education and research at land-grant colleges. Individual states and farmers' organizations disseminated research findings of the experiment stations to rural areas. As these extension efforts increased, it became clear that coordinated federal support was needed. The Smith-Lever Act authorized cooperative extension work between land-grant colleges and the U.S. Department of Agriculture. It specifies that:

Cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting information on said subjects through demonstrations, publications, and otherwise . . .

It also provided for the funding and administration of agricultural extension activities as a cooperative arrangement involving three levels of government -- federal, state, and county.

The Cooperative Extension Service has functioned basically unchanged since it was established by the Smith-Lever Act. However, several later acts have intensified and expanded extension services. The system now operates in every state, with a land-grant college serving as headquarters for a network of local advisors (county agents) who are skilled agricultural experts in residence in virtually every county in the state. These local advisors are graduates of agricultural education programs. They live in the community, know its people, and are directly concerned with local agricultural and agribusiness problems.

In this system, the functions of identifying problems, planning, research and development, evaluating new knowledge, and applying it in the field are well integrated. In each state, the relationships between the county agents and the state agricultural experiment station at the university are very close. Agricultural education and research is motivated by feedback from county agents, and there is a constant stream of research results and technical information flowing from the institution to the county agents in the field. Experts in every agriculture-related field (e.g. soils, crops, structures, veterinary science, animal breeding and nutrition, forestry, and farm machinery) are available to respond to problems identified by the county agents. Typically, the county agent maintains an active role in the rural community. He calls on farmers, attends local meetings of farm organizations (e.g., Farm Bureau and
4-H Clubs), and assists agribusiness in every possible way. He perceives his major role as educational.

At the federal level, the U.S. Department of Agriculture also provides agricultural research and sponsors legislation and programs to support agricultural development. Thus the coupling between local/state/federal agricultural assistance is very strong. Also, the Cooperative Extension Service "fits" the model shown in Figure 1. The local county agent and his staff serve as an adaptive agent, and the system operates as shown in Figure 2.

Figure 2. The Agricultural Extension Assistance Triad
As Pearson\textsuperscript{1} points out, in the agricultural cooperative triad "the government identifies goals and supplies the funds needed to produce the public goods. The university extension controls research and development, and supplies the trained manpower needed to service industry and maintain its own research and development and training functions. Industry implements new technology within its productive process by incorporating technology directly from the extension service and by using the contribution of university trained manpower."

There is no denying that the U.S. Cooperative Extension Service has been successful. Agricultural production has increased steadily over the years, and the agricultural sector leads all economic sectors in productivity growth.

The U.S. is not the only nation with a cooperative extension service for agriculture. Many nations have agricultural extension agencies with similar objectives. According to an international directory of extension organizations, however, very few involve the triad of university/government/industry.\textsuperscript{2}

It seems unlikely that the agricultural extension field office system should or can be duplicated for industrial extension service. The two needs, although superficially similar, are distinctly different. Perhaps the major difference lies in the diversity of technological assistance which could conceivably be required of any industrial extension field office system. The technology of agriculture as a whole is diverse, but it is generally more homogeneous on a county or regional level. Farms in a given region tend to have the same set of crops and livestock, similar soils and weather conditions, and similar farming practices. In the industrial case, the major industries in a region may be resource based; however, there are no other natural forces which limit the types of industry. Any county or region may contain a large number of small firms producing both goods and services of many types. There may be literally hundreds of different product-related enterprises, each with different technological needs. No industrial extension staff of reasonable

\textsuperscript{1} Pearson, \textit{op. cit.}, p. 33.

size could possibly have the breadth of technological knowledge that would be required. It is essential that any industrial extension service include a back-up agency to which field office personnel may turn for a wide variety of technical information and research.

It is extremely doubtful that public sentiment in the United States, now or in the future, will permit the commitment of public resources to industrial productivity which have been and are being provided for agriculture. (It is estimated that in fiscal year 1977 more than $876 million of public funds will be spent by Agricultural Experiment Stations and the Cooperative Extension Service.) The major legislation which brought about the present system of agricultural extension services was passed when the United States was largely an agrarian nation and most voters were farmers. Foresighted government leaders of the time recognized that the strength of the growing nation lay in agriculture. Their wisdom is undisputed. Currently, the U.S. is the world's leader in agricultural production, but its economy is also highly dependent on industrial production. In spite of this, there is not the same attitude toward business as there is toward agriculture and certainly not the same propensity to assist business as there was to assist agriculture almost a century ago. For whatever reason, public attitude appears to be that industries in general have earned a reputation as exploiters of resources and people and that they should be regulated and heavily taxed rather than assisted.

Industrial Extension Field Offices in the United States

Although there is no counterpart to the Agricultural Extension Service, the United States Small Business Administration (SBA) serves small businesses throughout the nation. The SBA is an independent federal government agency created by Congress in 1953 to encourage, assist, and protect the interests of small businesses.1/ The agency attempts to carry out its mission through programs in the following areas:

- Financial Assistance to Small Businesses
  - Direct and immediate participation loans
  - Loan guarantees

---

Economic opportunity loans
Disaster loans

- Development Company Loans
  Loans to state and local development agencies

- Surety Bond Program

- Minority Enterprise Program

- Small Business Investment Companies (SBICs)
  SBICs are SBA-licensed companies which supply venture capital and long-term financing to small firms for expansion, modernization, and sound financing of their operations. SBA may make loans or guarantee 100 percent of the loans made by private lending institutions to SBICs to add to their own funds for financing small firms.

- Procurement Assistance
  SBA helps small firms to participate in bidding on U.S. government purchases.

- Management Assistance
  Courses
  Conferences, workshops, and clinics
  Counseling and individual assistance
  Technology utilization

These programs are made available to small businesses through a network of 85 field offices in major cities throughout the 50 states of the United States. Obviously, SBA assistance to small businesses—with an average of less than two field offices per state—is not comparable to agricultural extension with resident agents in virtually every county in every state.

In addition to the Small Business Administration, organizations of various types in many states in the U.S. offer assistance to small businesses, and several states have industrial extension centers connected with one or more of their universities. Only a very few, however, provide a network of field offices with resident specialists to assist local industry. Perhaps the oldest such service is operated by the Engineering Experiment Station at the Georgia Institute of Technology in Atlanta, Georgia.
Georgia Tech's Industrial Extension Service

The Industrial Extension Division, a component of the Engineering Experiment Station at the Georgia Institute of Technology, has a network of seven extension offices throughout Georgia. Georgia Tech's present program of industrial development assistance had its beginning in the mid-1950's with the establishment of the Industrial Development Division. The first extension office was established in Rome, Georgia, in 1961 with the objective of improving the economic level of the Coosa Valley area through the attraction of new industry. This objective has been only slightly modified over the years, and the present system of industrial extension offices strives to promote the economic level of the state of Georgia through economic development. Each office carries out activities aimed at attracting new industry and promoting growth in existing companies.

The Industrial Extension Division is now a unit of the Technology and Development Laboratory in the Engineering Experiment Station, as shown in Figure 3. Each of the field offices has a staff of from one to three professionals trained in engineering or business. The central office at Georgia Tech has an administrative staff of four. Industrial extension activities in the field offices may be divided into two broad categories: (1) assistance to local, area, and state economic development groups, and (2) technical assistance to small companies.

Assistance to Local, Area, and State Economic Development Groups. This portion of the extension office activities has the objective of bringing new industries into the area. It includes the following:

- **Encouragement of local organizations devoted to economic development.** The service provided to local development groups usually begins with organizational guidance and support. Where possible, use is made of existing organizations such as chambers of commerce and development authorities. Local groups are guided in the creation of committees within their organizations which can exercise responsibility for certain functions and policies such as financing, industrial site development, publications, transportation, utilities, manpower resources, governmental relations, and relations with existing industries.

  It should be emphasized that the purpose in assisting local development groups is to create strong local organizations and that the field office
Figure 3. Organization for Industrial Extension at Georgia Tech

President
Georgia Institute of Technology

Vice President
for Research

Georgia Tech
Research Institute

OFFICE
OF THE DIRECTOR
Engineering Experiment Station

SERVICES

Deans
Academic Colleges

OFFICE OF INTERNATIONAL PROGRAMS

ELECTROMAGNETICS LABORATORY

TECHNOLOGY AND DEVELOPMENT LABORATORY

SYSTEMS AND TECHNIQUES LABORATORY

APPLIED SCIENCES LABORATORY

RADAR AND INSTRUMENTATION LABORATORY

ELECTRONICS TECHNOLOGY LABORATORY

SYSTEMS ENGINEERING DIVISION

NUCLEAR RESEARCH CENTER

RADIATION SYSTEMS DIVISION

PRODUCTIVITY SYSTEMS DIVISION

SYSTEMS DEVELOPMENT DIVISION

SOLID STATE SCIENCES DIVISION

RADAR TECHNOLOGY BRANCHES

COMMUNICATIONS TECHNOLOGY GROUP

SYSTEMS TECHNOLOGY BRANCH

ELECTRO-OPTICS DIVISION

CHEMICAL AND MATERIAL SCIENCES DIVISION

EM EFFECTIVENESS DIVISION

SOLAR ENERGY AND MATERIALS TECHNOLOGY DIVISION

TECHNOLOGY DEVELOPMENT BRANCHES AND GROUPS

ELECTROMAGNETIC COMPATIBILITY GROUP

DEFENSE SYSTEMS BRANCH

INDUSTRIAL DEVELOPMENT DIVISION

ANTENNAS AND COUNTER-MEASURES DIVISION

ENERGY AND ENVIRONMENTAL ANALYSIS DIVISION

XM PROGRAM OFFICE

INDUSTRIAL EXTENSION DIVISION

Organization Engineering Experiment Station Georgia Institute of Technology

6-77
does not assume local development responsibilities. The office staff provides continuing guidance and assistance when their services are requested, but the local leadership must assume the responsibility for formulating local policies and decisions.

- **Assessment of economic, natural, and human resources in the area and identification of industrial infrastructure needs.** Another service provided to local and area development groups is that of economic research. Such work involves the collection and analysis of resource data in order to determine the potential of individual communities for economic development. The most common forms of publication of these data are "Economic Profiles," "Industrial Data Digests," and "Condensed Facts Sheets." Other types of economic research include information on existing industry, raw materials, wage rates, labor availability, utility services, transportation, and natural resources. Analysis of these data provide indications of the communities' assets and liabilities as related to economic development.

The extension office professional staff also assists commissions in making traffic and thoroughfare studies by supplying information concerning worker commuting patterns, potentials for industrial growth, industrial transportation needs, etc. Similar information is also supplied for the purpose of preparing proposals for federal grants and loans, legislative requests, and other needs related to infrastructure development.

- **Identification of potential industrial investment opportunities.** Resource assessment also provides a basis for realistic local and area action programs for attracting new businesses. Also, it serves to disclose manufacturing and service opportunities to supply the needs of established industries and helps to identify opportunities for expansion or diversification of existing firms. In many cases, the extension office staff prepares project feasibility studies for use in promoting industrial development.

- **Industrial site selection.** The extension office staff often assists local development planners in conducting land-use studies, recommending those areas of individual communities which should be set aside for and restricted to industrial use. Such recommendations are made after a thorough survey of the locations of existing industries, the potential for industrial growth, and available and planned transportation services, as well as available and planned utility services such as water, sewage disposal, natural gas, and electricity.
Extension office personnel also provide assistance in planning, developing, and promoting private and public industrial parks and districts.

Industrial site selection is another service provided to local and area development groups. These studies have produced data on numerous parcels of land (including maps, site sketches, aerial photographs, and data summary sheets on each parcel) and have emphasized the importance of controlling good land to ensure its availability at a reasonable cost. Site data are used in promotional work by the communities and are provided to area and state development agencies for their promotional use. Also, the data are readily available for consideration by industrial prospects.

- **Industrial recruitment and community promotion.** The industrial extension field office assists local and state development agencies in providing information to recruit industrial prospects. For the most part, this takes the form of a documented presentation prepared specifically for the prospect's requirements and may also include personal visits to the company headquarters as well as participation in meetings between the prospect and local representatives.

- **Liaison between local development organizations and other agencies.** Another important function of the extension office is that of providing liaison between the statewide development organizations and the local and area development groups. By maintaining active and participating membership in professional development organizations, area office personnel are able to maintain good contact with industrial development groups from utility companies, transportation companies, construction companies, and financial institutions. Through these contacts, area office personnel are able to assist in getting suitable communities in their areas considered for prospective industries.

**Technical Assistance to Small Companies.** In addition to area development assistance, another function that is equally important in creating jobs and upgrading a community's economy is management and technical assistance to existing firms. Such assistance is particularly needed in small companies that do not have large technical staffs or up-to-date technical and management libraries.

- **Background.** Direct assistance to industry by Georgia Tech's industrial extension field offices was initially carried out on a very modest scale because of limited funding. However, in 1965 the State Technical Services
Program was created by an act of Congress. Its purpose was to speed industrial and economic growth of the nation through dissemination of technical and scientific knowledge. The program was administered under the U.S. Department of Commerce and provided matching funds to states wishing to participate. In Georgia, the State Technical Services Program was administered by the Office of the Board of Regents of the University System of Georgia and implemented by three institutions of the University System -- Georgia Tech, The University of Georgia, and Georgia State University. Georgia Tech's principal mission under this program was to provide technical information and assistance to facilitate technology transfer to industries within the state. This act and its related funding provided the impetus for expansion of Georgia Tech's industrial extension field offices to the present level of operations.

In 1969 the federal program of assistance under the State Technical Services Act came under the influence of sweeping economy drives in the federal government. In spite of favorable accomplishments of the program, federal funding was discontinued and, on the national level, the program was dropped. The State of Georgia, realizing the value of the program to the state's industry, made a decision to continue the funding. The Industrial Extension Division is now financially supported by state funds (allocated through the Board of Regents of the University System), contracts from local and area development groups, and contracts and grants from federal agencies.

**Approach.** Initially the State Technical Services Program stressed transferring technology by providing pertinent technical publications in response to industry needs. It quickly became apparent, however, that when these technical publications were put in the hands of a plant manager, plant engineer, or entrepreneur, the information was often never used. It was found that, much of the time, technical publications required a great deal of interpretive work before the technology could be implemented. Also, even when interpretive work was done, direct technical assistance by field engineers was required.

The Industrial Extension Division is responsible for providing a major portion of the state's technical assistance to industry. Extension office professional personnel respond to requests from companies desiring assistance and also contact industries in their areas and, by plant visits and interviews with key company personnel, determine how they can best assist company growth.
During the initial visit to a company, the extension officer explains the various programs carried out by the Industrial Extension Division and obtains as much information about the company as possible. This information is noted on a confidential manufacturer's data sheet (see Figure 4) prepared during the interview. It covers production equipment and capabilities, raw materials and waste (which also includes air pollutants and water pollutants), sales and marketing, plant facilities and possible expansion plans, and an appraisal of the company's assistance needs.

Usually during this initial plant visit, the extension officer will have an opportunity to tour all of the manufacturing facilities. In many instances during this tour, he is able to make on-the-spot recommendations for improvements. It is sometimes very difficult, however, to get the company officials to disclose the company's problems and information needs. Often, if the official is reluctant to divulge such information, the extension officer is able to deduce from observations and conversations what the company's present and potential problems are.

As a result of this initial visit, problems requiring laboratory work or which are otherwise beyond the capability of the extension office are sent to the Industrial Extension Division headquarters at Georgia Tech in Atlanta. The assistance requests are screened and then assigned to either a researcher in the Technology and Development Laboratory or directed to specialists in other laboratories in the Engineering Experiment Station and the academic faculty.

In many instances, the extension officer finds that the information gathered by these specialists, while very pertinent to the company's needs, is too technical for the company personnel who will use it. In these cases, the extension officer must rely on his own technical background and knowledge of the company and its personnel to interpret and present the information sent to him. He may even provide direct assistance in implementing the recommended changes in management and/or technology.

There are no official limitations on assistance provided by the industrial extension field office. General practice, however, is to give priority to small companies and to limit the time commitment to approximately five man-days.
Figure 4. Confidential Manufacturers Data Sheet Used by Georgia Tech's Industrial Extension Service
Problems. During the almost 17 years that Georgia Tech has provided industrial extension services, certain problems related to this work have emerged which seem to be quite general.

- Gaining the confidence of industry. One of the major problems is gaining the confidence of the client company management. Characteristically, small company entrepreneurs and managers do not trust any organization that is in any way sponsored by the state or federal government. They all, to some degree, fear governmental intervention or governmental meddling. As a result, one of the first things that the extension office professional must do to gain the confidence of company management is to give convincing assurance that any information obtained will be held in strictest confidence and, specifically, will not be passed on to government agencies or competitors. The fact that extension office personnel live in the communities that they serve is certainly a major factor in gaining the confidence of local industry. This accomplishes two things: (1) it enables extension office personnel to better know the community and general problems and needs of local industry, and (2) it gives local industry the comfortable feeling that extension office personnel are part of the community and not merely agents of a big city governmental organization.

- Problem identification. Another common problem is the reluctance of a plant manager or entrepreneur to admit that problems exist. When extension officers first visit a company, they explain their desire and capability to assist in solving problems which the company may be having. The usual response is, "Oh, everything is fine -- no problems." After company management is better acquainted with the extension officer and has developed a more trusting relationship, he usually begins to disclose a number of technical and managerial problems. These, quite often, are only symptoms of the real problem, however, and it sometimes requires many hours of painstaking work to analyze all of the symptoms and arrive at the basic problem. Then the manager or entrepreneur must be convinced that this, and not his stated symptom, must be corrected. The old engineering cliché that a problem defined is 90% solved is very often the case when working with small industry.

- Company acceptance of recommendations. Another basic problem is that company management wants to be told what it wants to hear. When extension officers report something that may be unpleasant, such as processes being
obsolete, or worn out equipment that is no longer capable of producing good parts, or anything that will cause inconvenience or cost money, the manager may become irritated and discontinue his relationship with the extension office. In spite of patient efforts to convince company management of the wisdom of the recommendations, they may not be accepted. The best defense against rejection of recommended improvements is a well-documented economic analysis.

- Difficulties in obtaining "back-up" services. Still another problem encountered by extension officers is in trying to get expert assistance from specialists at the Engineering Experiment Station and academic faculty when it is needed. The problem lies in the fact that most such individuals have priority commitments to their own organizational components. Even though the need may be urgent, they are often prevented from giving time and attention to problems referred by extension personnel because such work is not a regularly scheduled part of their responsibilities and not included in evaluations of their performance. Also, the administrative system does not provide payment either to the specialist or his organization for time expended on industrial extension problems.

- Cost of extension service. Finally, the most critical problem is that of limited funds. Invariably, there is never enough money for everything that should be done. As a result, a priority system must be used to achieve the greatest benefit to the state from the funds that are available. In many cases this means not being able to supply the technical needs of a small manufacturer because the available resources can be better used in helping a larger manufacturer. The rationale behind this is that the major objective is to create jobs with scarce dollars. If the benefit, in terms of jobs created, would be greater by helping a larger company, then resources must be spent with the large company.

The two primary measurements of the effectiveness of industrial extension activities are (1) changes in company employment levels and (2) changes in company profitability. The latter is important because of its implications for industrial growth and long-term economic benefits to the community and state. Unfortunately, however, exact profitability data are difficult to obtain.

Employment change is much more obvious and its measurement has indicated that Georgia Tech's industrial extension field offices have been very effective.
In a cost/benefit analysis conducted by the nationally known consulting firm of Arthur D. Little, Inc., six companies selected for evaluation out of more than 600 visited by industrial extension field office personnel indicated that the assistance provided was instrumental in creating or saving over 300 jobs and yielded a benefit/cost ratio of 22:1.

Industrial Extension Field Offices in Developing Countries

In spite of the generally acknowledged importance of small industry in the development process, it appears that organizations to provide technical, managerial, and financial assistance to small companies are just beginning to be established in the Third World. The literature of industrial development contains many publications on "technology transfer" (usually referring to the transfer of advanced technology from the industrialized nations to less developed countries) but virtually nothing concerning managerial and technical assistance to small companies. Apparently there has been no effort to assess the availability of industrial assistance in countries throughout the world as has been done with agricultural extension. \(^1\) The discussions of industrial extension field office activities which follow are therefore restricted to those countries and activities with which the staff of the Office of International Programs at Georgia Tech has had first-hand experience. With the exception of the Small Business Advisory Centers in the Philippines, each of the organizations has worked in cooperation with the Office of International Programs under the US/AID Institutional Grant Program, "Employment Generation through Stimulation of Small Industries."

The Philippines: Institute for Small-Scale Industries. Since its establishment in 1966, the University of the Philippines' Institute for Small-Scale Industries (UP/ISSI) has always committed itself to the support of small-scale industry and entrepreneurial development. It is one of twelve government agencies involved in the promotion and development of small and medium industries and is a member of the Department of Industry's Commission on Small and Medium Industries.

\(^1\) International Directory of Extension Organizations and Extension Training Institutions - 1975.
UP/ISSI was established with the following objectives: (1) to train competent people to a level where they are able to assist existing small-scale industries to increase productivity and to develop and promote new ones, (2) to provide consultancy and extension services to existing small and medium industries, (3) to conduct research on plant operations and make the results of such research available to interested parties, and (4) to assume the leadership in overcoming the various problems of small and medium industries. In their efforts to achieve these objectives, UP/ISSI staff are organized into the following operating departments:

- Planning and Management
- Consultancy
- Information
- Training
- Low-Cost Automation
- Technology
- Research
- Entrepreneurship

Each of these departments is responsible for several specific areas related to the Institute's basic objectives. The Technology Department, for example, is concerned with response to technical inquiries, fostering local innovation (inventions), technological assessment, and technical extension activities. The Training Department is responsible for the many training courses on entrepreneurship development, small business consultancy, project study preparation, regional industrialization, low-cost automation, and other areas of interest to the small business community. One or more of these courses is under way at all times. In the period July 1, 1973, to June 30, 1974, UP/ISSI trained a total of 9,778 participants in various management functional areas.

Consultancy services are available for the preparation of project feasibility studies, work simplification, managerial control systems design, planning, and business problem analysis. During the same one-year period cited above, the Institute staff evaluated 70 project studies, conducted surveys of 43 provinces for identification of potential industrial projects, and assisted 946 small and medium-sized firms in management, financial, and technological aspects of production.
In August 1976, the Institute opened a Pilot Extension Office (PEO) at Tacloban City, Leyte, to serve the Eastern Visayas Region. This began a three-year project with the aim of making available to the region's entrepreneurs the assistance offered by UP/ISSI. It is anticipated that it will be the forerunner of a network of such industrial extension offices. The objectives of the PEO are as follows:

1. to continuously conduct consultancy in the region,
2. to undertake technical studies and research on request of various government agencies concerned with industrial development,
3. to undertake research for the promotion of small industries, and
4. to undertake the publication of studies, monographs, research papers, and other written works on small and medium industry.

The PEO staff consists of six professionals with a broad mix of educational background and experience. Included in the group are a certified public accountant, a mechanical engineer, a professional chemical engineer, an economist, a public administration graduate, and a commerce major.

In the first year of operation the staff has assisted more than two dozen enterprises with technical problems. When the initial contact is made with an entrepreneur, an Interview Card (Figure 5) is created as a permanent record for follow-up. If technical assistance is provided, a "Client Activity File" is set up to record the details of the assistance provided (Figure 6). A monthly accomplishment report in the following format is sent to UP/ISSI headquarters:

MONTHLY ACCOMPLISHMENT REPORT FORMAT

I. PROJECT DEVELOPMENT AND EXTENSION SERVICES
   A. Project Inquiries and Guidance
   B. Project Supervision/Management
      - Follow-up Action and Visit
      - Progress Report on Technical Assistance
      - Marketing Assistance
      - Design of Machineries
      - Plant Layout
- Product Costing

II. DATA GATHERING

(Research Activities)

III. MISCELLANEOUS

A. Involvement with Other Agencies, Institutions, etc.
B. Communications Drafted
C. Personal Development (Seminars attended, etc.)

IV. PENDING/EXPECTED

Assignment and the target date for accomplishment.

![INTERVIEW CARD]

Figure 5. Interview Card Used by Pilot Extension Office, UP/ISSI
TECHNICAL ASSISTANCE ACTIVITY RECORD

Visit Locale: ___________________________ Date: ______________ By: ________

Problem Area Code: ______________________

Time (Including Travel) Used: ____________

Report Brief: (include follow-up anticipated)
(note significant statistical changes)

Figure 6. Technical Assistance Activity Record Used by Pilot Extension Office, UP/ISSI
UP-ISSI EXTENSION OFFICE NO. 1
TACLOBAN CITY

TECHNICAL ASSISTANCE ACTIVITY RECORD

<table>
<thead>
<tr>
<th>Date</th>
<th>Visit Locale</th>
<th>Staff</th>
<th>Report Brief</th>
<th>Time Used</th>
</tr>
</thead>
</table>

3-29
Working relationships have been established with other development-related organizations in the Tacloban area, and one trade association, the Tacloban Ironwork and Engineering Industries Association, has been established. A proposal for a training program to train automobile mechanics and machinists was submitted by the PEO and funded by the National Manpower and Youth Council. This training program, with instruction provided by local entrepreneurs in their own shops, is now under way. In its efforts to promote small industry, the PEO has shown audiovisual presentations of management films in each of the five urban areas of the region. A total of 225 entrepreneurs attended these meetings.

The initial obstacle to the work of the PEO, distrust and suspicion from the small industry managers, has been overcome. The major obstacle at present is the lack of funds to pursue all the assistance and development activities that are obviously needed. Funding for the trial period was obtained through a Small Industry Grant from the United States Agency for International Development. Efforts are now being made to obtain other financial support for continued operation of the extension office.

The Philippines: Small Business Advisory Centers. The Small Business Advisory Centers (SBACs) of the Philippines are a network of government-financed industrial extension centers administered by the Department of Industry. These centers are an outgrowth of the Medium and Small Industry Coordinated Action Program (MASICAP), which is also in the Department of Industry. MASICAP was initiated to identify new industrial projects and entrepreneurs, prepare project studies and loan applications for submission to venture financing institutions, and assist proponents in the venture initiation process. It soon became clear that management and technical problems arose during the implementation of projects assisted by MASICAP, and the Small Business Advisory Centers were formed in July 1975. There are presently ten centers and two more are planned. Any small or medium-size business (i.e., assets not exceeding $4 million) can obtain assistance from a Small Business Advisory Center without charge.

The brochure published by the Department of Industry describes the SBAC as follows:

The Small Business Advisory Center (SBAC) of the Department of Industry is a catalyst for the growth and development of small and medium-sized businesses in a given area. As such, its role is to stimulate and coordinate all possible types of assistance needed
to develop and strengthen this sector of the economy. Its function is to harness resources from both the public and private sectors and channel these toward small and medium-scale industries (SMSI).

It is the local friend of small businesses to which they could go for advice, assistance, support and attention. The Small Business Advisory Center provides managerial and technical consultancy services to small business establishments to improve their productivity and efficiency. In this regard, SBAC does the following:

-- Diagnoses a client's operations
-- Identifies areas of improvement
-- Makes the necessary recommendations that are expected to bring about an improved system
-- Quantifies the costs and benefits of implementing the said improvements
-- Assists the client in implementing the proposed improvements
-- Checks on the actual costs and benefits the improved system has actually brought about.

Presently, Centers are staffed with five persons. However, this is considered minimal staffing, and the plans are to increase the staff size at Centers which serve the more heavily populated regions. At the present time, field staffs are heavily weighted with business and commerce graduates. However, the need for technical expertise is recognized and there is an intent to add engineers (particularly industrial engineers). There is, however, some question as to the best qualifications for industrial extension personnel. The Secretary of the Department of Industry is said to advocate "industry specialists" (e.g., sugar industry, woodworking, and copra processing) as opposed to a mix of specialists in various disciplines. On the other hand, SBAC officers fear that industry specialists would have difficulty responding to the broad mix of technical and managerial problems which the Centers are asked to solve.

A major problem has been the high turnover among SBAC staff. Two incentive programs have been proposed which, when adopted, should solve this problem: (1) each professional will be given an opportunity to earn a Master's Degree in Business Management; and (2) after K years of service (K is as yet unspecified), an SBAC professional can start his or her own business and obtain a maximum of P4 million equity capital from government sources or with government assistance.

A support group at Manila headquarters responds to problems and information needs which the field staffs cannot handle. However, it is a rare exception when a field staff does not handle a problem. In theory, SBAC personnel can
also refer problems to any member of the Commission on Small and Medium Industries, which includes the Science Center of the Philippines, Natural Science Development Board, the Design Center of the Philippines, and others (12 agencies in all). In practice, however, each of these organizations has its personnel committed to its own activities, and requests by SBAC for assistance generally are not answered in a timely manner. The SBACs do have access to and use UNIDO experts. Further, the Department of Industry plans to recruit "sponsoring groups" with various skills to respond to inquiries from the field. Participation will be strictly voluntary.

In some regions there are more than enough "walk-in" clients, but in other regions the staff must visit the local firms to make themselves and SBAC services known. There seems to be some difficulty in getting started, and a slide presentation is being produced to be used as a way to inform the business community of SBAC services.

Record keeping seems to be extensive. A coding system is used for each client, and all activities with each client are recorded. Similar records are kept at Manila headquarters so that a response to a problem in one region may be used in responding to a client's needs in another region. Each SBAC office submits a quarterly report showing a summary of activities for the quarter. These are used to prepare a report on the total SBAC operations, which includes the following measures of effectiveness:

- Ratio of clients generated over establishments visited
- Number of walk-in businessmen
- Ratio of implemented to concluded cases
- Commercial viability of SBAC

"Profiles of Center Output," showing establishments visited, clients generated, cases generated, cases concluded, cases in-process, and cases implemented, are also given in the report.

Perhaps SBAC operations can be best illustrated by reference to a specific center. The SBAC for the Eastern Visayas region is located in Tacloban and is now in its second year of existence. The objective of the staff is to assist small and medium-size businesses (manufacturing, trading, and services) so that they will prosper, grow, and provide employment. To this end, the Center is developing a list of small companies, setting up priorities (potential for growth, export oriented, labor intensive, management qualifications, receptiveness to assistance), and actively assisting small and medium-sized firms.
They are also identifying investment opportunities and searching out (and developing) entrepreneurial talent. These potential projects are then referred to the MASICAP group, which shares an office with SBAC, for economic analysis and funding application preparation.

During the first year, the office was staffed with only two persons. The present staff is five people with the following educational backgrounds: industrial engineering, accounting, mechanical engineering, agribusiness. The long-range plan is to have a staff of 25 with backgrounds in business and engineering.

Effectiveness measurements are focused on cost-benefits (e.g., sales increases in response to assistance efforts). However, it is very difficult to obtain information to facilitate effectiveness measurements. The Center attempts to develop a continuing relationship with each client. After the initial assistance, a complete plant survey is conducted and an intensive study is made of the firm's operations. An effort is made to get the client to report his business results to SBAC on a regular basis.

Nigeria: Industrial Research and Development Unit, University of Ife.
In Nigeria, many systems provide assistance in some form to industry. The Ministry of Industry, Trade, and Cooperatives in each of the 19 states, for example, has a Department of Small-Scale Industries and offers industrial consultancy, training, and development services. In addition, the national Ministry of Industry plans to establish development centers in every state. These Industrial Development Centers are fully staffed with as many as 50 professionals with a wide range of trades and skills. There is also a Center for Management Development which presently assists large companies but which has been selected to establish an Institute for Small-Scale Industries. Also, the Administrative Staff College of Nigeria (ASCON) is a large organization which trains high-level administrators. This group works with the top management consultants in the world to provide the best possible instruction.

The Industrial Research and Development Unit (IRDU) and its field extension offices are a part of the Department of Economics at the University of Ife in Ile-Ife. IRDU was started with the objective of providing direct managerial and technical assistance to small-scale industry. The objective was later expanded to include medium-sized industries, and three industrial extension field offices were opened. These are located in Ile-Ife (Oyo State), Ado-Ekiti (Ondo State), and Agbor (Bendel State). Additional extension field offices
are planned for Ilorin (Kwara State), Ijebu-Ode (Ogun State), and Ikorodu (Lagos State). Staffing in each extension field office is as follows:

Extension Officer - Industrial Economist with a Master's Degree
Assistant Extension Officer - Assistant to the Extension Officer. This man should have 2-3 years of college and a Higher National Diploma (HND) or an Ordinary National Diploma (OND) in Business Administration or Technology
Clerk typist
Office cleaner
Driver

The extension field offices provide direct consultancy to manufacturing, process, and service enterprises but must be careful to deal only in those fields which have no interest to private consultants. Assistance to small and medium-sized enterprises by field office staff includes the following:

- equipment procurement
- arrangements for equipment maintenance
- plant layout
- equipment design
- site selection and relocation
- accounting systems design
- preparation of feasibility studies
- preparation of loan applications

Requests which cannot be handled by field office staff are referred to the Polytechnic.

One of the major problems for small-scale industries in Nigeria is apprentice training. There are state exams for the various skilled trades, and persons passing these exams are virtually assured of employment. However, small industries usually are not able to hire these people. There is a guild system in Nigeria, and IRDU staff members are looking for ways to involve the guild in apprenticeship training standards and content and perhaps in certification of apprentice training graduates.

Each field office also does work in industrial development. The staff at the Ile-Ife office, for example, took the list of publications furnished by the U.S. National Technical Information Service and identified a number of industries which could be started with a small amount of capital. This list
was circulated to government and businesses. Interest was expressed in some of the industries and feasibility studies were prepared. Studies for a printing company and a pharmaceutical company have now been completed.

Other activities include surveys conducted for the state government. For example, an economic survey of industrial institutions, commercial institutions, and service companies was made for Oyo State. Other states have expressed an interest, and it appears very likely that a survey will be completed for each of the six states.

Another objective of IRDU is to collect reliable data for research, and surveys such as the one for Oyo State are being used to build a data bank for use by graduate students and other researchers.

Each extension office keeps detailed records of clients, plant visits, discussions, and time spent on each project. Assessment of effectiveness is measured by the following:

1. reception by managers,
2. employment increases,
3. improvements in technology and/or operations of the company,
4. client success in obtaining loans, and
5. number of clients who are members of the Association of Small-Scale Industries in their state. About three states give direct assistance (financial and otherwise) to their Association of Small-Scale Industries.

The major deterrent to the effectiveness of the extension field offices to date is the size of field office staffs.

Indonesia: Development Technology Center, Institute of Technology Bandung. Field stations in Indonesia are now being established to transfer technology developed at the Institute of Technology Bandung and to train entrepreneurs in management and technology. The first such field station is near Pelabuhan Ratu, and two others are planned but their locations have not yet been announced.

The objective of the field station is to identify the assistance and training needs in the area and to satisfy those needs. It is expected that the stations will serve small-scale industry and building contractors. A staff of 10 engineers is now being recruited.

3-35
The first field station is being established in collaboration with the TOOL Foundation of the Netherlands.

Summary and Conclusions

It is generally recognized that small businesses are essential to the economic well-being of every nation. In fact, current industrial development strategy emphasizes the necessity to develop small-scale industry as a base for employment and an infrastructure to support large industry. Moreover, it is universally conceded that small companies have managerial technical problems that cannot be solved by company personnel and that external assistance is necessary. Current thinking is that the delivery systems for this external assistance should function as an "adaptive agent" to locate, interpret, adapt, and demonstrate the general knowledge and "state-of-the-art" technology which the small business manager needs to improve his operations. The model for such a delivery system is the U.S. Agricultural Extension Service and its army of resident county agents to assist farmers and agribusinesses throughout the nation.

In actuality, however, no nation, industrialized or developing, has been able to develop and install an industrial counterpart to the Agricultural Extension Service. The principal reasons seem to be that the variety of small-scale industrial problems require a breadth of knowledge for their solution which is beyond the capability of a small staff of resident experts. Agricultural extension has a strong coupling to land-grant educational institutions and research which takes care of this problem, but efforts to do the same thing with industrial extension have not been completely successful. For a number of reasons, governments seem to be unwilling to commit the same quantity of resources to industrial assistance that are provided for agricultural assistance.

The problem of providing assistance to small businesses is not well solved in any nation. In the United States there are, in every state, several federal, state, and locally supported organizations that are interested in small business development and which provide assistance of some type to small businesses. Unfortunately, their efforts are fragmented, overlapping, often wasteful, and largely unknown to the small business community. In the developing countries with which the staff of the Office of International Programs
has worked, there are also multiple agencies striving to provide industrial extension services to small businesses. They are presently at an early stage of development.

In the Philippines, the efforts of all groups with an interest in small business development are loosely coordinated through the Commission on Small and Medium Industries. Industrial extension field offices are operated on a pilot basis by the University of the Philippines' Institute for Small-Scale Industries and by the Department of Industry. The Small Business Advisory Centers operated by the Department of Industry are located in each region. They are funded by the Philippine government and, although lightly staffed at present, plans are to provide adequate staffing by competent specialists.

Nigeria, likewise, has several organizations at the state and national levels which provide assistance to small companies. Here, too, extension field offices are being established by both the Industrial Research and Development Unit at the University of Ife and by the National Ministry of Industry. However, only a very few such centers have been established thus far.

Indonesia also is attempting to establish extension offices in connection with the Institute of Technology at Bandung. One such office has been set up and two more are planned.

In each of these countries, an educational institution is involved with at least one of the efforts to provide assistance to small businesses through industrial extension field offices. On the surface, it appears that these offices should be able to fulfill the "adaptive agent" role mentioned earlier. In practice, however, this role is made difficult by the inaccessibility of researchers and specialists from whom information or work is requested.

Undoubtedly, each of the industrial extension field office networks discussed in this paper can provide many examples of the benefits that they have provided to small businesses. There is no doubt that they have helped and are helping to increase employment through small business development. There appear to be, however, a few rather obvious faults with present small business assistance efforts:

1. There are too many organizations involved and their activities are not well coordinated.
2. Organizations are not adequately staffed and funding is always inadequate.

3. The large number of organizations involved tends to spread resources too thinly.

4. Assistance priorities, if there are any, are established at each office or agency without an overall plan.
The Economics of Financial Incentives

Financial incentives to raise the level of capital spending are now an established element of fiscal policy strategies used by modern western-style economies. In theory, financial incentives (1) increase the flow of internal funds, thus facilitating capital stock adjustments, and (2) lower the implicit rental price of capital services.1/ By lowering the implicit rental price of capital services, the desired stock of capital should increase. A growth in the stock of capital permits a more ready absorption of a growing labor force into productive activity.

Most less-developed economies have responded to growing population and labor force by giving capital formation high priority. Below-equilibrium interest rates, achieved by various methods, have been commonly employed to spur capital formation in selected economic sectors. Only slowly did recognition come of the adverse employment effects produced by artificially cheap capital. Theoretical discussions of this problem have moved increasingly in favor of higher interest rates (1).

The national policy objective behind financial incentives is the stimulation of economic activity and output. Raising capital spending (or, more precisely, net investment), given an aggregate consumption function and unchanged governmental receipts and expenditures and assuming a closed economy, can be expected to produce an increased real national output, if unemployed resources were initially present. This, of course, is elementary macroeconomic theory. Again, the employment effects of increased capital spending, however, might not be positive even though output effects are. The matrix shown as Figure 1 defines all possible employment effects from changes in capital intensity and total output levels in an economy. As may be seen, cells 1.1 and 3.3 have employment results that are indeterminate.

1/ Capital services are an input flow into the productive process. Under restrictive assumptions, a static equilibrium level is reached when the marginal value of capital services just equals the price of capital services.
Table 1
EMPLOYMENT EFFECTS OF CHANGES IN CAPITAL INTENSITY AND OUTPUT LEVEL

<table>
<thead>
<tr>
<th>Average Capital Intensity</th>
<th>Output Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increased</td>
</tr>
<tr>
<td>Increased</td>
<td>Employment ?</td>
</tr>
<tr>
<td>Unchanged</td>
<td>Employment Increased</td>
</tr>
<tr>
<td>Decreased</td>
<td>Employment Increased</td>
</tr>
</tbody>
</table>

The employment outcomes specified above require the assumption of an aggregate production function with properties permitting a competitive equilibrium. The production process of the competitive model also assumes competitive pressures ultimately force a plant size determined by the low point of a "U" shaped industry long-run average cost curve. ¹/ In equilibrium, a unique plant size emerges. Firms, however, which may be composed of a number of plants, have no determinate size, although some scarcity, commonly managerial talent, is assumed to provide some upper limit.

The real world, of course, differs from that theorized by the competitive model. Labor immobility and institutional constraints make it possible for firms to use a wide range of technologies on a continuing basis. Plant sizes vary greatly, although in defense the economic theorist has argued that this merely means the movement to competitive equilibrium has not been completed. In U.S. manufacturing, for example, not only do we observe continuing wide differences in plant sizes, but also systematic wage differences. Average compensation per worker increased steadily with firm size in virtually all U.S. manufacturing industries. Smaller firms, presumably using older technologies, appear to compete by paying lower wages. When capital is replaced by the largest firms, which generally use the most advanced technology, it filters down and is used by progressively smaller firms until ultimately the ability

¹/ The empirical evidence casts considerable doubt on the existence of "U" shaped long-run average cost schedules.
of the small firm to exploit pockets of immobile labor is exhausted or else restricted by minimum wage legislation.\footnote{The largest firms are typically unionized, and continuous wage pressures on management tend to force growing capital intensity.} At that point, the technology and the capital represented by it disappear from use. The capital equipment itself is either scrapped or exported.\footnote{The international trade in used machinery is based upon the same considerations as purely national used machinery markets.}

Thus, from a real world point of view, the matrix of Figure 1 also requires no shifting of capital intensity between firms in an industry (or between industries) if the employment effects of output and capital intensity changes are to be as indicated. For example, given that the value product per worker is significantly lower in small firms than in large firms, a reduction in employment and capital in small firms could have a complete output offset by larger firms using slightly more capital (but not enough to prevent the average capital intensity from falling). This case would then result in lower, not higher, employment as the matrix predicts.

Taking into account these considerations, it should be clear that the employment effects that can be predicted from tax incentives used to foster capital formation are not completely reliable. This is clearly a drawback to the use of this policy tool where employment generation is of first-order importance. Another aspect of subsidies to business capital spending is their economic stability effects. Typically, the empirical evidence shows that these subsidies are most used by larger firms. Moreover, the U.S. experience has shown that the volume of the subsidies is largest during boom times and smallest during recessions. From a stabilization viewpoint, the opposite should occur. The procyclical behavior of capital spending subsidies is thus a negative factor also to be considered.

Specific Tax Incentives

Tax Holiday. Of the specific financial incentives used to spur industrial development, the "tax holiday" to new industry is the one most frequently offered. The tax holiday is an income tax exemption for usually five but sometimes as many as ten years. Certainly, increasing net returns to a prospective
firm by this means may be a powerful location or establishment inducement. In
the rather special case of Puerto Rico (which "exports" to the U.S. mainland
duty-free), the income tax exemption has been called by some observers the
single most important factor in the rapid industrial growth experience there.

The proponents of the tax holiday have argued that: (1) it is tangible
evidence of a governmental commitment to new investment; (2) given the uncer-
tainties entailed in foreign investment, the tax holiday is particularly ad-
vantageous because it either shortens the "pay back" period or else permits a
more rapid expansion by the firm; and (3) the tax holiday is relatively inex-
spensive when the benefits of the new output and employment effects it generates
are compared against it.

The arguments against the tax holiday are: (1) it is most valuable to
those who need it least, i.e., new high-profit firms probably would not need
this incentive; (2) firms receiving the income tax exemption may have invested
without it being offered (this is probably the most telling criticism of the
tax exemption incentive); (3) administration of income tax exemption programs
is frequently poor; and (4) once the income tax exemption program is estab-
lished, there are political pressures to extend and lengthen it.

There does appear to be some consensus that an income tax exemption is
effective if: (1) all the other factors in development are not unfavorable,
i.e., the income tax exemption cannot offset seriously negative factors; (2)
it is part of an overall development package; (3) it is limited and selective;
(4) it is as automatic as possible in its administration; and (5) it is only
given in the early stages of industrial development. This last point recog-
nizes that a newly industrializing country is unlikely to have the agglomera-
tion economies present in more advanced economies and is thus less likely to
be giving the income tax exemption to foreign firms which would be attracted
in any case. (South Korean government policy, however, still offers the income
tax exemption to new foreign investment despite its relatively advanced stage
of development.)

It seems clear, however, that where new industry is created that would not
exist in the absence of a tax holiday, the longer run net benefits are likely
to be positive. Exceptions to this might be firms requiring a very high level
of governmental services (roads, fire protection, etc.) and which generate
below-average wage payments. In such case, the additional outlays at all levels
of government for services to the new industry and its workers may be greater than the additional tax revenues from the increased tax base.

A personal income tax exemption is not uncommon as part of the tax exemption incentive program in developing countries. This permits the recruitment of foreign specialists for periods of one to five years. Without such an exemption, the employment cost of foreign specialists would become prohibitive to the firms they assist.

**Tariff Policy.** Import duty relief is the second most common tax incentive for industrial development. The logic of this tax incentive is quite straightforward. New capital goods purchased abroad should not have import duties levied against them, particularly when capital expansion is a primary objective of governmental economic policy. This elementary proposition, however, becomes more complex when there is a domestic capital goods industry producing reasonably close substitutes for foreign imports. Replacement parts for foreign capital goods already in place require application of the same considerations. Of course, where the new foreign capital goods (and their spare parts requirements) are not used to produce for the domestic market but only for export, the issues become simpler again.

With the great need for export earnings, most LDCs are particularly anxious to induce a new foreign export industry. To help such industries, free ports or duty-free zones are frequently established. The principle here is to allow the foreign firm to locate and import duty free all necessary inputs (and in combination with domestic inputs of the host country) to produce an output for export. Careful controls against smuggling out of the duty-free area are the only administrative problem of consequence. Alternatively, duties can be collected in the usual manner and then refunded to the export producer. These refunds are commonly called "customs drawbacks." They typically employ time-consuming procedures and thus immobilize the producer's working capital balances for unnecessarily long periods. The free port or duty-free zone is, therefore, preferable from the point of view of the export producer.

Domestic producers of export products are also given special treatment. Usually these include tax incentives, duty-free imports of inputs, and even outright subsidies. Domestic producers for the domestic market are generally protected from foreign competition. This action is justified mainly by the
familiar "infant industry" argument. An evaluation of the arguments for protectionism, however, goes beyond the scope of this paper. Export duties are not commonly levied. They reduce exports, but where the exporting country has a monopoly supply position or an oligopoly position through joint action with other producing nations, the government(s) involved have taken advantage of such situations. The OPEC nations are an obvious example of an oligopolistic supply situation where export taxes have been levied successfully.

**Accelerated Depreciation.** Depreciation is simply the recovery of investment. As such, it is an allowable deduction from income (revenue) in calculating income tax liability. Given the time value of money, the greater the sheltering of income (revenue) from taxation in the early years of an investment project, via accelerated depreciation allowances, the more attractive the investment project becomes. Accelerated depreciation is then another means of increasing investment by raising the normal returns on such investment.

The depreciation formulas allowed vary over time and from country to country, of course, but their economic effect is the same. (Some specific examples of accelerated depreciation schedules are given in the incentive program used by the less-developed countries selected for this review.) Finally, it should be clear that where complete income tax exemption is given, accelerated depreciation has no value to the firm during the tax exemption period. In fact, a firm would improve its long-run profitability in such case by deferring, if possible, depreciation charges until the tax exemption period ended.

**The Effectiveness of Tax Incentives**

The effectiveness of tax incentives is not fully clear. Using the U.S. experience after the 1962 tax cut, which included an investment tax credit, researchers have interpreted the empirical evidence differently. Bischoff (10) states that the U.S. investment tax credit probably "... stimulated more investment spending than the policy ... cost the government in taxes." Coen (10), looking at the same question, reports "... policies that produced an estimated $8.6 billion in tax savings from mid-1962 through the third quarter of 1966 increased (capital) expenditures by only $2.8 billion." These confusing results probably stem, as Fromm (10) suggests, from a lack of agreement among economists about the determinants of investment spending. Despite this, tax incentives remain an important governmental policy tool. On a broader
level of analysis, Acharya (2) finds "... some scope for fiscal and financial intervention in inducing economy-wide factor combinations with more employment per unit of capital ... (but) ... quantitative estimates how much of a change may be expected from given changes in factor prices ... and ... what are the efficient ways of intervening to change factor prices, the available research does not permit firm conclusions."

Clearly, the use of fiscal incentives needs careful consideration and must be compared with the other alternatives available that can produce the desired level of capital spending. Further, these alternative choices will tend to have different distributional effects, which adds another constraint, given the pressing need for greater equity.

Financial Incentive Programs in Less-Developed Countries

The financial incentive programs used by less-developed economies vary in their details, but, generally, they have three major components: (1) tax holiday or exemption from income taxes for a specified number of years; (2) exemptions from customs duties, both import and export; and (3) accelerated or supplemental depreciation allowances. The depreciation-related incentives, of course, are significant only to firms ineligible for or beyond the income tax exemption period. (Usually only new foreign firms are offered the income tax exemption incentive.)

The relative importance of these major components varies considerably from country to country. Generally, where foreign investment is important, the tax holiday component looms large. In the case of Brazil, however, the income tax exemption is structured primarily to benefit existing domestic firms (Public Law 34/18). The longer run effect of this should be an increased concentration of economic power. Korea, on the other hand, with a more orthodox approach, uses the income tax exemption as the major feature of its financial incentive program to induce new foreign investment. There, new foreign investment currently amounts to about 40% of total national annual net investment.

In the following sections, the financial incentives offered by Brazil, Korea, the Philippines, and Nigeria to increase investment are described. The differences in approach taken become readily apparent. Data limitations, however, prevent comparisons of the effectiveness of these tax incentive programs. Consequently, only a brief description of their essential features can be
given. As will be seen, their differences stem mainly from the differing patterns of government funding, i.e., the types of taxes levied by governmental units.

Brazil. The federal constitution of Brazil gives the federal government the power to tax: (1) imports of goods; (2) exports of Brazilian goods; (3) rural property; (4) income and revenue of any kind; (5) the production of industrial goods; (6) operations of credit, exchange, and insurance; (7) transportation and communication services, except those of a strictly municipal nature; (8) production, importation, circulation, distribution, or consumption of liquid or gaseous fuel or lubricants of any origin or nature; (9) production, importation, circulation, or consumption of electric power; and (10) production, circulation, or consumption of minerals produced in the country.

The states are given the power to tax: (1) transfer of real estate, (2) sale and distribution of merchandise, (3) inheritances, and (4) legal documents. Municipalities may tax urban real estate and may tax for services rendered.

The principal business tax levies in Brazil are the federal income tax, with a basic rate of 30%, and two indirect taxes: (1) the Imposto Sobre a Circulação de Mercadorias (ICM) or Merchandise Circulation Tax, a state tax, and (2) the Imposto Sobre Produtos Industrializados (IPI) or Industrialized Products Tax, a federal tax. The tax rates of the ICM and IPI vary by state and product.

A major investment incentive for business is allowing the corporate taxpayer to invest up to 51% of its income tax liability in approved projects in lieu of paying such amount in income tax. This measure, of course, fosters continued concentration of economic power in Brazil. (In addition, there is no federal inheritance tax forcing the break-up of large estates.)

The basic approach taken by the Brazilian government has been to leave industrial development to private firms. The government will undertake some projects, however, when there is no private firm alternative or when national interest needs are to be served. Investment is guided by an Industrial Development Council (CDI) under the Ministry of Industry and Commerce. Approval of an investment project by the CDI provides a wide range of benefits: (1) exemption from duty (averaging 30%) on imported equipment, provided generally that no similar Brazilian product exists; (2) exemption from the IPI tax on such equipment and credit for IPI charged on local equipment; (3) accelerated
depreciation on locally purchased equipment; (4) priority in applications for
loans from official credit sources (provided local capital participants are
involved); and (5) priority analysis for alteration of tariffs in order to pro-
tect local infant industries. The duty exemption also implies exemption from
the state ICM tax on imported equipment.

All incentives are controlled by the CDI. The CDI also sets Brazilian
industrial objectives. These objectives are defined by sectors: (1) capital
goods industries, (2) basic metallurgical industries, (3) intermediary metallic
products industries, (4) intermediary nonmetallic products industries, (5)auto-
motive and spare parts industries, (6) durable consumption goods industries, and
(7) nondurable consumption goods industries. The specific incentives by indus-
trial sectors are contained in hundreds of decree laws, making a complete enu-
meration impractical here. Basically, these decree laws give tax liability
reductions for reinvestment, tax exemptions (import duties, etc.), financing
priorities, and the like for favored industries. Generally, Brazilian capital
participants are also required in favored projects in order to gain incentive
benefits.

As an example, Decree Law 221 grants income tax, sales tax, and duty ex-
emptions for projects in the fishing industry. Further, all legal entities
registered in Brazil were allowed to deduct 25% of their income tax liability
for investment in fishing projects approved by the Superintendency of the
Development of the Fishing Industry (SUDEPE).

Another example pertains to industrial and agricultural projects approved
by the Superintendency for the Development of the Northeast (SUDENE). It
allows any legal entity operating in Brazil to deduct from its income tax:
(1) up to 75% of the face value of bonds (but not more than 50% of income tax
liability) it buys from SUDENE issued to increase the resources of the fund of
Investments for the Economic and Social Development of the Northeast (FIDENE),
and (2) up to 50% of the value of income tax and other nonrefundable assess-
ments for reinvestment in SUDENE-approved industrial, agricultural, or tele-
communications projects. For the Amazon region, a counterpart to SUDENE has
been created, the Superintendency of the Development of the Amazonian Region
(SUDAM). Its corresponding investment fund is FIDAM (Fund for Private Invest-
ments in Amazonia). It too has incentives similar in character to those of-
fered by SUDENE.
Export incentives were broadened under Decree Law 1219, which created the Commission on Granting Fiscal Incentives for Exports (BEFIEX). Essentially all industrial exports are granted exemption from direct taxes, and profits from export operations are income tax exempt. Fiscal incentives to trading companies are given to firms registered with the Foreign Trade Department of the Bank of Brazil (CACEX). The primary incentive given is exemption from income taxes on foreign sales of manufactured products. The National Foreign Trade Council (CONCEX) coordinates Brazil's export/import programs. The law creating CONCEX also created, within the Central Bank, the Export Financing Fund (FINEX).

Korea. Investment incentives in Korea have focused on foreign investors. In 1975, foreign investment in Korea represented about 40% of total investment. This ratio, however, has been falling; domestic savings as a percent of GNP have risen dramatically since the early 1960s. Nevertheless, the Korean government still has the inducement of foreign investment as an important policy objective. The fourth Five-Year Development Plan (1977-1981) has foreign investment of US$10 billion as its target. (Japanese are by far the largest foreign investors, which has had important political repercussions.)

The financial incentives offered foreign investors are:

1. Corporate income tax on foreign enterprises is reduced in proportion to the percentage of stocks on shares which foreign investors own in the enterprise. This total exemption is reduced after five years of operation to a 50% tax reduction, which goes on for another three years.

2. Foreign-owned enterprises are exempt for five years from the Acquisition Tax, Property Tax, and Dividends Tax. After the five-year exemption, these taxes are at half rate for another three years.

3. Capital goods imported by foreign investors are exempt from Import Duties, Commodity Tax1/, and Textile Product Tax.

4. Foreign investment projects approved and operating under the Foreign Capital Inducement Law are exempt from the Defense Tax (a 2½% surcharge on all imports) until the exemption period expires.

1/ The Commodity Tax applies to 122 specified commodities and ranges from 2% to 200% of the sales price.
5. Personal income tax exemption for five years.

6. An additional depreciation of 20% to 30% of original depreciation for export and machinery industries.


Financial incentives for domestic investors are offered to promote shipbuilding machinery, iron and steel, nonferrous metal refining, power generation, chemical fertilizer, mining, and refining, as well as the petrochemical industry. For investors in these industries, three mutually exclusive financial incentives exist: (1) they may be eligible for a reduction or exemption from corporate tax for six years; (2) they may be allowed to deduct 8% of the total investment from the tax liability; and (3) they may be eligible for special depreciation up to 100% of the total amount originally depreciable. The Office of National Tax Administration authorizes all investment credits. Where the tax credit due exceeds taxable corporate income, the excess can be carried forward for four years.

Industrial estates are classified into four major groups: (1) free export zones, (2) special industrial estates, (3) export industrial estates, and (4) local industrial estates. They have been actively promoted by the Korean government. While industrial estates are open to local as well as foreign investors, the free export zones require firms with a majority of foreign ownership.

Nigeria. The study of tax incentives in Nigeria was last performed by Aluko (1), who acknowledged the paucity of data at that time. No more recent data are available.

The Philippines. The investment incentives in effect in the Philippines are given by the provisions of the Investment Incentives Act (R.A. 5186) and the Export Incentives Act (R.A. 6135). In addition, Presidential Decrees No. 92, January 6, 1973, and No. 485, June 19, 1974, have provided revisions and amendments to these two incentive laws. The Presidential Decrees gave priority to export-oriented industries using indigenous raw materials and extended coverage to include public utilities.
The investment incentive laws are implemented by the Board of Investments (BOI), a government agency created in 1967. Only firms registered with the BOI are eligible to take advantage of the investment incentives offered. Thus only "deserving" projects receive this aid. Firms receiving financial incentives also must accept some BOI supervision.

Under the Investment Incentives Act, eligible industries are classified by ownership and type as (1) Filipino-owned pioneer and nonpioneer and (2) foreign-owned pioneer. Combining ownership and type, there are then three classes of eligible industries: Filipino-owned pioneer, Filipino-owned nonpioneer, and foreign-owned pioneer. All three of these classes are given the unqualified benefits of the following provisions of the law (15):

1. Deduction of organizational and pre-operational expenses from taxable income over a period of not more than 10 years from start of operation.

2. Deduction of labor training expenses from taxable income equivalent to \( \frac{1}{2} \%) \) of expenses but not more than 10\% of direct labor wage.

3. Accelerated depreciation.

4. Carry-over as a deduction from taxable income of net operating losses incurred in any of the first 10 years immediately following the year of such loss.

5. A tax credit equivalent to 100\% of the value of compensating tax and customs duties that would have been paid on machinery, equipment, and spare parts (purchased from a domestic manufacturer) had these items been imported.

6. A tax credit for tax withheld on interest payments on foreign loans, provided such credit is not enjoyed by lender-remittee in his country and the registered enterprise has assumed liability for tax payment.

7. The right to employ foreign nationals in supervisory, technical, or advisory positions within five years from registration.

1/ A major task of the BOI is to formulate Investment Priority Plans. The criteria used, in order of importance, are: (1) labor intensity, (2) dispersal of industry, (3) local availability of raw materials, (4) export potential, and (5) rate of return on investment.
8. Deduction from taxable income in the year reinvestment was made of a certain percentage of the amount of undistributed profits or surplus transferred to capital stock for procurement of machinery and equipment and other expansion.


10. Protection from government competition.

11. Tax credits equivalent to sales, compensating and specific taxes and duties on supplies, raw materials, and semi-manufactured products used in the manufacture, processing, or production of export products.

12. An additional deduction from taxable income of direct labor cost and local raw materials utilized in the manufacture of export products, but not exceeding 25% of total export revenues for producers, 10% for traders, and 50% for service exporters. In the case of traditional exports, the local raw material component is not included in the computation of said deduction.

13. Filipino and foreign-owned pioneer projects are exempt from tariff duties and compensating tax on imports of machinery, equipment, and spare parts, if they are new or expanding and have less than a 20% return on equity. Expanding pioneer projects with 20% or greater return on equity and existing pioneer projects desiring to replace or modernize their facilities are entitled to mere deferment of taxes and duties, without any reduction in their amount. Filipino-owned new and expanding nonpioneer projects with total assets not exceeding ₱500,000 are also eligible for the first two years of commercial operation. Nonpioneer projects with assets over ₱500,000 and expanding nonpioneer projects with less than a 20% return on equity are entitled only to reduced tariff and compensative tax on a deferred basis for a period not exceeding 10 years. Expanding nonpioneer projects with 20% or greater return on equity shall be entitled to only deferment of taxes and duties without any reduction in their amount.

14. Filipino and foreign-owned pioneer projects are given post-operative tariff protection.

15. Filipino and foreign-owned pioneer projects are exempt from all taxes under the National Internal Revenue Code, except income tax on a gradually diminishing percentage.
16. Filipino and foreign-owned pioneer projects can employ foreign nationals within five years from operation or even after this period in exceptional cases.

17. Filipino-owned pioneer and nonpioneer projects have preference in the grant of government loans.

The Export Incentives Act creates three eligible categories of beneficiaries: (1) export producers, (2) export traders, and (3) service exporters. The incentives offered parallel those given under the Investment Incentives Act. Specifically, for all three categories, they are:

1. Item 11 above, qualified to be applicable to service exporters producing and exporting television and motion pictures or musical recordings.

2. Item 12 above, with the sentence treating traditional exports deleted and further qualified to be applicable to all registered export producers, except foreign firms exporting 70% of their production.

3. Preference in grant of government loans, qualified to be applicable to (a) all projects for expansion under List A of the Export Priorities Plan and to both pioneer and nonpioneer projects under List B, and (b) enterprises at least 60% Filipino owned.

Export producers and traders are eligible for:

1. Item 4 above, qualified to be applicable whenever a registered export producer or export trader shall use a brand name for an export product that distinguishes it from products produced outside the Philippines.

2. Exemption from export and stabilization taxes.

3. An additional deduction from taxable income of 10% of incremental export sales when a registered export producer or export trader shall use a brand name for an export product that distinguishes it from products produced outside the Philippines and whenever financial assistance is extended by an export trader to an export producer in an amount equivalent to not less than 20% of the export trader’s export sales during the year.

Export producers and service exporters are eligible for:

1. Item 6 above, qualified for export producers to be applicable only to all projects for expansion under List A of the Export Priorities Plan and to
both pioneer and nonpioneer projects under List B, and qualified for service exporters to be applicable to expansion projects only involving the production and export of television and motion pictures or musical recordings. Also qualified to apply to service exporters catering primarily to foreign tourists.

2. Exemption from tariff duties and compensating tax on importation of machinery, equipment, and spare parts, qualified for export producers to be applicable (a) only to all projects for expansion under List A of the Export Priorities Plan and to both pioneer and nonpioneer projects under List B; (b) to new or expanding nonpioneer projects with total assets not exceeding ₱500,000 for the first two years of commercial operation; nonpioneer projects with assets exceeding said amount and expanding nonpioneer projects with less than 20% return on equity are entitled only to reduced tariff and compensating tax on a deferred payment basis for a period not exceeding 10 years; expanding nonpioneer projects with 20% or greater return on equity shall be entitled to mere deferment of taxes and duties without any reduction thereof; (c) to new or expanding pioneer projects with less than 20% return on equity; expanding pioneer projects with 20% or greater return on equity and existing pioneer projects desiring to replace and modernize their facilities are entitled to mere deferment of taxes and duties without any reduction thereof. For service exporters, the above is qualified to be applicable to expansion projects only in the producing and exporting of television and motion pictures or musical recordings and to service exporters catering primarily to foreign tourists.

Export producers are eligible for:

1. Item 7 above.

2. Items 2, 5, 8, 9, and 10 above, qualified to apply only to all projects for expansion under List A of the Export Priorities Plan and to both pioneer and nonpioneer projects under List B.

3. Items 14, 15, and 16 above, provided the export producer is in a pioneer area.

4. Export producers get additional incentives whenever their processing or manufacturing plant is located in an area designated by BOI as necessary for proper dispersal of industry or which is deficient in infrastructure, public utilities, and other facilities.
Under both the Investment Incentives Act and Export Incentives Act, certain provisions are favorable to investors in registered enterprises. Here, however, the beneficiary categories are expanded to include foreign export producers, traders, and service exporters and foreign-owned nonpioneer industries. The concessions and guarantees offered are as follows:

1. Both Filipino and foreign investors in registered enterprises are guaranteed (a) the right to repatriate investments and remit earnings (subject to Central Bank regulations), (b) freedom from expropriation of investment, (c) freedom from requisition of investments, (d) protection of patents and other proprietary rights, and (e) exemption from capital gains tax on disposition of capital assets, provided proceeds of sale are invested in new issues of capital stock of a registered enterprise within six months from the date gains were realized. This exemption under Sec. 6(b) of R.A. 5186 is applicable only to Filipino investors in pioneer projects.

2. Filipino export producers engaged in a pioneer area and Filipino-owned pioneer projects receive (a) a tax allowance to the extent of actual investment but not to exceed 10% of taxable income, and (b) tax exemption on sale of stock dividends provided sale occurs within seven years from date of registration.

3. Filipino export producers and Filipino-owned pioneer and nonpioneer projects have preference in GSIS and SSS loans for purchase of shares. Applicable to Filipino export producers only for all expansion projects under List A of the Export Priorities Plan and to both pioneer and nonpioneer projects under List B.
REFERENCES


15. The Philippines, Board of Investments. *Summary of Incentives,* (no date).
