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TECHNOLOGY TRANSFER AND LDC AGRIBUSINESS ENTERPRISES

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Technology Transfer in Developing Country Private Agribusiness Enterprises

On October 19, 1984, representatives from the International Executive Service Corps presented workshop materials as part of their ongoing exchange of technical materials with US/AID. The following materials are an attempt to document some of the ideas, concepts, and cases that were discussed. Certain sections, as in the part dealing with technology as knowledge transfer, have been used in an earlier workshop on Training and Manpower Development and serves as a basic definition component for all three of the planned workshops. Other parts are unique to this particular session dealing with technology transfer to private sector agribusiness enterprises.

The goal of the workshop and related materials is to share some of the IESC experience in regard to providing technology change programming for developing country enterprises. Over 2000 different agribusiness projects have been completed by IESC in the past twenty years. From these cases and the personal experience of volunteers, certain ideas and concepts have emerged, especially in terms of what are the major needs and constraints affecting Third World enterprises. Some of this material has already been utilized in a variety of research and publications and IESC will continue to seek avenues to study and evaluate its own experience and communicate the findings to the development community at large. Thus, the attached two sections bring together some models developed as early as 1975 and other materials created as recently as September of 1984.

Specifically, this monograph addresses two major issues:

- How can technology be defined and characterized so that improved planning and organizing of technology transfer can take place and

- What are the major factors affecting enterprise and their capacity to develop, acquire, and exploit technology in the agribusiness sector?

Throughout this monograph attempts have been made to organize cases and experience into explicit planning and evaluation models. The focus of analysis is from the perspective of the foreign private enterprise and conclusions are drawn regarding what type of technology is required, how to transfer technology, and what factors must be managed at the enterprise level to assure more effective diffusion and utilization of technology.

I. DEFINING TECHNOLOGY TRANSFER

The planning and organizing of technology transfer often appears difficult and even mysterious to the manager who is not familiar with the terms and principles that govern successful technology management. In most cases the supplier and user have to involve experts from different fields. Legal experts evaluate the contractual and proprietary issues associated with joint ventures and licensing. Engineers are concerned with how the technology will be packaged, transferred, and installed in the plant or on the farm. Manpower development staff are concerned with training and motivating workers, supervisors, and technicians. Even financial and accounting specialists must be involved in order to develop cost accounting systems.

The manager or entrepreneur must struggle with all these issues to determine the costs and benefits associated with different technology options. What problems must be overcome? What is the real value of the technology in his environment? What is a fair price to pay? And what extra services should be requested from suppliers and partners? All of these are critical questions that must be addressed in the decision-making process. Yet, most managers have little time to devote to mastering all of the different technical issues, vocabularies, and techniques that must be dealt with in technology transfer management.

Today, almost any technology transfer program involves at least three principal actors: the user, the supplier, and the government agency controlling technology transfer in the user country. The successful negotiation, transfer and installation of technology must deal with these three principals' different interests, points of view, and conceptual terminology. Getting the most value from the program depends fundamentally upon being able to predict, and therefore manage, these different and often conflicting approaches.

Where does an entrepreneur or manager start? Obviously he and other managers of technology change must approach the task in terms of the different actors that participate in the planning, approval, and transfer process. But they must also try to sort through the various concepts of technology and come up with simple tools that help identify the technology required, how it will be transferred, and the type of problems that will likely affect the success of the operation. Then, they must formulate some mechanism to help assign costs and values to different options.

The following pages discuss the different concepts of technology, organizing them in the following way:

A. Traditional views of technology: what is the traditional view of technology and how has that affected negotiations between buyers and sellers?

B. Broader definitions of technology: defining technology as different categories of knowledge.

C. Sources of technology: what are they and what kinds of technology do they provide?

D. The role of management practices in technology transfer: theories of management and how they fit into technology transfer.

A. TRADITIONAL VIEWS OF TECHNOLOGY

The first problem buyers and sellers of technology face is that they may have a different terminology for technology. Suppliers may look at it simply as something that is patentable--a machine, for example. But users may look upon technology as a wide variety of knowledge. This definition id more complete, but it also makes a negotiation more complex. Companies seeking to buy technology may be aided in their efforts if they understand how the definition of technology has evolved over the past several decades. It will also help them to understand why, and how, governments have intervened in the negotiating process and often influenced its outcome.

Traditionally, technology was thought of as the physical equipment required to execute specialized tasks. Often, technology was imported as a complete package, through direct investment by a foreign firm. The technology was merely a part of the total scheme of the firm's business activity. As markets expanded, foreign firms sometimes sold manufacturing procedures or devices, through management contracts, licensing, or technical assistance agreements. Later, turn-key operations and joint ventures became another vehicle for transferring physical technology. These methods posed new and often exasperating problems for both supplier and recipient, in terms of defining the technology to be transferred.

By the mid-1960s, some governments were not satisfied with these methods. In as effort to get control of this elusive, but critical component in their economic development, they focused on specific elements of technology transactions, such as transfer pricing, patent agreements, technical assistance, and other

components of the technology process. Unfortunately, their studies failed to encompass the total process of technology transfer. Meanwhile, foreign companies continued to lump technology transfer with other business activities to produce aggregate indices of profitability or productivity.

As a result of these contradictory approaches, cooperation between government analysts and supplier firms became severely limited in evaluating technology. The international companies had not segregated their concept of technology from the whole business picture and the government analysts could not relate separate technology elements to the overall business venture.

The adaptability of a company and its ability to treat each contract as an individual situation is the key to success. If the supplier can accurately interpret the goal of the recipient, and if the recipient can explain its goals to the supplier in mutually understandable terms, then a framework for successful cooperation had been created. Even so, both buyer and seller must be aware that the government may wish to get involved in the discussion. Government officials will want to know why, or how, the technology in question will enhance the knowledge base of the country. This discussion can lead to painful, time-consuming debates that require both buyer and seller to think about the technology as a contribution to a larger system that just their own operations.

B. BROADER DEFINITIONS OF TECHNOLOGY

As we have noted earlier, technology is often discussed in relation to the control and dissemination of knowledge. It is helpful to buyers to think about technology as coming in two forms: "hardware" and "software". Hardware is embodied in factories, machines, products, and infrastructure. Software is the non-material component of the production process, such as the organizational structures and processes as well as the human experience derived from participating in actual operations. Software may be categorized as know how. One good definition of technology, which encompasses both hardware and software, is that given by the U.S. scholar, Goldring:

> "any tool or technique, product or process, physical equipment or method of doing or making, by which human capability is extended."

With this definition in mind, technology may be subdivided into five basic categories:

General Knowledge: that which is publicly available, the so-called "common fund" of knowledge available through books, universities, etc.

Industry-Specific Knowledge: technical knowledge that is common to an industry and possessed by all firms within it. Such knowledge may be considered as a "ticket of admission" to the industry in question. It encompasses the knowledge of how to produce a general industry product or manage a general industry process.

System Specific Knowledge: the knowledge necessary for the production of a specific product. Other firms producing a similar good would, in the course of actual operation, probably have a similare type of knowledge.

Firm-Specific Knowledge: knowledge unique to a specific firm. Such knowledge is not necessarily linked to the production of a given product but rather results from the firm's overall activities. It could include technical knowledge that goes beyond what a competing firm might acquire if producing similar products, e.g., the Xerox process, the Coca-Cola formula, special metal casting techniques, special skills in marketing and management, etc.

On-going Problem-Solving Capability: primarily the knowledge needed to solve production and management problems on a continuing basis. Generally, this know how results from experience.

It is obvious that these types of knowledge are vested in different degrees in technology suppliers, as well as users.

The problem from the user point of view lies first in deciding what types of know how are required to fulfill their development needs---technology for planning? for production? marketing? Then a choice must be made between alternative suppliers in accordance with their ability to deliver the knowledge at an acceptable price.

In terms of types of technology, buyers in countries with well established technostructures can probably afford to acquire separate parcels of technology (unbundled, or disaggregated, technology). In other words, they may not necessarily have to import the full systems that provide technologies for all of the project cycle. However, buyers in countries that lack the required industrial base may have to be more systematic, not only in obtaining the initial plant, equipment, and start-up technologies, but also in assuring access to a continuous stream of technology.

Another equally important question is what methods of transferring the technology are most relevant. The transfer mechanism chosen depends on the ability of the user to absorb the technology. In some cases, only documentation and equipment may

be required, but in other cases, extensive training, learning visits, or long-term exchanges of personnel may be necessary.

C. SOURCES OF TECHNOLOGY

There are seven basic sources a buyer can turn to to acquire technology. Each supplies certain types of technology and, as a result, uses certain methods of transfer. The type of technology and the method of transfer determine the costs and benefits to the user. These sources are as follows:

- General educational programs
- Direct foreign investment
- Consulting/engineering firms
- Independent licensing, technical assistance agreements and management contracts
- Purchases of equipment and supplies
- Intergovernmental assistance
- Private volunteer organizations

General educational programs are the essential mechanism through which technical manpower and skilled personnel are developed within any country. Obviously, this ingredient is essential in creating a technostructure. An important aspect, often overlooked, is that expertly trained engineers, lawyers and managers must be coupled with an adequate supply of technicians and semiskilled workers to form a complete system. One of the problems facing managers in many developing countries is the difficulty in finding managerial and technical skills, and then holding onto those so trained.

Direct foreign investment is a traditional source of acquiring technology and capital. the unique aspect of direct foreign investment si that it provides general, industry specific, system specific, and on-going problem-solving knowledge. It also has the greatest capacity to provide long term development. In certain cases, direct foreign investment has been unable to modify its technology so as to make it °appropriate° to local conditions. There are also cases of misuse of transfer pricing and management and technology agreements to avoid taxation or remittance restrictions. Even considering these shortcomings, no other source of technology and quite the same unique capability of creating the most efficient long term technological system, or of delivering a complete know how package.

Though it brings a multitude of training and infrastructure impacts, direct foreign investment also brings certain foreign control and intervention in the local environment. In most cases, due to its proprietary privileges and its concern for maintaining product exactness, the MNC may be optimizing on the global level and, therefore, has some stake outside the local jurisdiction. This foreign influence over local industrial activities has created political reactions, and has resulted in major efforts to control the MNC as a foreign supplier. (The negative side of these policies is that they may inadvertently cut off the flow of technology from the MNC rather than merely modifying its behavior. Some developing countries, and therefore companies operating in these environments, have a very weak bargaining position when it comes to trying to change the overall technology transfer process, which had evolved over a long period of time and had by and large proven successful.)

Consulting and/or Engineering Firms provide knowledge that is primarily industry-specific through technical experts who work with local companies for a fixed period of time. These suppliers seldom provide long-term technological support, although it is available in certain circumstances (and at a higher price). These firms traditionally receive direct payment in hard currency or, possibly, payment in kind (a percentage of production or of a local natural resource). This approach allows a greater amount of local control over the use of the technology.

Licensing, Technical Assistance Agreements, Management Contracts represent major contractual methods through which specific industry systems and sometimes firm-specific technologies can be purchased. They may be individual contracts or part of direct foreign investment. In many cases, these agreements provide training and other on-going maintenance for the licensee. However, in most instances, a licensing, technical assistance, or management agreement deals only with one part of the system. It is generally assumed that the other critical components of the system exist, are functioning efficiently, and will fit with the technology imported.

Many firms in developing nations, in fact do not have available the technical infrastructure or supporting industries to make maximum use of these kinds of specialized agreements. there are exceptions---industries that have a comparative advantage. For example, most licensing and specialized technology agreements take place between large corporations operating in different developed nations. In such firms, this is an efficient means of purchasing incremental technology for existing operations. It is not necessarily an efficient means for establishing industrial activity.

There are costs to the "debundling" strategy of purchasing licensing, consulting, management contracts, and technical assistance. such technology usually must be paid for directly in hard currency. But this method provides for more local control. (On the other hand, some would argue that a straight licensing agreement provides the least amount of local control since the local user has a minimal amount of bargaining power over the supplier. If, for example, the supplier had contributed capital and had a long-term stake in the user¶s activity, he would have greater motivation to ensure the success of the operation.)

Purchases of Equipment and Supplies are a traditional avenue for technology importation. In most cases, equipment is sold, accompanied by training programs to ensure that the user has the knowledge to use the equipment he has purchased. The drawback of this kind of technology transfer is that it seldom provides on-going support to modify or further exploit the equipment in any fashion other than that related to its original specifications. Repeated purchase of evolving technology can be made, however, and a permanent relationship with a supplier can thus be fostered. Though the user does have significant control over the technology on a day-to-day basis, he is in many ways dependent upon the equipment salesmen, over whom he has little bargaining power except to refuse a purchase.

Intergovernmental Assistance is another important vehicle for providing certain types of appropriate technology, especially in the area of health and agriculture. Programs range from general humanitarian assistance to all types of military and industrial assistance. Private companies in developing countries can have direct involvement in these arrangements, or they may get spinoffs in terms of becoming suppliers, or utilizing the advanced techniques that flow into the community from these governmental programs.

Such programs can have a political cost. In terms of bargaining power, the user has less vis-a-vis the foreign government than vis-a-vis private suppliers. However, in many cases, the foreign government may be the only organization capable of accepting the risk of making transfers to industries in certain developing countries. One point to note is that, though government assistance programs may be technically desirable, they may lack the dynamism of private activities.

Private Volunteer Organizations such as the International Executive Service Corps (IESC) or the Pan American Development Foundation transfer a wide variety of technologies to developing countries. Unlike large corporations or governments, the basic operating objective of many of these organizations is to serve critical social goals, and they may not be as sensitive to the problems of profit maintenance as other suppliers. Also, the

private volunteer organization may have a wide range of knowledge capable of transfer, but they seldom have large enough resources to transfer a complete technology package that covers the entire range of traditional project cycles. However, the private volunteer organizations can be important alternate sources of technology. They can be employed advantageously by a firm in a developing country to plug a technology gap, at a low cost.

Summary and Evaluation

To summarize, we can see how alternative sources package and deliver technology in different ways. The basic trade-off centers on whether the user desires technology for all stages of the project cycle, or whether he seeks specific systems that can be fitted into an existing technostructure. The costs associated with the different sources can include direct hard currency payments for equipment and/or services, and the surrender of some control over output. Government-to-government transfers can involve political obligations.

The value of this general model lies in the following:

- It helps the local user conceive of the scope of a project, and hones his ability to deal with an appropriate supplier.

- It helps the local user understand how various technology delivery systems can help him.

- It helps both supplier and user design a project with the goals of governmental regulatory agencies in mind.

The chart indicates that multinational firms provide the most extensive range of technology. Private firms in developing countries that wish to have firm-specific knowledge and on-going problem solving capability may wish to explore this avenue of transfer. However, if the concern is not to develop the most competitive industries in the initial stages, this may not be the best solution. Multinational firms may exhibit certain oligopoly practices and restrict technology transfer in a way that might inhibit the full utilization of the technology transferred, thereby creating a dependency for the local firm and costing it more in long-term financial and control terms than is garnered in economic benefits. On the other hand, it is intuitively obvious that through its direct investment the foreign technology supplier has a commitment to the local user that goes far beyond any initial transfer. This involvement may motivate the MNC to continuously supply updated firm-specific knowledge in terms of changes and improvements so that the user can deal better with new problems brought on by external markets.

As noted earlier, problems can also arise in the purchase of unbundled technology. Such alternatives as consulting and engineering, licensing, and equipment sales seldom provide the means for on-going problem-solving, but they can offer firm-specific and system-specific knowledge. Specialized consulting agreements can be set up to guard against the problems implicit in receiving segmented technology but there is little actual practice so far in this regard. In fact, there seems to be a sufficient history of tragedies in which turnkey plants have been completed under the initial specifications and subsequently, rapidly atrophied, unable to compete for lack of ability to change and keep pace. Unbundled technologies do not provide the security and stability of a permanent relationship that can be established through a direct foreign investment relationship.

TYPES OF KNOWLEDGE TRANSFER MADE BY SUPPLIERS

The following chart summarizes the types of technology generally provided by each kind of supplier.

(TECHNOLOGY) KNOWLEDGE TYPES	SUPPLIER						
	General Education	Direct Fgn. Investment	Independent Consulting/ Engineering	Independent Licensing	Equip. Sales	PVO*	Govt. Assistance
General Knowledge	Yes	Possibly	Seldom	O	O	Seldom	Yes
Industry Specific	Possibly	Yes	Yes	O	O	Yes	Yes
Production System Specific	Possibly	Yes	Yes	Yes	Yes	Yes	Yes
Firm Specific	O	Yes	Possibly	Yes	Possibly	Possibly	Seldom
Ongoing Problem Solving	O	Yes	Seldom	Seldom	Seldom	Possibly	Seldom

*Signifies Private Volunteer Organizations

O indicates almost never provided.

D. THE ROLE OF MANAGEMENT PRACTICES IN TECHNOLOGY TRANSFER

We have spoken earlier of the "software aspect of technology. One element of software that merits special consideration is management practices. Long-term functioning of an enterprise depends not only on production, process, and marketing knowledge, but also on the know how necessary for planning new production processes, organizing resources, and for measuring performance against goals. These are elements of managerial technology, which is defined as the know how necessary for managing the productive functioning of an enterprise. In the transfer of managerial technology, the sophistication of the user, or the strength of management know how, is particularly critical.

Importation of technology is useless unless the receiving organization has the managerial capabilities for planning how the technology will be used, for organizing personnel to make most efficient use of the technology, and for diagnosing problems arising from the new technology. Effective transfer for the supplier depends on an understanding of the managerial practices of the local enterprises as well as on how the user organization can change in order to manage production functions more efficiently.

Implicit in the definition of transfer of technology is the concept of change in the behavior of the user. An analogy might be the plumber who clears a drain or repairs a damaged pipe in a home. If, in the interaction with the plumber, the homeowner acquires the skills to enable him to clear drains or repair pipes in the future, a transfer of technology has occurred. If, by working with an outside consultant whose assignment is to design an organizational chart for a firm, the manager learns new techniques that will enable him to reorganize his firm in the future, managerial technology has been transferred. Change in the abilities and behavior of the technology user is the critical element in both of these examples. Transfer of managerial technology is thus defined as a change in the ability to manage the productive functioning of an enterprise.

The concept of managerial practices as they affect technology transfer is complex, but it is functional for the user firm to grasp its importance. If the user understands the technology seller's approach to management, he will save himself time and money in the application of that firm's technology.

E. A MODEL FOR ANALYZING THE COMPONENTS OF TECHNOLOGY TRANSFER

Discussions on technology as knowledge help user firms understand the movement of know-how, but they fail to provide practical management tools for dealing with the range of technologies that come into play when undertaking a full-scale manufacturing project. A systems-type approach that draws on an "audit matrix" can be useful here. The audit matrix helps the receiver break down the various stages of transfer and can improve understanding between the receiver and supplier, therefore helping to pinpoint likely areas of conflict at an early stage.

The Six Contexts of Technology Transfer

In most manufacturing activities technology transfer occurs within six contexts:

1. at the beginning of a program to initiate plans and budgets;

2. then to create specialized designs and to guide construction;

3. during plant start-up where industrial engineering and training play central roles;

4. later in on-going value engineering developments (programs that reduce cost and improve quality);

5. and down the line to accelerate product development and conduct research.

6. The sixth context is pervasive during all the others. The technology transfer process reaches out to the local environment to improve suppliers, generate new sources of labor, or help establish government standards.

Several types of transfer mechanisms might be used in each of these contexts, and they may be summarized as follows:

Types of Technologies	Transfer Mechanisms
Planning and Proposal	Documentation
Design and Construction	Training
Start-up	Seminars
Value Engineering	Learning Visits and Exchanges
Research and Product Development	Equipment
Environmental Support	

This overview of the total technology system provides for systematic evaluation of some forms of support not traditionally included in technical assistance or licensing agreements. At the most general level, the audit matrix can demonstrate what mechanisms are used to transfer each type of technology. The chart shown on the following page is the first step towards a more specific analysis of all technology components required to establish a typical manufacturing facility. It should be kept in mind, of course, that there is no one best means for technology transfer. In mass-production technology, one element may be more important than another. For the receiver, the stage of design and construction may bring more critical new technology than the start-up phase. These determinations depend not only on the type of industrial technology being supplied, but also the overall needs of the receiving unit and its environment. Even so, the audit matrix is a useful starting point for getting a grip on the issues involved.

AUDIT MATRIX

TRANSFER MECHANISMS

TYPE OF TECHNOLOGY	DOCUMENTATION		TRAINING		SEMINARS	LEARNING VISITS & EXCHANGES	EQUIPMENT
	Manuals, Special Procedures, & Drawings etc.	Regular Information	Formal	OJT			
PLANNING & PROPOSAL							
DESIGN & CONSTRUCTION							
START-UP							
VALUE ENGINEERING							
RESEARCH & PRODUCT DEVELOPMENT							
ENVIRONMENTAL SUPPORT							

Planning and Proposal Technologies

In the planning stage, before decisions are completed for supplying a new plant or manufacturing activity, corporations do a great deal of groundwork to calculate the risks involved in the proposed program. They bring in specialized personnel to compile detailed proposals and budgets, and create other types of planning tools that will ensure them on-going control. This early planning and organizing of technology is important in evaluating the relationships that must be established locally to obtain supplies of materials as well as labor, technicians, and other backup infrastructure.

Teams of planners and organization specialists are normally dispatched to the new site to work with local personnel in buying detailed plans. Corporate cost-accounting guides, evaluation models, and other plans serve as documentation for supporting this earliest technology phase. Examples of some of the information, guides, and decisions that are developed in this stage include the following:

- Market and environment analysis
- Risk projections and operating estimates
- Preliminary design analysis

- Capital budgets
- Organizational memorandums (project management, division management, staff support, etc)
- Personnel selection and training
- Control documents (what problems are expected, how will they be identified, etc.)

The skills required to support this foundation phase should be transferred in some degree to the new facility to ensure on-going growth and flexibility. The management techniques and procedures for planning, analysis, and proposal are often the hardest to acquire and the most important in the long-term picture.

Some Tips for the User

Often, the user firm overlooks the need to work closely with the supplier at this stage. Yet it is the crucial point where important management skills can be gained that can be invaluable later in forecasting and controlling the fully grown activity. If the recipient firm does not request participation at this stage, it normally is not involved until the construction design stage.

Suppliers and receivers agree that if more joint planning were done, later contract misunderstandings and start-up problems could be avoided. In many turnkey operations and technology sales, the receivers have little information on how the supplier views the initial problem and why it recommends the techniques or machinery ultimately transferred. In some cases the receiver, through early participation in planning, may find he wishes to sacrifice certain elements of the technology package to gain others that the supplier had not deemed important in its initial planning.

Since many technology agreements are derived from bargining situations, the competitive position of the supplier and receiver often preclude cooperation at the planning stage. It is important to keep in mind that a short-term focus on a "low cost" or a "good deal" may be shortchanging both parties in terms of the total technology transferred and the long term success of the project.

Design and Construction Technologies

At this stage the technology focus is on the creation of physical facilities. The supplier corporations will bring in

engineers, architects, and designers to provide architectural drawings, plant layouts, machinery plans, and other kinds of basic information. Specialized requirements for power, water, and control of waste material must be included in construction planning.

In addition, a great deal of effort goes into construction management. However, the process of selecting and supervising bids from local contractors is a management skill often bypassed in technology acquisition. Problems of coordinating purchasing requirements are standard elements of the design and construction stage. Daily management must be provided to ensure proper completion of construction steps. Many international companies have specialized field engineers who are formed into teams for new projects. These specialized technicians may have participated in the design and construction of scores of plants around the world. Their collective capabilities are normally hard to secure and harder to take advantage of unless the local recipient is encouraged to work closely with them. A close relationship at this stage is a type of on-the-job training.

Start-up Technology

The start-up phase begins when the bulk of production technology is brought to the site. At this stage written procedures, processes, specifications, manuals, quality control guides, and a wide variety of other documentation is transferred. In addition, specialists are sent for extended periods to install machinery, make appropriate tests, and establish quality control procedures. At the same time, an extensive training is going on at the plant as well as at headquarters. While one group of specialists is establishing the basic procedures and testing equipment, the permanent personnel are either simultaneously trained on-site or at corporate centers elsewhere. Repair and maintenance systems, procurement procedures, manpower development programs, scheduling, and a wide variety of other management production procedures must be developed during this phase. In most production facilities it is at this point that the role of the production and industrial engineer becomes prominent.

Before the initial production runs can begin, several types of start-up activities must be carried out:

- Procedures for purchase of supplies spelled out
- Cost control guides and routines completed
- Direct labor hired and trained
- Indirect labor hired and trained
- Quality-control tests and procedures created

- Production routines completed
- Maintenance and engineering departments established
- Equipment tested and adjusted

In no other phase is there such a flow-through of production technology. All the elements of materials handling, packaging, production, and quality control must be transferred and made operational. The manpower for the entire plant requires training, from the plant manager to the most basic plant worker.

Production manuals, tests, routines, and processes must be established in order to build a solid foundation for dealing with production situations. Normally, a specialized manufacturing start-up team will arrive to support the local management in the initial days of operation. By the time it leaves, the entire technology for the basic plant will be functioning.

In many technology agreements, support may be terminated once the plant is operating effectively. However, technology is dynamic and sequential in nature. By the time the plant is operating, most likely even newer techniques and equipment will have evolved to improve efficiency or assist in adapting to new competition or product requirements.

Value Engineering Technologies

At start-up the firm is normally concerned with testing basic procedures and adjusting the new equipment. Once this is accomplished, the focus of attention shifts toward improving cost effectiveness. A great deal of the engineer's and manager's time is spent in applying techniques that improve production facilities. Inspection procedures, control systems, and tests are reevaluated and modified to maximize output. At this stage, a plant could evolve its own innovations and techniques. A great deal of value engineering progress can come from the exchange of ideas among internal staff teams. Corporations often encourage these exchanges through seminars. Such programs help foster a professional competitive relationship, as well as aid in the exchange of information.

When the new facility is connected to a larger global organization, the telex often represents a vital link for questioning and problem-solving. A request for information on supplies or a specific production bottleneck can be fed to the technology supplier, where it is analyzed and then passed on to plants with similar situations. Thus, the requesting facility receives the benefits of multiple experiences. The international company's professional seminar is another way of formalizing the human contact that stimulates new ideas and techniques. Some

companies require all specialists and managers to spend up to 30 working days annually on exchange or seminars. New information is regularly distributed through revised manufacturing instructions and memorandums on plant problems. Specifications and recommendations for equipment are also routinely available to all the plants.

Research and Product Development Technologies

If an effective technology base has been established, the new plant and its support activities should be capable of improving basic procedures as well as developing new ones. The manufacturing facility will normally evolve an independent product development and industrial engineering capability sufficient to sustain itself in most areas. However, transferring the research capability is much more difficult. The basic research and technology core often must be centralized to allow the economies of scale and concentration of highly specialized skills necessary for breakthrough research.

The transfer of research facilities can also be difficult because of barriers against the importation of equipment and supplies. Specialty chemicals, laboratory animals, or electronic data processing are among the infrastructure requirements for research. In addition, basic laboratory research demands well-qualified technicians and scientists and these talents are often not in sufficient supply for industrial research. Presently, most technology suppliers resist transferring basic research. They generally confine their activities to transferring the capability of pushing a plant to an independent product development stage. To get beyond this point, local governments and institutions must take greater responsibility for improving the infrastructure and human resources that facilitate research.

Environmental Support Technology

The flow of technology to the environment outside the plant can often be of considerable value to a wide range of individuals, businesses and institutions. For most manufacturing facilities, the success of long-range programs depends not only on quality control in the plant but also on the dependability and quality of suppliers. As a result, management often provides local universities and training institutes with materials and technical support that enable them to improve their courses devoted to training workers and managers. In addition, plant managers support local standards associations and other professional societies that stimulate improvements in the technical culture of their environment. some governments are now identifying the potential value of this type of technology. This attitude seems to reflect a more innovative approach to securing technology than just through purchasing processes or equipment.

II. USER FIRM CHARACTERISTICS:

HOW THEY AFFECT SUCCESSFUL TRANSFER

Investors in Thailand in the 60's recognized the need for a local company that could manufacture kraft paper for use in bags, sacks, corrugated boxes and wrapping paper. These products would be used by such growing industries as cement, tapioca and sugar. To speed the start up of the new industry, the investor group chose a turnkey strategy. In 33 months the entire plant was constructed and on stream. The hard technology systems were delivered, according to contract, but the company nevertheless suffered almost a decade of crises, verging on bankruptcy at least three times.

The difficulty stemmed form an unclear evaluation of the needs of the user organization and the abilities of various suppliers. The main problems reported by the paper manufacturer, Tawee Butsuntorn, had to do with the basic management practices of marketing finance and production. After the first cycle of managerial crises, an interim management team was imported form the U.S., later to be replaced by a Japanese firm that placed their own manpower in key managerial and technical functions. The present structure of the company finally emerged in 1976 as a result of new financing from Thai and U.S. supporters and a comprehensive managerial contribution from the Honshu Paper Company of Japan.

Millions of dollars were lost because the technology program did not deal adequately with the relation of hard and soft technologies. The key role of management systems was underestimated. Much of our discussion about user needs will focus on how to relate the analysis of hard technology needs and the complementary management systems.

A. USER FIRM CHARACTERISTICS

Many firms are unable to diagnose the types of problems or opportunities confronting them, and this hampers them in the acquisition of new technologies. Often, the problem is related to the firm's managerial capabilities. Four basic management capabilities can be identified: organizing,, controlling, planning and leading. Inadequate development of these capabilities can prevent a firm from identifying practical technology needs or effectively exploiting the technology available to it. The most critical problem, however, is often associated with technology planning.

A firm's structural makeup can also get in the way of smooth technology transfer. For example, managerial and technical manpower may be inadequate to the task at hand. (This is not surprising, since the typically small size of the local market and inadequate technological infrastructure can hamper expansion of specialized management skills.) An even more fundamental handicap is that many firms are not committed to general management development. Often, the sign of this is their interest in only acquiring engineering or specialized production knowledge, without simultaneously building their general managerial know how. They proceed along these lines because it is easier to seek solutions to selected problems than to develop new capabilities in such amorphous areas as general planning, problem identification, and long-term organizing. Experience indicates, however,k that programs combining general management development development with system - specific knowledge are more likely to upgrade a firm's capabilities and hence result in a successful technology transfer.

The local environment also conditions the capability of a firm to search for new technologies. The most important ingredient in the environment is predictability. Frequent and unexpected changes in public policy affect risk taking. In the face of an unstable political environment, or economic turbulence, a firm may be reluctant to plan for the long - term commitment necessary for technological development. To cite one example, companies in Peru were exposed to drastic changes in political and economic policies during much of the 1970's. Early in the decade, the government encouraged the import of technology. Then, when the country began experiencing a balance-of-payments crisis in 1975, the government scrapped many of these incentives and instituted import restrictions and currency controls. These policy fluctuations relegated Peruvian firms to a continual state of confusion. Many firms planned to buy and install new equipment, only to find out later that they could not receive the permission to import or pay for the equipment.

Another important aspect of the local environment is external demand for new products. Firms that acquire technology to take advantage of real market opportunities generally experience a smoother technology transfer than do those that are simply buying technology in response to perceived needs not directly related to market openings.

Finally, a firm's historical characteristics influence its ability to receive technology. Not surprisingly, firms that have had experience in acquiring new technologies and in the process have learned to diagnose their needs and value technology are better prepared to exploit opportunities for technology transfer.

B. MAJOR ISSUES

Overall, the major issues impeding the ability of the user firm to receive, adapt, and utilize technology can be summarized as follows:

1. Firms lack the general managerial capability to diagnose problems and opportunities and thus cannot formulate long-term goals, which can be matched to specific solutions.

2. Programs dealing with explicit technology improvements may be important to the short-term prosperity of the firm, but are often not coupled to general management development.

3. Many firms do not comprehend the long-term value of technological improvement, and thus do not actively seek to acquire technology in an orderly fashion.

4. Firms operating in an unsettled environment resist making long-term commitments to technological change. Their reluctance can perhaps be offset by strong market demand, or by the presence of a leader who can motivate personnel and take the risks required to exploit the opportunities for technological advancement.

5. Firms that can identify market opportunities or respond to clearly defined internal crises will be more aggressive in seeking technology.

6. The lack of general management resources in the local environment is a major constraint to technology acquisition. Without such resources, it is difficult for a firm to organize itself to exploit technology improvements to the fullest.

The following paragraphs analyze these points more closely, attempting to show how they are linked to successful technology transfer. The goal is to give the user firm a mirror with which to examine its own characteristics.

C. MANAGERIAL CAPABILITIES

As noted earlier management capabilities can be divided into four elements: organizing, planning, controlling and leading. Organizing is the assignment of tasks to different people and the coordination of their efforts. Planning, a key activity of all manager, entails clarifying objectives, setting goals, establishing policies and creating methods that will guide the firm to its objectives. Controlling is the system managers use to measure day-to -day activities against objectives, thereby determining where and when corrective action is needed. Leading refers to the way in which policies are formulated, formal standards use, and employees motivated.

Planning should be the first step in the management process. A simple model in which the planning function is shown to trigger other management activities can be derived as follows:

EXPECTED MANAGEMENT PROCESS	
STAGE I	STAGE II
Planning	Controlling
	Leading
	Organizing

However, this pattern does not coincide with that often seen in firms. Instead, a strikingly different sequence emerges that helps explaining where user firms go wrong in their technology planning.

ACTUAL MANAGEMENT PROCESS		
Stage I	Stage II	Stage III
Organizing	Planning	Leading
Controlling		

This observation suggests that the average firm initiates its management process by acquiring a system-specific technology around which it develops organizing and controlling activities. The technology is often selected at random, principally because of a lack of internal capability to assess technology needs and a short-term view of business opportunities. The planning activity may be initiated later as a result of government regulations or because of a general belief by management that planning, in an undefined sense, can be useful. Whether or not planning and goal setting becomes a purposeful, long-term activity of the firm will depend on its ability to develop planning in an effective relationship to other management processes.

D. PLANNING

Planning involves three sequential steps:

1) diagnosing the existing situation,

2) defining future goals, and

3) Identifying the kinds of change required to solve existing problems and achieve the stated goals. Planning, or the process of identifying the gap between the existing and

possible future situation, is fundamental to management development. However, planning is often not used effectively for goal setting by firms, even though they may have formal planning systems. Most often, their planning systems are focused on the internal environment and consist of production schedules and budgets. Very little time is spent in assessing trends outside the firm, such as competition and market opportunities, or trying to develop contingency plans. This oversight is largely due to the lack of managerial expertise.

Another explanation for narrowly focused planning systems is a lack of information on local markets, industry trends, current economic developments, and available technology. Specifics on local demographics and changing business environments are in woefully short supply in many countries, and the search for information on technology focuses heavily on foreign sources. Journals and manuals, equipment sales, visits to foreign countries, and foreign and local consultants are more heavily utilized sources of technology information than are local government offices, regional trade fairs, or local libraries. A further impediment is the inability of management to use whatever changes. Without this capability, planning systems are irrelevant to technology evaluation and search.

Controlling

Controlling ensures that results conform to goals. Most firms have some type of control system in place. Generally it includes production standards, quality controls and costing and budgetary systems.

Production standards are often set by top management. Only a relatively small percentage of firms have quality control systems operated through separate quality control departments. Research also shows that there is less staff participation in the formulation of budgetary controls, which, like production center systems, are normally dominated by senior management. The presence of controlling systems does not necessarily mean that the firm is better prepared to receive technology. However, limited staff participation in the overall controlling process may be an impediment.

Organizing

Organizing is the function that determines how work is assembled to achieve goals. The way in which tasks are allocated and clusters of workers are integrated into a coordinated effort conditions, to some extent, the ability of the firm to adapt to new situations through technology transfer. It appears that firms that have decentralized decision-making and use specialized staffs have the greatest potential for expliting technology transfers.

Leading

Leading, or activating, is the process by which the manager directs and motivates other personnel to implement the firm's plans. The extent to which the manager responds to the personal needs of employees, resolves office conflicts, and establishes rewards bears directly on the performance of the firm. Sometimes the sheer force of charismatic leadership can overcome obstacles to the firm's acquisition and utilization of technology, but this is distinct from the continuous process of activating, which implies mechanism, rather than the force of personality for motivating personnel and decentralizing decision-making.

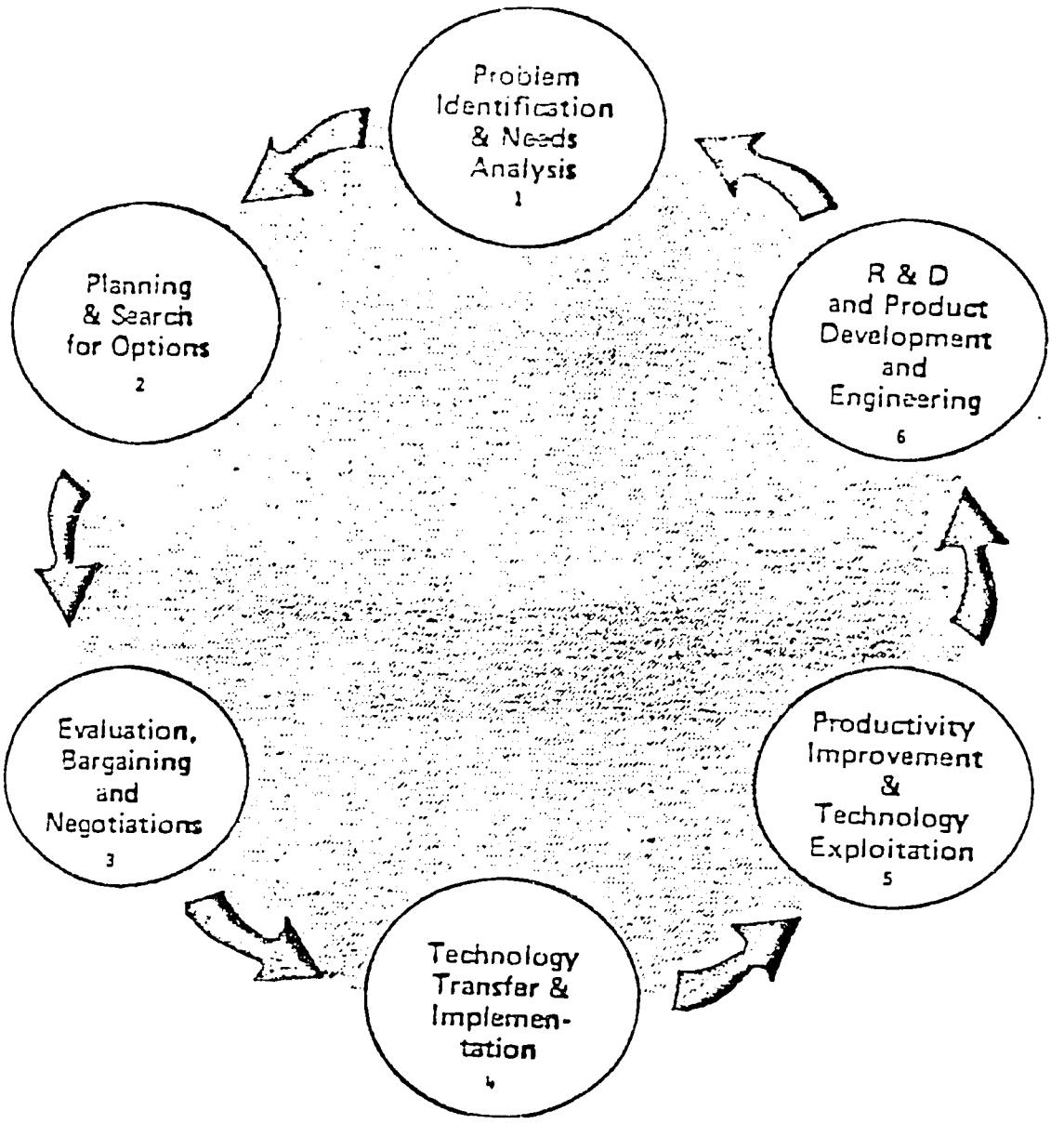
As with organizing, there exist a variety of decision-making structures among the firms. However, the norm is the executive officer formulates policy, with relatively little input, if any, from other management groups or special staff. Production and marketing decisions are often made by the chief executive also.

The leading process as defined here has little impact on conditioning the firm to receive technology. In the absence of an established planning mechanism, the individual leader often plays the critical role in motivating and organizing the firm to acquire technology. Unfortunately, he is usually acting on instinct or whim rather than on well-analyzed plans.

E. THE TECHNOLOGY CHANGE CYCLE

The importance of planning and its relation to other management processes becomes clear if we examine the actual decision process that a firm follows in undertaking a technology program and then followed by planning and searching for different options and mechanisms for acquiring technology. The next stage is the evaluation, bargaining and negotiation process through which the firm finalizes its technology program. Once purchased, the technology must be transferred and implemented. Almost immediately the enterprise must begin making productivity improvements and looking to new ways of exploiting the technology it has acquired. Finally, the user may undertake its own product development and research. The diagram on the following page outlines these six basic phases of technology evolution and program development.

SIX BASIC PHASES OF TECHNOLOGY EVOLUTION
AND PROGRAM DEVELOPMENT



These six stages are cumulative. Any attempt to improve the firm's ability to acquire alternate technologies at Stage 4 will fail if the firm has not already moved through Stages 1,2 and 3. Many technology change programs are mismatched to the needs of the user firm precisely because they assume capabilities that the firm has yet to attain.

Hence, it is important for the user firm to understand its own abilities to identify needs, search for technology, and exploit technology opportunities. Some user firms may have already acquired the internal capability to utilize foreign technology. If so, their immediate concern would be to obtain more information about alternative sources of technology. Most firms, however, will not have the general management capability to begin seeking, much less acquiring or exploiting, technology. Their critical problem is to develop organizational capability. For them, soft technology programs (e.g. management and skilled technical capabilities) are of much greater need than hard technology (e.g. new machinery).

A review of the consulting projects undertaken by the International Executive Service Corps during the last ten years confirms the importance of soft technology.Most of the IESC projects were commissioned to deal with production snags or new equipment installation problems. However, volunteer consultants in over 80% of the cases studied had to attack general managerial problems as well.

The seven examples of typical consulting projects listed below demonstrate the degree to which the assistance offered tended toward management and training activities.

EXAMPLES OF SELECTED TECHNICAL ASSISTANCE PROJECTS
UNDERTAKEN BY IESC IN FORESTRY PRODUCTS

Typeof Company	AssistanceRequired	Major Need of Company as Identified by Consultant
1.Manufacturer of plywood and particle board in Central America	Establish new marketing and distribution programs--train staff in basic marketing and sales management.	Ability to identify needs for new products that relate to changes in the local market.

Type of Company	Assistance Requested	Major Need of Company as Identified by Consultant
2. Manufacturer of tissue paper and kraft paper bags in Latin America	Design new production controls and equipment maintenance systems, create new product from waste paper. Reduce chemical cost and use.	Training of senior management in organizing and planning systems. Need to refocus managerial orientation to include production, marketing, and human resource development.
3. Manufacturer of plywood and veneers in Latin America	Correct automation, which had caused major problems in "down time" and plant utilization. Install controls and maintenance systems to bring about productivity.	Better coordination between plant organization, equipment utilization, and marketing so as to take advantage of export and new sales opportunities.
4. Cardboard manufacturer in Latin America	Reduce costs of raw materials and production through new standards and manufacturing procedures.	Organize the approach to production planning and supplier assistance; forge links with U.S. companies in similar industry.
5. Logging and sawmill activity in South East Asia	Lay plans for completing plant construction, devise budgets and cost controls, design operating manuals for logging and mill activities.	Train and organize staff to carry out to standards such operations as sorting, stacking, curing, grading, and packing.
6. Manufacturer of prefabricated wooden buildings in Latin America	Install production and storage controls; coordinate purchasing planning between manufacturer and suppliers.	Focus on building worker and technician skills and motivation.
7. Hardwood sawmill in Latin America	Devise training and management systems to organize mill. New equipment and plant facilities could not be utilized without overall worker and management organization.	Foster planning and manpower development; instill knowledge of basic tasks and techniques.

The importance of adequate managerial resources is underscored in each of these cases. without such resources, the user enterprise cannot value options and therefore cannot engage in a well-targeted search for the optimum technology. As a result, the assistance requested, as demonstrated by these cases, is other off the mark.

At bottom, the absence of good managerial resources leaves a firm to acquire technology in an ad hoc fashion, perhaps as the result of contacts with equipment salesmen or by informal linkages with enterprises outside the country. Dependent on such random information, the user may--or may not--find the technology he chooses applicable to his home environment.

F. ANALYZING THE NEEDS OF USER FIRMS

Successful planning of technology projects starts with gap analysis. Simply speaking, this is the need to identify the difference between what a firm is doing now and where it could be after it carried out a technology change. Whether the ultimate strategy is a joint venture, licensing arrangement, or specific consulting assignment, the program starts with identifying the need and what the change would bring. The basic questions to be asked are:

- What aspect of the firm's hard or soft systems should be changed?

-What will be the value of the change?

-What are the characteristics of the change program, the costs, the possible problems that will be encountered?

As stated earlier, most technology projects break down because the initial step of needs analysis and problem identification are poorly executed. From the initial planning problem, other difficulties arise that are associated with the inability of the user to sereach for the right combination of technologies and then to receive and install them. Again and again, user firms are sold equipment or a license, but they fail to organize themselves properly to train their workers, adapt their accounting system, shift their marketing efforts or take other steps that would make the technology work to par. Therefore, the planning and analysis for a technology transfer must deal with the larger issue of the overall project cycle, including the mechanisms for transfer, the management systems that will be affected and the other key functions of the corporation that must be adapted to the technology change, such as marketing, finance, accounting etc.

The following chart summarizes hard technology, soft technology and project cycle categories.

Hard Tech Categories	Soft Tech Categories		Project Cycle Categories
	Management Process	Functional Systems	
Equipment and Tools	Planning	Marketing	Planning and Marketing Analysis
	Controls	Production	
Products and Service Models	Organizing	Finance	Design and Construction
	Leading	Personnel	
Procedures, Methods and Formulas	Staffing	Research and Development	Start Up
			Value Engineering
Layout and Design			Product Development
			R & D

Earlier discussion has shown examples of how all of these different types of technologies are combined in a typical subsidiary program of a multinational corporation. A variety of consulting project examples can show that even in the smallest types of technology projects the relation between hard and soft systems is critical. Again, the review of these consulting programs will reaffirm the need for greater emphasis on the soft systems that make up the management capability to apply and exploit the hard technology embodied in processes, formulas and equipment.

G. EXAMPLE CONSULTING ACTIVITIES IN FOOD PROCESSING

Even in the smallest of consulting programs introducing technology change, we can see the characteristics of our planning categories. Unfortunately, most technology users are unable to identify at the outset the type of technology change they require. In many of the cases studied here, we encounter companies pruchasing equipment rather than improving existing systems through maintenance, training or reorganization. In other cases, enterprises that could gain dramatically from new product designs or other changes are unaware of the opportunity associated with such change. these cases, drawn from the experience of the International Executive Service Corps, provide a good base for comparative information, since they span so many different industries and involve a variety of public and private firms. Importantly, the IESC volunteer normally brings over 25

years of on-the-job experience and therefore provides consulting that combines both hard and soft technology. As mentioned earlier in the discussion on forestry products examples, the consultant almost always feels that the user need has been poorly identified and that the consulting program requires more managerial assistance that is usually requested.

The following examples of the freezing and canning programs help show how user firms could have better qualified their needs. Additionally, the cases demonstrate the monetary value to the client company of a consulting project. They further show the significant value associated with the managerial-oriented programs. The IESC programs studied have included over 400 projects in food processing. Underlying that number is a trend of nine types of projects that we can classify loosely into hard or soft technology categories. They divide as follows:

CONSULTING CATEGORIES IN FREEZING AND CANNING
IESC TECHNOLOGY CONSULTING PROGRAMS

HARD TECHNOLOGY CATEGORIES	SOFT TECHNOLOGY CATEGORIES
-Equipment selection and installation	-Planning and organizing export activities
	-Planning and feasibility studies
-New products and formulations	-Quality-control programs
-Treatments for waste and spoilage	Maintenance control programs
	-Training and productivity controls
	-Financial administration

The following examples show how different needs are met with consulting programs and what type of value is related to these efforts. Since technological advances are constantly being made that can further aid producers to upgrade operations, the average user should be constantly analyzing his operations for these types of opportunities and others.

Hard Technology Examples

The examples of hard technology transfer are linked to programs that deal with equipment changes or the introduction of new treatments, formulations, or work methods. Sometimes the technology is transferred through models, drawings, or manuals. In the three cases chosen here we have tried to highlight how the experienced consultant can greatly enhance the selection and application of hard technology changes. Specifically the cases deal with new product development, equipment purchases and changes in packaging and treatment for the control of waste and spoilage.

New Product Development

The effort to devise new products can involve a food processing firm in costly experimentation. finding the right receipes, correct measurement of ingredients, proper mixing, purchase of the right equipment and defining labor needs are some of the critical points in the new product chain.

In Malaysia, a producer wanted to develop oriental style meals to sell in the U.K. The task was to adapt home-style receipes to large batch cookery and create a pilot production plant. He brought in a consultant who devised formulas and preparation procedures for quantity cooking, advised on the kinds of equipment required and helped set up the equipment.

Among other things, the consultant cautioned the Malaysian owner against using a nutrogen tunnel for his particular operation. Instead, the consultant suggested air blast technology, which costs about one-sixth that of the nitrogen process. Then, the consultant located a good used packaging machine that saved $15,000 on the price of new machinery. The consultant further arranged for filling equipment that controlled the amount of product going into each package. This enabled accurate per batch costing and eliminated the need for five hand laborers. Within a year, the $1 million investment made by the Malaysian firm was yielding over $1 million in sales.

In Portugal, the experience was repeated A meat products producer that was having difficulty developing a good-tasting hamburger decided to use the services of a consultant. The consultant altered the recipe, using soy protein to supplement the meat and meat flavoring to enhance the taste. The result was a 12% value saving per pound of meat. The consultant also devised a simple way of repositioning the hamburger forming machine to eliminate hand pressing altogether. Within six months, the new hamburger operation was generating $2000,000 in sales on an annual basis, and profitability as running about 25% of gross sales.

Equipment purchases. Equipment upgrading is often thought to be necessary, by food processing firms, but the choices of machinery available and its high costs make a new purchase a difficult decision to take. Always the company is bothered by the question: Is this the machine I really need?

Consulting programs can help companies avoid unnecessary expensive purchases. For example, an Ecuadorean freeze-dried coffee processor, with a sales volume in the $15 million range, faced a sediment problem so severe that he stopped producing altogether and was contemplating the purchase of a centrifuge, which would have cost at least $70,000. A consultant saw that changes in piping and percolation would eliminate the sediment problem His advice saved the company $70,000 in machinery acquisition.

An even more spectacular saving was achieved by a Peruvian plant owner exporting green onions. He was unsure whether one of the bottlenecks to productivity was a too small boiler or too low freezing capacity. He brought in a consultant, who, through drawing up precise energy and materials balances, was able to determine that the bottleneck lay with the boiler sized, not freezing space The plant owner avoided spending at least $200,000 on unnecessary freezing chambers and instead settled on a larger boiler at a cost of about $80,000.

The consulting program resulted in other positive achievements. By other on-site changes, the consultant was able to reduce drying time of the onions by almost 50% which netted a large productivity increase. This change plus others led to a doubling of output within one year.

Control of waste and spoilage.

Improvements in this area depend on proper packaging and product treatments as well as organization and control processes to assure that the technology is applied properly. Damage to food products can take place during harvesting and upon arrival at the plant. "In process" waste often results from the action of poorly trained personnel and ineffective controls over processing. Storage before shipment can be the occasion of major deterioration in the processed product. Consultants can organize and install controls to monitor spoilage problems throughout the entire production process. They can help improve field collection programs and modify boxing and storage systems. some times, their special knowledge aids in selecting the right equipment or procedures necessary to treat the raw and processed materials or to provide proper protection in storage and shipping. In many cases, productivity outputs of from 10% to 60% can be gained just from careful planning and control of waste and spoilage activities.

In a fruit-packing operation, a consulting program undertaken by an IESC executive helped the producer determine the fungicides and procedures to be used to assure that all fruit was properly treated during transit to the processing plant and in storage before shipment of the packaged fruits to markets. This same program required adaptations in equipment to allow the use of more effective chemicals and decay control procedures. With the new procedures, chemicals, and equipment modifications, the company was able to dramatically reduce the rejection of exported fruit. previously the company had been experiencing as much as 50% rejection of its fruit exports in European ports. The change introduced by the consulting program reduced this loss to under 10%.

Soft Technology Examples

Soft technologies are essential to application of the hard technology. So many times, enterprises overlook the critical need to train and direct personnel properly. control systems for quality, worker productivity, maintenance and many other areas are critical to profitability. The average user must be very careful to look for these technologies in the design and start up of any new product line or production activity. Additionally, the user firm must place great emphasis on building its management system so that it can continue to adapt and improve its technology through value engineering and technology adaptation. Much of the ability to gain continuing productivity improvements will come from this internal capacity to constantly adapt and improve management systems. The following six examples show how different planning and controlling programs led to major profit improvements for freezing and canning enterprises.

Planning and feasibility studies. these are the foundation of a new business and represent a good opportunity to use consultants. they can bring in-depth industry experience and can prove invaluable in helping review proposals or in developing new plans. In one case, a consultant helped review a proposal for and entire new canning operation. He saw that the plant was doomed to failure due to certain problems inherent in the local market. Unfortunately, the company had received the proposal and study from a foreign equipment supplier who was anxious to promote the entire program in order to sell his equipment. After the consultant analysis, the company wisely avoided the new investment, averting a potential loss in excess of $6 million.

In another instance, a consultant set up a complete plan for processing a variety of vegetables for local distribution and export. The consultant alone was able to develop the market research, equipment purchasing requirements, and budgets for start up. Additionally, he outlined job descriptions, reporting formats and information systems. He also identified the types of

problems that might arise and developed contingency planning. After the project, the volunteer was available for on-going communication with the client, thus providing a referral and information link. The client probably saved months of time and over $200,000 in startup costs as a result of the consultant's efforts. Success was clearly tied to the consultant's ability to integrate several aspects of management systems and build a capability in the firm not only to start up the new lines, but also to continue with on-going value engineering and productivity enhancement.

Quality control. Almost any point in the production line can be damaged by a quality control flaw---poor choice of raw material, negligent processing procedures, lack of tasting procedures, inadequate packaging and many more. And virtually at any point in the quality-control stream, consultants can intervene to help the producer upgrade quality.

A case point is a firm producing soluble coffee that was unable to sell his fine quality coffee at a premium price in the international market. A consultant hired to solve the problem recognized that the tasting procedures, which included mixing the drink with heavy doses of local sugar, were valueless in terms of determining international acceptability. The executive set up a tasting panel using the simple method of blind tastings among people selected from the plant who demonstrated a good palate for coffee.

This simple solution resulted in the firm not only being able to sell its product for $.30 more per pound on the European market, but also won it a gold medal in international coffee competition.

Equipment maintenance. This is a type of control system that is frequently inadequate in food processing. It translates into machinery downtime that in turn means lower unit output and higher costs per unit of output. Again, consultants can provide a variety of services to help a company get the most out of its machinery. They can address the problem of preventative maintenance, or alternatively, of improving utilization of existing equipment.

The experience of a company in Turkey illustrates the practical advice a consultant can provide. The company, a producer of raisins and figs for export, called in an executive to install a maintenance schedule. The goal was to reduce production interruptions due to chronic equipment breakdowns and to extend the life of machinery. In use was a variety of conveyors, sorters, washers, packaging equipment, paper cone machines, fumigation devices and other supportive equipment. The consultant drew up a work plan which listed the different types

of maintenance work and separated it by frequency of inspection and by building. With this type of informational tool, the maintenance supervisor could isolate recurring problems and at all times be aware of the work required, work performed, and work to be done. The volunteer also identified very specifically the duties of the maintenance supervisor, lubrication personnel, building and grounds keepers, and maintenance mechanics.

In the process of drawing up the maintenance control schedule, a major production bottleneck was eliminated by redesign of the blowing and piping systems used in the 38 fumigation rooms. All incoming fruit had to pass through these chambers, which then need three to seven hours to be cleared of methyl bromide before employees would enter to remove the fruit. The redesign enable the clearing time to be cut to half and hour, allowing for dramatic increase in the utilization of key equipment.

Planning and organizing. This technology, not unlike that associated with Planning and Feasibility Studies, described earlier, comes into play when user firms desire to undertake new activities, like selling markets. Consulting firms can promote new export development in a variety of ways. Improving production efficiency to lower costs and to make exporting feasible is one major way. Designing new products is another. In tandem with these approaches, the consultant may also work with the food processor to develop a better understanding of foreign markets standards. For example, companies in many countries trying to export fresh fruits and vegetables to Europe and the United States face obstacles regarding the types of fertilizers, fungicides, insecticides, and other chemical treatments used. Expert consultants can help exporters create testing programs that assure that their products are being treated with the chemicals and procedures suitable to the import controls of the foreign markets. These controls may extend to packaging, coloring, or other final preparations of the products.

A good example of what can be achieved via a consulting program is illustrated by an Asian company that wanted to produce frozen fruits and vegetables for the U.S. market. An IESC consultant trained the Asian firm's produce buyer in U.S. Department of Agriculture standards for selection of farm crops, taught better inspection methods on the production line and then arranged for the plant manager and the employee charged with quality control to undergo training in a U.S. plant. for this firm, the soft technology program broke the crucial bottleneck to exporting---achieving product quality acceptance in foreign markets.

Training and production controls.

These soft technology programs, just like quality control programs, can achieve visible results. They are particularly needed by firms that suffer rapid turnover of personnel and changes in management staff. Because of frequent changes, new workers and supervisors often operate with little knowledge of the standards and methods that should govern their work. Consulting programs can help establish standardized programs for retraining and maintaining worker and supervisor skills. The experienced consultant can help reorganize and sequence production, develop new crewing mixes, and develop specific training programs to help improve worker and supervisor efficiency. Specialized control systems can be designed in tandem with retraining effort to help management monitor the actual results on the production line. The monitoring system enables management to identify where productivity is being lost, and take quick corrective actions.

A good application of this technology occurred in a plant freeze-drying onions in Peru. The company management asked an IESC consultant helped the workers and supervisors to use methods that reduced loss of product during skin removal and root trimming. He also made some equipment modifications on the boilers, condensers, and freezers. The new procedures improved the throughput by 16% and led to a yield improvement of 7% without requiring any new equipment or changes in raw materials.

Financial administration.

Proper accounting and information systems are often the first step toward building an effective management process. Without the technology that supports sound financial administration, firms may be losing money without even knowing why.

An African company provides a good illustration. The company, troubled by a chronic cash squeeze, called in an expert who was an accounting, inventory control and cost reduction specialist. The company, which employed over 1,000 people and registered annual sales of about US$3 million, was devoting 10%-15% of its sales dollar to servicing loans, while continuing to operate at a loss. The consultant saw that the firm lacked a basic cost analysis system for determining prices, a proper budgeting procedure for allocating resources, had poor inventory records and had no sales forecasting capacity. The consultant instituted these basic systems and trained two of the firm's accountants in their use. The result was a new lifeline for a company that was slowly going bankrupt, but unable to identify the source of its difficulties.

Lessons Learned From Consulting Cases

These examples are but a small sampling of the variety of programs that individual or groups of consultants and technical advisors might offer. It should be noted that most of the examples resulted in significant value to the user. However, in many cases user firms purchase consulting when it is not necessary or acquire assistance when their firm is not well organized to exploit it.

1. Do I understand how the work flow actually operates and what segments of it offer opportunities for change?

2. Do I know how well the machinery is working in relation to its optimum performance capabilities?

3. Does my information system tell me where I am gaining or losing money in terms of each critical step of my work flow: harvesting, collection, transport to the plant, initial sorting, processing, etc.?

4. Are my workers, superivsors, and managers well trained and do they know what is expected of them? Do they know the proper methods and procedures and do they know why workers, supervisors, and managers are doing a good job?

5. Can my management team analyze the work flow and management systems to identify possible areas of technology change? Can I evaluate how much it will cost and benefit me to change any part or combination of systems?

7. Do I know what my competition is doing in terms of new machinery, products, packaging, or procedures?

8. Do I know what is happening in similar industries and enterprises around the world? How can I find out how my operations differ from theirs?

9. Do I understand how I must change and adapt management systems in line with expected changes in my hard technology systems?

Given some ability to answer these questions positively, the user firm can determine what type of consulting, licensing, or other technology strategy might serve its interest. The interest must somehow focus on what stage of project development is required (planning, design, etc.) what mechanisms are required for transfer (training, equipment, etc.) and what aspects of management systems must be adapted (organizing, control, finance, marketing, etc.)