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DEVELOPED COUNTRIES:

REACTION IN THE CORPORATE BOARDROOM
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Introduction

The literature on the transfer of technology¹ to less developed countries (LDCs) has burgeoned in the last decade. See Moxon (1979) and Contractor and Segarfi-Nejad (1981) for reviews of the major aspects of the field. However, even with the extensive amount of research done in the field, there has been a surprising lack of attention given to the relationship between technology transfer and corporate planning. Mansfield (1974) observed that "we need to know more about the decision-making process within firms with regard to the transfer of technology abroad." He continues that "although Aharioni (1970) has conducted studies of the decision-making process with regard to the general aspects of foreign investment, little information is available concerning this process with regard to the transfer of technology." Since Mansfield made his observations, however, little if any work by researchers has been done to fill this void.

This study examined the way corporate planning and decision-making was applied to the transfer of appropriate technology to LDCs. The focus of the study was on the inputs to and the means employed in planning rather than on the outcomes. Thus, our specific concern was with the decision-making processes and organizational arrangements that firms have implemented for the transfer of appropriate technology to less developed countries.

The purpose of the study was to determine: (1) the extent to which corporations have instituted organization arrangements to systematically plan for and monitor technology that they transfer to less developed countries; and (2) the factors that impacts the extent and types of modifications made to the technology being transferred.

The Transfer of Appropriate Technology to LDCs: The Issue

Less developed countries have increasingly become aware that their development goals, desires, and strategies are all intricately tied to their ability to obtain technology from sources external to their own country. The LDCs initial desire to obtain a general technology has, over time, been replaced with increasingly sophisticated techniques to obtain only those technologies most appropriate for their own environments. This higher level of scrutinization on the part of the LDCs is based on the realization that the purchased technology can have a significant impact on employment, regional development, entrepreneurship, balance of payments, and so forth.

On the other hand, it is generally agreed that multinational corporations (MNCs) have attributes that enable them to transfer resources, materials, and capabilities across boundaries. They are large in size, capital, and scope of operations both functionally and territorially. They are heavily growth oriented and are thus more involved in technological innovations and R & D than are smaller nationally based firms.

The MNCs search for further gain and growth, coupled with the LDCs need to increase national output, employment, and foreign exchange revenues have resulted in a situation with potential gains for both parties. Where as MNCs can offer capital, technology, export opportunities, and so forth, LDCs are increasingly offering markets, raw materials, labor, and a general environment in which corporate equity can function (Frank 1980).

However, even with the existence of these these potential initial gains, there are major points of contention concerning the transfer of technology. It has been alleged, among other things, that:

- * MNCs produce inappropriate products -- too sophisticated, too highly designed, and too elaborately packaged -- to meet the needs of the poor masses.

* Foreign firms utilize inappropriate production processes that:

- Are excessively capital-intensive in relation to the bundance of cheap labor in LDCs.
- Intensify employment problems.
- Aggravate inequalities of income.
- Worsen balance of payments by importation of capital equipment.
- Bias the output toward excessively sopisticated products.

In view of these and other areas of conflict and the response taken in various quarters to these areas of conflict, it is the postioion of this study that the transfer of technology to less developed countries is an issue important enough to warrant the attention of senior corporate managers and planners. Such attention would appear to be justified because of two interrelated external and two interralated internal enviromental factors.

External Factors

Many individual LDCs have divsed some system of technology transfer review, incentives or disincentives, laws, or review process in order to ensure the acquisition of only those technologies suitable for their particular needs.

Camp and Mann (1975) and Mason (1978) have reported on the efforts of Mexican and Southeast Asian LDCs in regards to enacting technology transfer laws and Contractor and Sagafi-Nejad (1981) and others have suggested that these efforts will spread increasingly to greater numbers of countries.

In fact, Robinson (1978) has observed that it seems likely that private business will be more often asked to justify the technology that it uses in the developing countries. And finally, Gladwin (1978) has pointed out that attempts to control, or the desire for a "humanistic" technology, carry major implications for multinational enterprise planning and decision-making;

the planning process will also need to become more "participatory" to be become more sensitive to the values and needs of those who are affected by the project or product.

Efforts to enact International Agreements on Technology Transfer actually began in 1883 when the Paris Union for Protection of Industrial Property was signed. Most recent efforts have been primarily by the United Nations Conference on Trade and Development (UNCTAD). The U.N. organ has been negotiating the reatification of a Draft Code of Conduct on the Transfer of Technology.² Additionally, LDCs verifiy among themselves that one of them has indeed been transferred technology from a given MNC.

Internal Factors

Considerations of both strategic consquence and economic efficiency would appear to imply top corporate level attention to the tranfer of technology. According to Doz (1980, a well-articulated worldwide integration strategy simplifies the management of international operations by providing a point of view on the environment, a framework to identify key sources of uncertainties, and a purpose in dealing with them. This strategy can guide managers in adopting a proactive stance. The simplicity of the driving principle of the integration also makes a consistent detailed strategic planning process possible as it provides a unifying focus to the various parts of the organization. This process both guides the implementation of strategy and provides for its refinement over time.

Applying Doz's argument to technology transfer, it woulf appear that incorporating technology transfer into the corporate strategic planning process would provide the reference point for technology transger decisions made in the field and would facilitate congruence between decisions made by the various company sub units.

Research Questions and Hypotheses³

The underlying question addressed in this research is:

To what extent does the transfer of appropriate technology receive "consideration" from senior corporate managers and planners?

Dependent Variable

"Transfer consideration" is defined as the extent to which the transfer of technology receives the explicit attention of senior corporate level planners and decision makers. It specifically relates to the effective integration of technology transfer into the succession of activities involved in project planning. This multidimensional construct, then, is an abstraction which is derived from an application of project planning principles to the transfer of technology.

More "transfer consideration" implies a more extensive integration of the issue of technology transfer into the planning process. It would also imply a greater probability that the technology transferred is strategically congruent while also sensitive to recipient development goals.

Indications of how central an issue the transfer of technology is i.e., the extent of transfer "consideration" were gauged by assessing such things as:

- The position of the technology transfer decision maker(s), i.e., the vertical and horizontal location of the organization.
- The existence of formalized corporate guidelines.
- The provision for systematic search for alternative technologies.
- The provision for handling the desires of recipient countries.
- The provision for evaluating impacts of the transferred technology on the recipient.

Explanatory Variables

Underlying the explanatory nature of the model is the concept of contextual analysis, a method used to explain behavioral patterns in terms of the social contexts in which individuals, groups, or organizations function. As Gladwin (1975) pointed out, if behavior is not consonant with its setting, then opportunities are lost, costs rise, and maintenance of the individual, group, or organization is threatened.

So the model employed in this study, based on contextual analysis, focuses on multiple variables that can significantly impact the extent to which the transfer of technology receives consideration.

It is, then, specifically hypothesized that the degree of "transfer consideration" is a function of the interaction of three sets of inter-related contextual factors -- supplier company, recipient country, and inherent technology. (See Appendix 1).

Data Acquisition and Analysis

The model was tested via firm-base interviews conducted at three U.S. multinationals⁴ in the agricultural equipment industry. Less developed countries are generally acknowledged to be agrarian, with needs for varying degrees of modernization of their methods of agriculture. For this reason, the agricultural industry was chosen. During the interviews, we spoke to numerous corporate and division level officials, including corporate vice presidents, a designated technology transfer officer, strategic planning managers, division product planning vice presidents and managers, division regional vice presidents and manager, marketing and production managers, and project directors.

The central feature of the overall research design is a comparative approach focusing similarities and differences in the behavior of firms in the same industry operating under similar contextual conditions.

Findings

There are two immediate observations. First, "transfer consideration" did not exist. That is, in none of the respondent firms was there any corporate level organizational arrangements or policy guidelines specifically designed and instituted to handle the transfer of technology to less developed countries. Rather the handling of technology transfer to less developed countries was delegated to division (sub unit) level or below. The reasons for this are in part explained by the fact that technology transfer is really not seen by company officials as a separable issue, but rather is seen as simply a natural consequence of an overall project package. And because of the particularity of each situation for which a project is being developed, it is held that organizational arrangements and guidelines would be useless.

Secondly, and just as revealing, we found no discernable relationship between a company's organizational arrangement to handle technology transfer and any factors influencing the adaptation, new design, and technology transfer process. Below we discuss the specific findings by first assessing various organizational arrangements and then the various influencing factors.

Organizational Arrangements to Handle the Transfer of Technology to LDCs

What We Found

In each of the companies, technology transfer has been delegated, either explicitly or implicitly, by corporate management to sub unit or divisional level. Consequently, it was only at the sub unit level that the transfer of technology received any attention, and not at corporate level as we have suggested.

In none of the countries was there a Technology Transfer Officer or other such designated individual whose job it was to oversee the technology that was transferred to less developed countries. (There was a Director of Licensing and Technology Transfer at one of the companies but he was involved exclusively in technology transfer to Eastern bloc countries). Written guidelines, again because of the particularity of each situation, were viewed as futile; consequently, no formal written guideline existed. One company official did, however, admit that he had started accumulating data concerning projects in which the company had participated in an effort to organize the information and make it generally available to operating units. This official's concern was that the company not have to "reinvent the wheel" every time a new project was being considered. In no company was technology transfer specifically addressed in the Project Proposal/ Capital Appropriations Request document. One company did have for use in its projects with centrally planned economies, a "Principle of Cooperation" document which did include information on the type of technology being transferred and resultant payments to be received. This document as reviewed by management at the group level. Only when the project under consideration is in a country specifically requiring a separate technology transfer agreement is technology transfer included in the project proposal (for example, in Mexico). Management's concern, in this case, is the legal implications of such an agreement. And only in this instance is Division Management Approval given explicitly for the technology transferred. In other cases, division (or group) management approves the project proposal as a whole, while technology transfer is viewed only as a consequence. Finally, there were no formalized structures to conduct searches for the availability of alternatives. The companies were aware of the various products offered and the process used by their competitors. However, there were no search efforts to determine if products or processes could be adapted make them more "appropriate."

Why the Findings Occurred

1. External Pressure on the Firm

We hypothesized that the transfer of appropriate technology was an issue important enough to warrant senior corporate management attention primarily because of two interrelated external factors: (1) attempts by various quarters to effect an international agreement on a code of conduct for the transfer of appropriate technology; and (2) efforts by individual countries to better control the technology being transferred to them. Neither of these factors, however, apparently had any significant, consistent impact on any of the companies that we interviewed. The companies were aware of the efforts in the U.N. and elsewhere to effect a code of conduct on the transfer of technology but these efforts did not seem to have any impact at all on the decisions made by any of these companies.

The extent to which the companies in our study conformed to the desires of individual recipient countries was a direct function of the relative bargaining power of the respective parties. We found that only the desires of the more advanced LDCs with larger present markets or near-term future potential markets had any impact on company decisions. That is, because of their large markets, when Mexico, Nigeria, Brazil, South Africa, et al. talk, companies listen. However, when the Sudan, Zambia, or Bolivia talk, no one hears. Of particular relevance was the ability of the larger recipient countries to limit access to their markets. Other recipient inducements, with few exceptions, appeared to be of minor importance.

It appears, then, that there has not been any concerted external pressure felt by these companies to transfer appropriate technology and therefore no real imperative to devise organizational arrangements to deal specifically with the transfer of appropriate technology to LDCs.

2. Technology Transfer to LDCs -- Not a Major Issue

Technology transfer to LDCs, for the companies in this study, was not a major, separable issue but rather a minor one that was merely subsumed under the project proposal or business plan. Each project was put together by an ad hoc team assembled for that purpose, and the technology transfer "fell out of" the configuration of the project. As one company official at Company Two observed, he had a problem in even identifying technology transfer as a separable issue because to him and his firm, technology transfer was nothing more than the natural consequence of doing business abroad. Special organizational arrangements to handle the transfer of technology to less developed countries were therefore felt to be unjustified.

3. Importance of LDC Markets

The products built by these companies were designed and built primarily for the industrialized markets.

Furthermore, the companies for the most part had operations (wholly-owned subsidiaries, joint ventures, and/or licensing arrangements) in LDCs only as a reaction to threatened foreclosure of these markets. And so their presence in LDCs reflects a reactive rather than proactive posture. As one Company Three official stated, there would undoubtedly be no operations in LDCs if it were not for the threat of market foreclosure. And, again, even these comments about LDCs were relevant only for a select group of countries (labelled newly industrialized countries -- NICs) that included the larger, more industrially advanced countries.

Consequently, there have been few major projects going into less developed countries, and explicit technology transfer considerations added to these infrequent projects were more rare. Therefore, as stated above, any organizational arrangements and/or policy guidelines were seen by these firms as being unjustified.

4. Strategic Planning

Closely related to the importance of LDCs to these companies is the apparent lack of long-range, globally based, strategic planning.

One company official confessed that if there was a major weakness in his company's strategic planning, it was a failure to look at the global enterprise from that very perspective. His company didn't have a global perspective in that the company was not thinking in terms of differing strategies for differing environments.

The products and processes of these companies appear to have been designed for the industrialized markets almost exclusively; these were the markets that received most of the attention of company officials and will continue to do so. Although all of the companies acknowledge the increased role that LDCs will probably play in their respective companies 10-15 years from now, none appears to be actively formulating strategies and plans to proactively service these markets. The concern of these companies is the classic U.S.-based phenomenon of short-term return on investment.

In summary, the lack of organizational arrangements made by the companies relative to the transfer of appropriate technology to less developed countries reflects the apparent limited importance placed on the issue or on those countries by these companies. The adaptation, new design, and technology transfer process is of a "creeping," evolutionary nature rather than the result of strategies, policy guidelines, or dictums.

Factors and Considerations Influencing the Adaptation,
New Design, and Technology Transfer Process

Exhibits I and II summarize company comments regarding those factors (highest degree of impact) and considerations (lesser degree of impact) that influence their adaptation, new design, and/or transfer process decisions. A brief discussion of some of the major factors and considerations follows.

Market Size/Scale/Volume by far dominates all other factors or considerations. In terms of manufacturing process technology, scale is the major determinant, with small volumes requiring more labor intensive processing, and large volumes mandating capital-intensive techniques. And although at some point there is a trade-off between usage of labor and capital which allows some flexibility of choice, the rule remains that the higher the volume, the more capital-intensive the process. In terms of product technology, company officials staunchly maintain that this technology is fixed and set. However, further discussion reveals numerous cases of major product modifications being made at the request of a government. Each of these cases involved large volume markets. And finally this criticality of scale supports the findings of numerous prior studies including Morley and Smith (1977), Frank (1980).

With possibly one exception, there has been no concerted effort by companies to develop smaller, less sophisticated products because the profitability of these models is not as great as the profitability on the larger models. Therefore, as a Company One official pointed out, although there is a potential worldwide demand for 8 - 30 h.p. tractors of 400,000 - 450,000 units, the low mark-up precludes much, if any development, even though these smaller sized tractors are usually most appropriate for less developed countries.

EXHIBIT I

SUMMARY OF FACTORS INFLUENCING THE
ADAPTATION, NEW DESIGN, AND TECHNOLOGY TRANSFER PROCESS

FACTORS	COMPANY ONE	COMPANY TWO	COMPANY THREE
TECHNOLOGY TYPE	The basic product <u>technology is fixed</u> . Only minor modifications are possible. <u>Process technology</u> varies widely based on scale, government desires, and availability of skills.	<u>Product technology is set and given</u> . <u>Process technology</u> varies widely based primarily on volume.	Basic product <u>technology is fixed</u> . Only minor modifications are possible. <u>Process technology</u> is a function of volume and varies.
MARKET SIZE/ SCALE/VOLUME	The major determinant of plant design and type of process.	Volume is the major factor determining the process used.	Constitutes 90% of the consideration as to the type of facility used.
RECIPIENT STRATEGIES/	Tries to do what the country wants consistent with volume. Policy changeability is a concern.	Unclear impact. If plans are known and viable, company tries to do what the country wants. Policy changeability is a concern.	Company tries to do what the country wants consistent with the economic viability of the project. Policy changeability is a concern.

EXHIBIT I (cont'd.)

FACTORS	COMPANY ONE	COMPANY TWO	COMPANY THREE
SKILLS, AVAILABILITY, AND INFRASTRUCTURE	The lack of these cause increased efforts to establish.	Impacts how things are done more than what things are done. The lack of these increases the company efforts to establish.	Impacts the degree of local content that can be reached within a certain time frame.
WILLINGNESS TO PAY	Has a major impact on technology transfer. A real concern.	Not a concern.	Not a concern.

EXHIBIT II

SUMMARY OF CONSIDERATIONS INFLUENCING THE
ADAPTATION, NEW DESIGN, AND TECHNOLOGY TRANSFER PROCESS

CONSIDERATIONS	COMPANY ONE	COMPANY TWO	COMPANY THREE
PROPRIETARY NATURE OF THE TECHNOLOGY	No impact -- anything is transferred. In fact, patented technology is licensed among competitors.	No impact -- anything is transferred to anyone except competition.	No impact -- anything is transferred to anyone.
RELATIONSHIP TO RECIPIENT	No impact. Less than 100% ownership requires consultation with the recipient.	Not a determining factor. The interaction is fundamentally different.	No impact. More formalized interaction when it is less than a 100% ownership.
RECIPIENT	No fundamental impact. May change the timing of what the company would have done anyway. Would never do anything unethical or unviable.	No impact. Would never do anything unethical or unviable.	Impact is not clear-cut. Is influenced by present and future potential market size, company resources, availability and timing. Would never do anything unethical or unviable.

EXHIBIT II (cont'd.)

CONSIDERATIONS	COMPANY ONE	COMPANY TWO	COMPANY THREE
FACTOR COSTS	Not a major factor.	Not a major explicit variable, but one that enters the analysis of the overall project.	Cheap labor is utilized as much as possible.
COST OF ADAPTATION	No effect.	Not a major explicit variable but one that enters the analysis of the overall project.	Simply factored into the overall analysis of the project.

Additionally, one of the key success factors of the industry, as related by company officials of all of the companies interviewed, is that of state-of-the-art product engineering. This is, in fact, one of the main reasons in this industry for the near nonexistence of proprietary technology: The real key to success is in product innovations.

This key success factor appears to lead to very similar phenomenon found by Morawetz (1974) and Louis Wells (Wells 1973) Where companies end up producing only the latest, most sophisticated products possible. Wells suggested that part of the reason for this is the objectives of engineers which include: (1) technical efficiency, (2) prestige associated with technical sophistication and modernity, and (3) the products of companies from the industrialized countries were very inappropriate to the needs of LDCs. And we believe that in our study, we have found the same or very similar dynamics at work. Recipient country strategies, policies, and desires are honored only to the extent that volume considerations allow. These strategies usually center around employment, exporting, recency of technology, and so forth. General comments concerning factors and considerations are aptly summarized in the Exhibits.

Implications of the Study

We again acknowledge the fact that there are several inherent limitations to this study which severely restrict the generalizability of our findings. The small sample size and single industry nature of the study is particularly restrictive. Notwithstanding these shortcomings, there are valuable implications derived which we shall now discuss.

Implications For Company Policymakers

Company Three and International Harvester have suffered chronic losses as has Company Two in its overseas operations. This less than rosy picture is in large measure a reflection of depressed demand for these companies' products in the industrialized markets, i.e., those markets on which these companies have chosen to concentrate most of their efforts.

If this situation were to continue, which might well be the case, it would seem to be prudent for these companies to begin rethinking strategies concentrating on the industrialized countries. Since the respondent firms acknowledge the growing importance of LDC markets to their own business, it would appear wise to begin immediately making proactive decisions which would put the firms in good stead at these locations. As an official at Company Two pointed out, there was insignificant demand ten years ago in several Southeast Asian LDC markets which today are thriving. Unfortunately for the U.S. firms however, the Japanese now have a lock on these markets. To preclude the possibility of this happening again, we suggest that the companies would do well to identify future potential markets in which they should now be developing a presence.

Closely related to this, respondent firms need to formulate, articulate, and disseminate a comprehensive global strategy based on a 15-20 year time horizon. And by taking this more proactive stance relative to LDCs,

the companies would then not always be forced to react to crisis situations created by policy changes in LDCs.

These firms, it seems, would also do well to realize that the transfer of appropriate technology is an issue about which LDCs are going to become increasingly insistent, and to ignore this trend would be, at best, foolhardy.

Implications for Recipient LDC Policy-makers

The findings of our study seem to indicate that the respondent firms view the markets of the less developed countries as too small to justify much attention. Secondly, the transfer of appropriate technology to less developed countries does not warrant senior corporate management attention nor specific organizational arrangements. In fact, it is not seen as a separable issue but subsumed under project evaluation programs. And finally, market size, scale, and/or volume totally dominated any other factor or consideration impacting the adaptation, new design, or transfer process. In essence, if the volume is there, a broad range of product and process modifications can be done but if the volume is not there little, if any modifications will be done.

LDC policymakers have only the option of formulating their strategies based on the strategies of these firms. It would appear to be a waste of time to approach these companies with the request that the companies transfer appropriate technology. Moreover, efforts to effect a "Code of Conduct" for technology transfer may also be futile. Economic considerations (volume) attendant to the proposed project seem to be what the companies respond to.

Several strategy options are open to LDC policy makers. First, foreclosure of their markets to imports might have an impact. Second, economic integration schemes such as ANOCM, Caricom, ECOWAS must be emphasized. The resultant larger market would then give that region the necessary bargaining power that the individual countries don't have.

Finally, LDC policymakers must do more "shopping around," looking to firms from both industrialized and developing countries to provide those technologies that the LDCs view as most appropriate for themselves.

Implication for Researchers

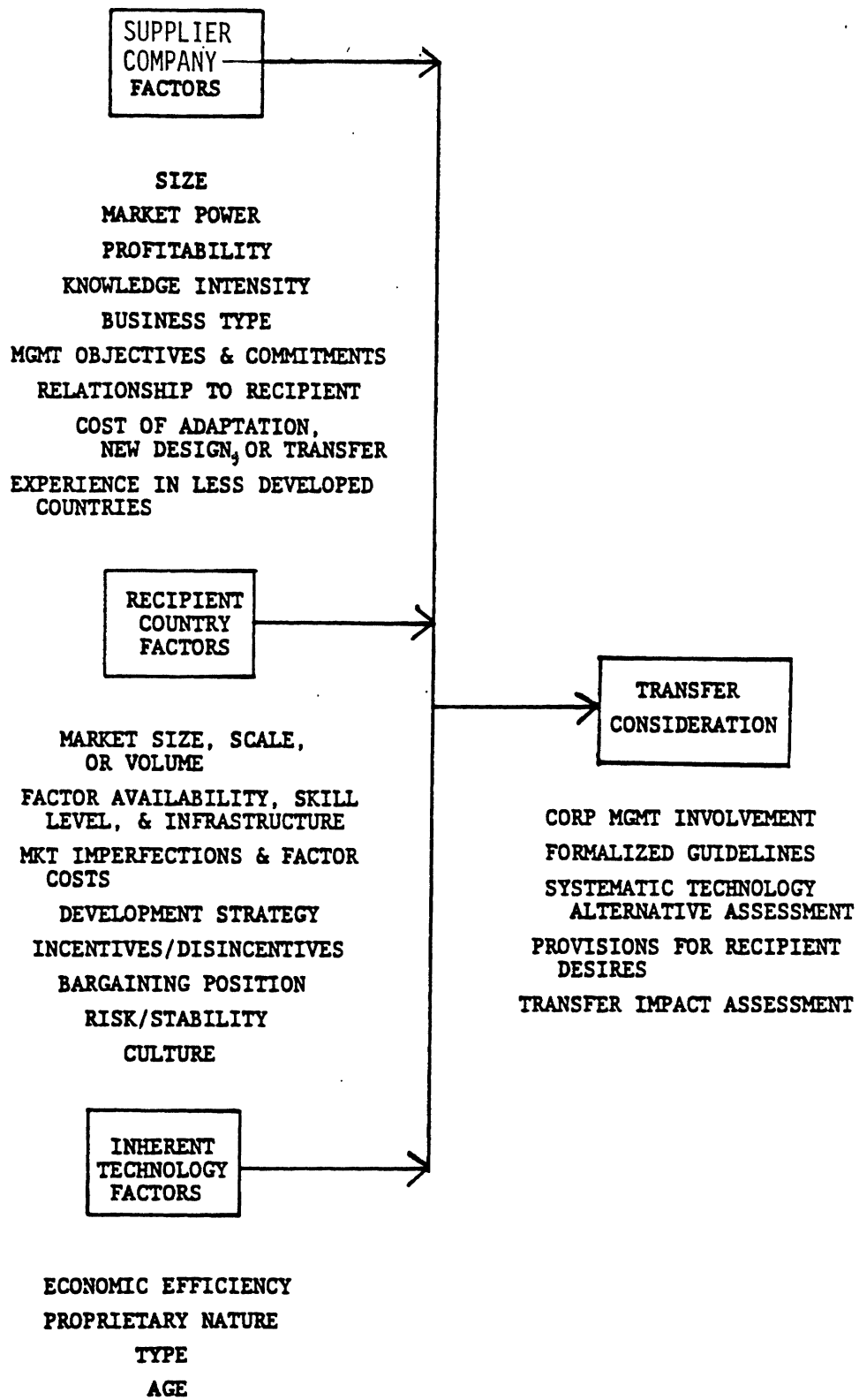
Because of the single-industry, small sample, homogenous nature of the study, we were unfortunately not able to actually test the model. However, do maintain our confidence in the validity of the model feel that a top priority should be placed on expanding the study to include more firms and other industries in order to test the model properly.

Our interviews covered only three of the leading U.S. agricultural equipment firms. The study should be expanded to include a larger sample of U.S. agricultural equipment firms, to give a clearer picture of the organizational arrangements and influencing factors involved in the transfer of appropriate technology to LDCs.

Another research step would involve expanding the study to include non-U.S. firms from industrialized and less developed countries. The results of such a study would allow cross-national comparisons.

And finally, research should move to firms in other industries, both U.S. and non-U.S., for further comparisons in regard to organizational arrangements and influencing factors involved in the transfer of appropriate technology to less developed countries. This would be especially true for industries that have more extensive operations in LDCs (for example Pharmaceuticals).

APPENDIX I



Footnotes

1. In this study, Technology as used will include the design of products, plants, and processes, as well as the managerial systems needed to establish plants and keep them operating efficiently (Moxon 1979).
2. The Draft Code of Conduct on the Transfer of Technology has the following proposed articles: (1) Restrictive Clauses - the technology agreement shall not include the use of the technology after the termination or expiration of the contract in question (unratified); (2) Technology Improvements - the technology recipient shall be informed and supplied with all improvements on techniques in question during the life time of the agreement; (c) Guarantees - for a certain period of time, the supplier shall guarantee to provide spare parts, components, and servicing of the technology without additional charges for maintaining this guarantee (unratified); (d) Special Treatments - special treatment shall be accorded to the developing countries in many areas, such as the right to sublicense, the transfer of nonproprietary technology, and the nature of royalty payments; (e) Settlements - the technology transfer agreement shall be subject to the laws of the receiving country and disputes shall be settled in the court of that country (unratified).
3. The firms included in this study are those major firms in agribusiness that consented to be interviewed. Allied Products, Allis-Chalmers, and FMC were also contacted by phone. The officials from these organizations recalled that the corporate strategy of their respective companies was to keep pace with the industry leaders. Technology transfer was not a consideration for them. Their limited product line was produced in one fashion and simply sold to whomever would buy.
4. For a full discussion of the conceptual model, see Mahone, Charlie E., Jr., Multinational Corporation Planning and The Transfer of Appropriate Technology to Less Developed Countries. Ann Arbor: University of Michigan Business School, 1981, Unpublished Doctoral Thesis.

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