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TRANSFER OF ENERGY AND ENVIRONMENTAL TECHNOLOGY FROM THE UNITED STATES TO INDIA: RESULTS OF INTERVIEWING EXPORTERS AND IMPORTERS

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I. INTRODUCTION: BACKGROUND AND PURPOSE OF THE STUDY

A. Background--The European Economic Community Study

The European Economic Community (EEC), at the request of the Government of India, carried out a large scale study entitled "Problems and Perspectives of The Transfer of Technology Between the Countries of the European Community and India." The EEC chose the ATW Institute at the University of Regensburg (Federal Republic of Germany) to be the principal research organization carrying out the study, and supervising subcontractors. The principal investigators at the ATW Institute were L. Hoffman, H Reile, H. Sanders, and F. Vardag.

The EEC/ATW study was interesting and unique in several respects. In the EEC countries, ATW used an extensive interview survey questionnaire that required quantitative responses to questions. The interviews were usually conducted on-site, after the researchers had identified the executives in each company who were in charge of technology collaborations with India.

The ATW staff and their European subcontractors utilized trade associations and governmental agencies to identify the most relevant companies, and the most relevant individuals within each company.

The study was ambitious in the breadth of hypotheses to be tested, and the intended use of quantitative indicators to test those hypotheses.

The hypotheses were the following:

Hypothesis 1: Given the Indian technology demand, the most important technology supplying countries will be those with a pattern of specialization in production of technology (measured by patents held) which corresponds to the Indian demand.

Hypothesis 2: If the process technology to produce a commodity originated in the export firm, the sources of technology supply are determined to a considerable extent by former sources of exports of the respective commodities. Firms which in the past have established strong relations with the Indian market will later become important suppliers of technology.

Hypothesis 3: When industrialization has passed through the early phases of import substitution and is turning towards more sophisticated and complex lines of production and, at the same time, is trying to expand exports, the relative importance of technology supplying firms changes. The relative importance of countries which were major exporters to India is likely to decline whereas others, which are technologically advanced but do not necessarily export to India on a significant scale, may come to the forefront.

Hypothesis 4: Under competitive conditions with easily accessible technology, both minority ventures and licensing agreements will be concluded. In the latter case there is a preference for lump-sum payment for the transfer. In case of large scale production, technology transfer contracts may not come about as long as the market is still open for imports.

Hypothesis 5: A supplying company which can secure its technological advantage by continuous research and development will enter a minority joint venture or a licensing agreement depending on the competitive position. If equipment can be supplied by other companies, minority ventures may be preferred.

Hypothesis 6: For large companies, even majority ventures may not be an attractive form of technology transfer if the domestic market is small and exports are either difficult or competing with sales of own branches in other countries. Small companies, on the other hand, could find a domestic market sufficiently attractive and might therefore enter minority ventures. If the risk of overseas investments is considered too high, they will prefer licensing agreements provided the remuneration is sufficiently attractive.

Hypothesis 7: The willingness of companies with large scale production to enter technology transfer agreements in case of import restrictions will be greater, the larger the share of imports to India in the company's total sales.

Hypothesis 8: If the effort of a firm to explore the Indian market is determined by the expected net return on its operation in India relative to other operations, then differences in success between companies could be explained by differences in significance of this net return relative to other things a company can do.

Hypothesis 9: Differences in the degree of comprehensiveness of the technical content supplied may explain why firms are successful.

Hypothesis 10: Financial terms heavily influence success in selling technology.

Although the EEC study was not completely successful in quantitatively testing all of these hypotheses it did uncover some interesting insights. The conclusions of the EEC study are included as Appendix B of this report.

B. Purpose and Methodology of the QED/TERI Study Funded by AID

Toward the end of the EEC study, it was decided to try the ATW questions out on some U.S. firms. The budget and time schedules were quite limited, so it was decided to concentrate just on energy and environmental technology collaborations between U.S. firms and Indian firms. The interviews were conducted by telephone. QED Research, Inc. was subcontracted by ATW Institute to conduct those interviews. The results were incorporated into the overall EEC study.

In June of 1983 the Energy office of the AID Bureau for Science and Technology solicited proposals for energy studies of less-developed countries. QED and the Tata Energy Research Institute (TERI) responded with a joint research proposal that had the following objectives:

1. To investigate how the energy technology importers see their own benefits from the transfer of technologies to India and how they perceive the impact of government policies (at both ends) on these benefits.
2. To investigate, from the viewpoint of the importer, the various ways in which the transfer also benefits the technology exporters.
3. To provide information about the energy technology bargain, how its content and its terms are fixed, and how government regulations (on both ends) affect it.
4. To identify the factors determining the success or failure of energy technology transfer agreements between U.S. and Indian companies.
5. To explore whether energy technology transfer operates in a manner that is significantly different from other technology transfer.

The study was funded by AID in the late fall of 1983.

The general idea was to "match up" the technology exporters that had been covered in the U.S. telephone interviews with their Indian counterparts, and

conduct interviews in India through TERI. The objective was to examine the same set of technology transactions from the perspectives of both the technology exporters and the technology importers.

II. RESULTS OF INTERVIEWING U. S. EXPORTERS (by QED Research, Inc.)

A. Difficulties Encountered in Interviewing U.S. Exporters

We knew that the U.S. interviews could only have limited success because a) it is only possible to get a limited quantity and quality of information through the phone interviews, and b) the budget only permitted interviews with a limited number of firms. The list of U.S. firms is included in this report as Appendix D.

A more important lesson learned is that it is best to go into corporations "through the top," rather than by lateral telephone contacts with intermediate level executives. In the European ATW interviews, a time-consuming process was followed whereby ATW had government agencies and trade associations contact Chief Executive Officers, and impress upon them the importance of the study. Then, the Chief Executive Officers would select which executives were most knowledgeable about business collaborations with India. Once the executives were instructed by their CEO to give the interviews a priority, the ATW had less trouble getting them to sit still for the on-site interviews. Although this process is lengthy, it is worth the extra time.

For the U.S. phone interviews, it was necessary to limit the number and complexity of questions. The questionnaire used is included here as Appendix C.

Aside from not having a priority with the interviewees, not "going through the top" also created another problem. U.S. corporations are quite decentralized, and executives change jobs every few years so it is not easy for an outsider to track down who is most knowledgeable about a technology collaboration that occurred a few years ago. Sometimes the knowledgeable person had gone on another overseas assignment.

Unfortunately, it ultimately proved impossible to "match up" technology exporters and importers in the manner originally planned. Although the list of U.S./India technology collaborations provided by the Indian Investment Centre in New York allowed us to find U.S. and Indian companies that had undertaken technology transactions with each other in the past, we were not able to zero in on particular transactions from both ends. So, we merely knew that the U.S. companies had engaged in energy and environmental technology transactions with India. The individuals interviewed were not specifically knowledgeable enough so that we knew whether they were referring to the same technology transfers. The Indian Investment Centre data is also not specific enough to help with this problem.

In spite of these problems, the U.S. phone interviews did yield some interesting insights.

B. Results of U.S. Interviews -- Qualitative Responses

This section summarized the results of interviewing 15 U.S. companies regarding their experience in energy and environmental technology collaborations with Indian firms. The interviews took place in the summer and fall of 1983.

The interviews contained both open-ended questions eliciting qualitative responses, and other questions requiring quantitative responses.

1. In most of the literature on technology transfer to less developed countries, there is a presumption that, because the technological transfer process is more efficient if an equity investment is involved, that technology exporting firms would be eager to have equity investments. Only one of the U.S. firms interviewed had an equity interest, and it did not seem to be a factor of great importance even to that company. None of the other U.S. firms expressed any disappointment at not having an equity position. This raises two obvious hypotheses: a) the conventional wisdom in the literature is wrong, or b) U.S. firms are different from technology-exporting firms in other countries. I have no information for testing either hypothesis.

2. The possibility that either the technology itself, or the products manufactured with it, might be exported from India to compete with the U.S. firm in other markets was a factor that was emotional in character, and often not subject to negotiation. In other words, the flow of any amount of the technology or its products back out of India was considered absolutely unfair and absolutely unacceptable. It was not evaluated in terms of the degree of market that the firm might lose. This attitude leads me to believe that the Indian government might lose the opportunity to negotiate at all with many U.S. firms if it fails to recognize that this issue is nonnegotiable to many firms.

3. A common theme in the qualitative comments was that any uniform limit on royalties (such as 5% of sales turnover) was overly simplistic and likely to hurt Indian firms in those situations that required a higher royalty. There was

the feeling that the level of royalties was only one part of each deal, but was treated by the Indian government as though it was a factor that overrode all other factors.

4. Many of the individuals I talked with were familiar with the technology policies of many less developed countries (LDC). Most of them a) regarded the Indian market as less important to them than other LDC markets, and b) then also had the feeling that U.S. technologies were relatively less desired by the Indians than they were desired by other LDCs. It may also be that technology exports to all LDCs is less desired by U.S. firms than it is by firms in other OECD countries. The respondents would make comments such as "European and Japanese firms are more willing to put up with the governmental hassle in India." Theoretically, this ought to be offset by the fact that India can be a bigger market, but I did not hear much recognition of that.

5. Most of the collaborations that were described to me were not the result of deliberate "searches" in either direction, but rather were the higher stage of previously established trade patterns in manufactured items. Also, the role of information and promotion activities by either the U.S. government or the Indian government probably played a larger role in establishing the original equipment trade than they did in encouraging the later transfer of technology.

6. Although the lower level of skill of the Indian labor force was often mentioned as an impediment to full implementation of manufacturing, there was quite a bit of praise for the engineering professionalism in India. The attitude seemed to be that Indian firms had better engineers than firms in other LDCs, but that the Indian government did not defer to them in decision making as much

as other LDCs, and that they ought to defer more. Several respondents remarked that the engineering quality of Indian universities differentiated India from many other LDCs. Also, it was recognized that Indian R & D capabilities, although still small in absolute size, are larger in India than in other LDCs, and more capable of expanding in the future.

7. A few of the respondents remarked that the difficulties in getting approvals from the Indian government had eased in the last few years. The time lags in each stage of the approval process had been shortened. Two respondents commented that the process now seemed "less political," and so it was now less necessary to have distasteful dealings with "influence peddlers." Also several mentioned that greater foreign currency availability seemed to lessen many governmental problems.

8. While there seemed to be pleasure with greater speed in the approval process, there was still a lot of dissatisfaction about the difficulties associated with the limitations on imports of key materials to implement manufacturing processes using U.S. technologies.

9. There did not seem to be much difference in the attitudes of U.S. firms in relation to whether their Indian partner was a public sector firm or a private sector firm. One respondent said that private firms could move faster in decisions, interest, and implementation, but that public sector firms could have more leverage over the Indian government in terms of giving their technology needs a higher priority in licensing approvals.

10. For the particular energy and pollution control technologies covered in the U.S. survey, a frequently mentioned problem was the decentralized pattern of organization of the Indian electricity industry. Several respondents mentioned the great variation in quality of management and engineering talent of the regional electricity operating boards. This has evidently led to failure in the operation of good technologies. Some of the U.S. businessmen also remarked that the regional electricity boards were not reliable in discharging their business obligations, yet were somewhat protected by their public sector status. On the other hand, two respondents were pleased with their dealing with the Indian state oil company.

11. Two of the U.S. firms who only made partial responses to the survey questionnaire referred me to their lawyers and mentioned that their problems with India involved actual or potential litigation. Another firm refused to answer some of the questions because they thought they sounded "political." This level of recognition of serious conflicts is not high, and may just be a function of the small sample size.

C. Quantitative Responses

The quantitative survey was organized around the following three "umbrella" questions:

1. (Question 2.1) Which importance for your company have the following items in arranging technology transfer agreements? (followed by 15 items)

Figure 1

Short Evaluation of the Question 2.1

	number of quotations			
	high importance (3)	medium importance (2)	little importance (1)	no importance (0)
buying of raw materials by the technology importer	0	1	4	5
supply of pre-products to the technology importer	0	2	5	3
quality controls by your company	2	6	2	0
agreements about the quantity of production	3	4	2	1
agreements about the promotion of export in third countries	4	4	1	1
agreements about not exporting in third countries	6	3	1	0
agreements about the promotion of exports to your home country	7	3	0	0
agreements about no export to your home country	7	3	0	0
redeliveries to your company	0	0	1	9
amount of remuneration for the transferred technology	5	3	2	0
agreement about royalties	5	3	2	0
agreement about outright payments	3	3	3	1
access to technical development by technology importer	4	4	1	1
long duration of agreements	2	5	2	1
joint venture	0	1	4	5
others				

2. (Question 2.2) Which were your motives for transferring technology to India and which of them did you generally reach? (followed by 7 items)
3. (Question 3.3.1) Which forms of technology transfer were included in the industrial collaboration agreement? (followed by 13 items)

The responses to these three questions are shown in Tables 1, 2, and 3 respectively. Ten out of the interview panel of fifteen firms provided responses to the quantitative questions.

The second round of interviews served mainly to confirm in numerical responses many of the qualitative comments that had been made during the first round of interviews and which were summarized in the previous section of this report.

The great sensitivity of U.S. firms about export of the technology or products of the technology comes through strongly in responses to Question 2.1. Likewise, the responses to Question 2.1 confirm the concerns of these U.S. firms about the adequacy of Indian remuneration for the technology, and also confirm that these firms did not have a strong interest in joint ventures.

The responses to Question 2.2 confirm that the sale of technology to India by these particular firms is viewed primarily as a marketing challenge -- a way of adding to corporate sales revenue. Although the U.S. firms were often involved with their Indian counterparts in the Indian production phases, they were usually viewed as rounding out the technology sale deal rather than as opportunities for

Figure 2

Short Evaluation of the Question 2.2

	number of quotations			
	high importance (2)	medium importance (1)	small importance (0)	no quotation
protection of existing markets	1	2	6	1
open up new markets	8	2	0	0
adaption to competitors	0	1	6	3
reaction to trade restrictions	2	3	2	3
protection of the import of raw materials	0	0	1	9
labour cost ad- vantages	2	2	2	4
expected gains	3	4	2	1
others				

Figure 3

Short Evaluation of the Question 3.3.1

form of technology transfer	number of quotations
joint ventures	1
turnkey agreement:	2
international subcontracting	4
selling of patents	1
licenses on patents	8
other licences	2
management and service contracts	5
franchising	3
product-in-hand contracts	0
production-sharing contracts	0
collective r & d	1
training of Indian labour	5
providing of home-country skilled labour	6
others	

profit on their own. One hypothesis to explain this is that the technologies involved in these sectors are embodied in heavy energy and environmental control equipment. Thus, it may be more difficult for Indian firms to incorporate these technologies into their manufacturing until a later stage of the Indian industrialization process.

The responses to Question 3.3.1 were interesting because they show that even those U.S. firms that are primarily interested in sales revenue from the technology itself still have to complement these sales with other business relationships such as (1) international subcontracting, (2) management and service contracts, (3) training of Indian labor, and (4) providing home-country skilled labor.

First, the specific questions provoked the respondents to say more about who their Indian partner was. In about 30%-50% of the cases, the Indian firm was not a firm primarily engaged in manufacture, but rather a service firm engaged in either: (1) engineering and construction services, or (2) an intermediary wholesale marketer of hi-tech products or the technologies themselves. It would be interesting to know a) whether non-U.S. OECD firms also deal through these kind of intermediaries, and b) whether the appearance of such specialized intermediaries is a recent phenomenon.

Second, although most U.S. firms are not now intimately involved in the use of their technologies in India, three firms said they were becoming more interested in that possibility because greater foreign exchange availability made them more optimistic about (1) getting around import problems, and (2) repatriation of profits.

III. RESULTS OF INTERVIEWING INDIAN IMPORTERS (by Tata Energy Research Institute)

A. Difficulties Encountered in Interviewing Indian Importers

The firms which have been interviewed by TERI include those which deal with energy directly or in the form of energy-utilizing devices. More than half of these companies have imports ranging from 5% to 15% of their turnover, in value terms, and almost all of them import their requirements from the developed countries. The share of the United States in total imports is seen to vary widely with its share falling mainly in the 0-10% bracket. While the export figures for these companies are generally comparable with the value of imports, exports are almost entirely directed towards the developing countries with a few companies exporting a small share to the developed countries and an even smaller percentage to the USA.

Nearly 15% of the companies do undertake research and development (R&D) activities though over half of them have an R&D expenditure of less than 1% of their total rate of turnover. Considering the fact that a decade back the expenditure of these companies under that head was nil or close to it this (significant improvement) represents an increasing awareness of the need to develop new technologies/improve upon existing technologies in order to maintain their share of the market. This awareness was brought out in the interviews

where 100% of the companies which have R&D activities of their own have given the adaptation and improvement of a product/process as the main motive behind their R&D effort. Other main reasons which have been stated include the development of a new product/process, quality control and customer/technical services. In the case of those companies which do not carry out any R&D activities the reasons given were:

- i. the firm is too small to support a viable R&D effort;
- ii. the firm has no problem that requires R&D.

These included those firms which basically had a marketing function and had no production/manufacturing activities.

The main form in which the government supports R&D activities is by providing income-tax benefits. Import assistance and accelerated depreciation are offered to very few companies. The main areas in which these R&D activities have met with success include:

- i. improvements in existing technology in order to upgrade product performance and reliability;
- ii. improvements in efficiencies, cost reduction and higher productivity;
- iii. development of accessories to better the performance of existing machinery and;
- iv. the establishment of near monopolistic markets as a result of R&D efforts.

The largest number of technology imports were found to be from the United States of America. Asked for a listing of the five most important companies/countries from whom the Indian firms have imported technology, the responses received showed the USA to be predominantly placed in all five positions - 95% of the first places, 54% of the second, 72% of the third, 66% of the fourth and 40% of the fifth places. Next in order of importance came the United Kingdom followed by Canada, Japan and Italy.

Access to technical development by the technology importer emerged as the item of highest importance in reaching agreements for almost 75% of the companies interviewed. Next in line came items like the amount of remuneration for the transferred technology, agreement about royalties and the duration of the agreements, not necessarily in the same order. Agreements about quality controls by the U.S. companies and about the promotion of exports to third countries assumed medium importance while the buying of raw materials by the technology importer, supply of pre-products to the technology exporter, agreements about not exporting to third countries, re-exports to the parent company and communication of technology to third-country markets merited little or no importance. Though agreements were reached on all items of high importance by all the companies agreements regarding items meriting a medium level of importance were reached in only 50% of the cases.

About a third of the companies interviewed did experience negotiations which did not lead to contracts, but no particular reason was attributed to this. Some of the explanations that did come to the fore included - lack of credit availability, cost of transfer, adverse market conditions and a general lack of interest on the U.S. company's side.

Opening up of new markets emerged as the main motive behind importing technology from the USA with over 80% of the companies giving it a high level of importance and about 10% assigning a medium importance to it. Expected gains came second with nearly 75% of the companies attaching high to medium levels of importance to it. Surprisingly, only about half of these 75% companies attached a high level of importance to this motive. Next in order of importance came "adaptation to competitors" closely followed by "reaction to import restrictions" and "protection of existing markets." Labor cost advantages, again surprisingly assumed little or no importance.

Views on the Indian economic policy are divided equally between favorable, neutral and unfavorable. While the import/export policy is generally considered as favorable, opinion on the exchange control policy is again divided. The taxation policy is looked upon unfavorably. The infrastructure, industrial licensing and legal (including the MRTP Act) policies fall in the neutral to very unfavorable bracket. The technology and repatriation policies are looked upon favorably, but opinion on energy and tariff policies is again equally divided between favorable, neutral and unfavorable.

The initiative for starting negotiations was very rarely found to be taken by a third party. In nearly 64% of the cases the initiative came from the side of the Indian firm and in 32% of the cases from the U.S. partner's side. 90% of the companies interviewed claimed to have established direct contact with the U.S. company or vice-versa with the balance resorting to help from advertisements/announcements, other companies and to a smaller extent, the Indian embassy. The Indian Investment Centre was not given any credit for

initiating negotiations by any of the random sample of companies interviewed, nor were the trade fairs, chamber of commerce or business/industry associations.

Of the responses obtained on the time taken to find the appropriate U.S. partner, over half fell in the 0-3 months bracket and a third in the 6-9 months bracket. The balance took about two years to find their U.S. partners. In short for nearly 7/8ths of the sample search process took less than 9 months which may be explained by the fact that 80% of the firms attributed the reason for choice of collaborator to their being the leaders in the particular technology which was being demanded.

The negotiation process in 75% of the cases took less than a year to complete but the time lag between submission of the agreement to the Indian government and its approval was closer to 18 months on an average in 60% of the cases. More than half the firms had to renegotiate their arrangements before finally getting the government's approval.

The various industrial collaboration agreements included different forms of technology transfer. Amongst these the training of the Indian labor emerged as the most popular form of technology transfer. This was followed by purchase of technology only, patent rights and the provision of U.S. skilled labor not necessarily in the same order. Joint ventures and agency contracts were also found to be fairly popular forms of technology transfer. While a few of the companies did enter into management/service contracts, international subcontracting and collective R&D agreements none of the companies interviewed seemed to favor either turnkey agreements or production-in-hand contracts.

Nearly 75% of the collaboration agreements were of five to ten years duration with the balance having no definite time limit and hence being automatically renewable. Close to 70% of the technologies were transferred without any modification whatsoever to adapt to Indian conditions, with the balance undergoing only minor modifications.

The following activities were covered in a majority of the collaboration agreements (in order of quantitative occurrence):

- i. Provision of documentation covering the technical issues involved (e.g. drawing, formulae, design, procedures, etc.)
- ii. Provision of subsequent advice and information in response to the importing company's request during ongoing use of technology.
- ii. Provision of initial advice on the technical issues involved by short visits (up to 1 month) of the U.S. company's staff to the importing company.
- iv. Provision of initial advice on the use and application of the technology by short visits to the U.S. company from the Indian side.
- v. Provision of subsequent advice and information on a regular ongoing basis.

The activities not covered in the majority of the collaborations are:

- i. Provision of equipment, instruments, etc.
- ii. Provision of materials and components for ongoing production.
- iii. Provision of initial advice on either technical issues or on the use and application of the technology by visits of staff from one side to the other for periods larger than a month.

- iv. Provision of initial advice on the use and application of the technology by short visits to the U.S. company by the Indian side.
- v. Provision of subsequent advice and information on a regular on-going basis.

In about 50% of the collaboration agreements provision is made for the Indian company staff to acquire experience in product development, process improvement, etc., through periods of training in the U.S. company's research laboratories and engineering offices.

Not all companies interviewed were able to respond to the question on the time elapsed between application on the U.S. market and application on the Indian market. Of the responses which were received roughly two-thirds of the estimates were roundabout ten years with the balance being closer to twenty years. Very few of the collaborations involved technologies which had been in use for less than five years.

The supply situation for these technologies was found to be generally good both on the domestic front as well as in the form of foreign competition. The largest number of foreign competing companies were found to be in West Germany followed by the USA, Japan, UK, France and Sweden in that order.

Close to 75% of the manufacturing companies have product quality control arrangements which work mainly through the following channels:

- i. drawings, specifications and adherence to specified acceptance limits;
- ii. stringent testing/sampling procedures;
- iii. documentation and subsequent advice;
- iv. training of personnel.

Arrangements regarding production quality worked through testing and quality control checks, process control and sampling methods.

Approximately 60% of the terms of payment were in the form of lumpsum/royalty with the balance being equally divided between lumpsum and royalty payments individually. The payment of royalties was generally seen to be started after a time lag of about two years.

A majority of the companies had no investment in their companies by the U.S. company, but 25% had investments to the extent of 25-40% share of the Indian company in question, 5% had U.S. investment in the range of 40-50% of their share and the balance of around 13% had more than 50% share of their company bought by the U.S. companies.

Almost all the companies which had repatriated profits out of this investment felt that this was either sufficient or low with about 10% only responding that this was high. The main reason attributed to the low repatriation of profits was the unsuccessful manufacturing and marketing of the products produced using the imported technology.

No loans from U.S. companies, government or private banks were involved for entering into the contracts. While loans from third parties were mobilized in 60% of the cases, no subsidies from those parties were involved. Also, these loans were assigned no degree of importance for purposes of concluding the contract.

Less than 25% of the companies felt that the payment for all goods and services provided by the U.S. company was less than cost recovering.

All of the responses received on the break-up of total costs between search process, negotiation process and the actual transfer process attributed 3/4ths share to the transfer process on an average with a little more than half having closer to 90% of their total costs associated with the transfer process. The balance of total costs was seen to be almost equally divided between the search and negotiation processes.

Relationship with the collaborator, as a measure of the success of the collaboration was found to be excellent with no exceptions. In terms of sales achieved, profits, market share, price of collaboration and technology stimulus too, the collaboration was found to be highly successful though a few companies did express some reservation about one or the other of the above items.

Some of the very positive experiences in the implementation of the contract from the viewpoint of the Indian companies are listed below:

- i. requests for information, drawings and documentation expeditiously fulfilled;
- ii. excellent relations with the collaborator;
- iii. training of Indian personnel;
- iv. good market support through literature, seminars, etc., by U.S. company.

The negative experiences included:

- i. the need to adapt the imported technology to Indian conditions (not due by U.S. company)
- ii. Indian Government's import and fiscal policies;
- iii. legal hassles on the U.S. side;
- iv. lack of trust by the U.S. partner in the Indian company.

The Indian Government was not given any credit for preventing the choice of an "inappropriate" technology unsuitable to Indian conditions.

In the opinion of the companies interviewed the main impediment to the technology transfer on the Indian side is India's licensing policy. This is followed by the size and growth of the Indian market, the bureaucratic time delays, policy on royalties and to a smaller extent the supply of inputs from the Indian market, financial compensation for the transfer, political/policy instability and the policy of trade unions.

The performance standards of the Indian labor as well as the qualification of Indian management have, generally, been found to be satisfactory with the education of the Indian labor force (or the lack of it) not creating any problem. The rationalization and the profit transfer policies also do not seem to pose any threat to the Indian entrepreneurs.

The main impediment of the U.S. side was, according to the Indian industrialists, the U.S. company's lack of information on the Indian market and

Indian government regulation policies. In a few cases, the U.S. taxation and licensing policies were also found to be constraining.

The following suggestions were made for improvements in the technology transfer process. On the Indian side:

- i. adherence to time limits for processing applications;
- ii. more flexible and pragmatic government policies mainly import, fiscal and policy on royalties;
- iii. simplification of licensing procedures;
- iv. improved media coverage and information dissemination about India in the U.S.A.;
- v. Government's ceiling of 5% on royalty payments should be made more flexible;
- vi. greater involvement of Indian embassy and the India Investment Centre.

On the U.S. side:

- i. conscious effort should be made to learn more about India;
- ii. greater access to technological developments should be provided;
- iii. the technologies should be modified for use in India;
- iv. greater participation by medium-sized industries.

IV. COMPARISONS BETWEEN THE VIEWPOINTS OF EXPORTERS AND IMPORTERS

A. Relative Importance of U.S. Technology

Among the Indian firms interviewed, all of whom had significant technology collaborations with U.S. firms, the following rankings of countries were made in terms of the importance of U.S. technology to their businesses:

<u>Relative importance of U.S. technology</u>	<u>Percentage of Indian firms interviewed</u>
1st place	95% of interviews
2nd place	54% of interviews
3rd place	72% of interviews
4th place	66% of interviews
5th place	40% of interviews

The countries coming next in importance were Britain, Canada, Japan, and Italy. It is evident from these interview results that U.S. technology is perceived by the Indians to be much more important to India than the perception by the technology-exporting U.S. firms. The U.S. firms perceived themselves as having a small technological role in the Indian economy relative to other countries.

The same Indian firms that ranked U.S. technology so high also reported that the U.S. only accounted for 10% of the imported physical inputs to their production processes. So, these Indian firms are willing to depart from their usual input buying patterns to access U.S. technology.

B. The Sensitivity About Re-export of Technology

The U.S. interviews indicated a great sensitivity to the issue of technology re-export. The image portrayed was that a U.S. firm could "lose" its technology through resale by the Indians, particularly after the initial licensing period expired (usually after five years).

The Indian interviews clarified the precise issues involved. The Indian government does attempt to preclude agreements that ban re-export of technology and agreements that commit Indian firms to a given technology for more than five years. However, the Indian firms pointed out that the overall business relationships between a given U.S. firm and an Indian firm can effectively provide U.S. firms with the kinds of non-competition protections that they desire.

There have been some well-publicized incidents in which private Indian firms have just plainly stolen foreign technologies and/or trade names. The same kind of incidents have happened in Japan, Taiwan, Singapore, Malaysia, Indonesia, and Korea. No research exists on whether these incidents originated in any way from technology collaboration agreements. The feeling in India is that these incidents are quite different situations from the situation when an Indian firm enters into a long-term contractual relationship with a U.S. firm for the use of a technology.

The Indian interviews made a strong distinction between a) re-export of products in which a technology is embodied, and b) re-export of the technology itself in a form that could erode the technological capital of the U.S. firm (as opposed to just competing with the product sales of the U.S. firm). The Indians feel that some U.S. firms and governmental officials pretend to be talking about

the latter when they are really talking about the former. the formal governmental policy of wishing to keep re-export options open is not uncommon among LDCs. The Indians point out that the kind of product re-export markets that the Indian firms usually go after are only in Asian LDCs, and are often not markets in which the U.S. firms have an important interest. So, as a pragmatic question, it isn't that difficult for U.S. firms and Indian firms to work out de facto non-compete understandings (perhaps unwritten). It is certainly easier for the individual firms to do this than governmental officials from either government.

C. Equity Investment

In the interviews of U.S. firms, there was very little importance attached to having equity investments. Only one firm said it had an "equity position." the Indian interviews, including ones with some of the collaborators of the same U.S. firms, indicated a quite different picture. Of these firms, 25% indicated a U.S. equity interest of 25-40%, 5% indicated a U.S. equity interest of 40-50%, and 13% indicated a U.S. equity interest over 50%.

Most of the U.S. interviews were with marketing personnel, who may not be familiar with the complete picture of their business interests in India, and thus might not be aware of equity interests. The U.S. respondents tend to think of an equity interest as an ownership position in the Indian enterprise as a whole. The Indian respondents tend to think of any compensation formula other than a percentage of gross sales as an "equity participation agreement." In this use of terminology the equity is a sharing of the net revenue, gross profit, or net profit

with the U.S. firm. It often does not refer to an equity position in the overall Indian enterprise.

D. Relative Importance of Other Features

The U.S. firms tended to emphasize their frustration in having to try to "get around" the Indian government's preference for "five and five" contracts--those not exceeding royalties of 5% of gross sales, and five years duration. The Indian firms stressed that most contracts ended up having a feature permitting easy extension for an additional five years, and that about 25% of the contracts (often the older ones) had "evergreen" features permitting extension beyond ten years.

E. Role of Intermediaries

The U.S. firms often mentioned the role of intermediaries, such as Indian manufacturer representatives, or Indian engineering and scientific firms. Their roles sometimes ended after they introduced the parties, and accomplished a "finders" role. However, there were also stories about the continued involvement of these kinds of intermediaries in later stages. The Indian firms either recall the events differently, or perceive the role of the intermediaries to be very unimportant.

F. Delays Due to Indian Government Approvals

Our interviews showed an average period of about 18 months required for approval of a contract by the Indian government. More than half the contracts had to be renegotiated before getting final government approval.

At the request of the Indian government, the EEC undertook a two-year study entitled Problems and Perspectives of the Transfer of Technology between the Countries of the European Community and India. The prime contractor for this EEC study was the ATW Institute at the University of Regensburg in the Federal Republic of Germany.

The EEC survey, mainly of European firms, showed an average approval period of 12 months, considerably shorter than the 18 months experienced in the U.S.-Indian collaborations surveyed in this study. We agree with the EEC conclusion that such lags can a) be so long that the technology involved becomes overtaken, and b) the costs and time involved may bias the system against participation by smaller firms on both sides.

G. Restrictions on Royalty Levels and Duration of the Contracts

The emphasis of the Indian government on "five and five" contract restrictions was addressed in the EEC study. That study recommended relaxation of these restrictions, and listed the following kinds of benefits:

- a. A greater willingness on the part of suppliers to substitute royalty returns for lumpsum payments, and hence share in project risks to a greater extent.
- b. A greater willingness to update technologies supplied in the original agreement.

- c. Consequently, less interest in taking returns in through input pricing policies.
- d. Improved incentives for new technology collaborations.

Our study differed from the EEC study in that we relied more upon Indian interviews, and both the exporters and importers of technologies knew we were also talking with their partners. Our U.S. respondents regarded these kinds of restrictions to be very annoying impediments that distorted how they did business with the Indians. The Indians emphasized that final deals were not blocked because of them, because there were plenty of ways to either get governmental waivers, or just evade them by providing other forms of offsetting compensation to the U.S. firms. so our results reinforce the EEC conclusions. These kinds of restrictions, like many kinds of government regulation, tend to pose a penalty on honest; and also tend to favor firms that have broad business connections with India, while discriminating against smaller firms or firms wishing to negotiate their first U.S.-India technological transfer. These are not the right kinds of incentives to embody in governmental policy.

V. COMPARISONS BETWEEN THE RESULTS OF THIS STUDY AND OTHER STUDIES

A. The EEC study

Since the EEC study was the parent of this study, it is particularly appropriate to compare our results with it. The conclusions and recommendations of the EEC report are in Appendix B of this report.

Our results are broadly compatible with the EEC study. In both studies the non-Indian firms were generally satisfied with the results of technological collaborations with Indian firms. In both studies, the non-Indian firms attributed their problems more to the Indian government than to the counterpart Indian firm. Interestingly, this pattern held independently of whether the Indian firm was in the public sector or private sector. The interviews of both studies indicate that there has been a considerable loosening up of governmental restrictions in recent years. In both studies, the rules and delays imposed by the Indian government were viewed by the non-Indian firms as nuisance obstacles to be somehow circumvented, rather than absolute impediments to doing business. One might use this information to formulate other hypotheses as to whether the rules and procedures of the

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Indian government really have a major impact, and thus whether they have benefits that justify the nuisance costs. Those issues are not examined in this study.

The results of both studies seem to indicate that there is a great deal of ignorance and misunderstanding that leads to missed opportunities by both Indian and non-Indian firms. The EEC study contains a very detailed list of recommendations for overcoming these information gaps. If we take just the raw interview results, we might conclude that U.S. firms and executives suffer from more ignorance and misunderstanding about Indian policies than their European counterparts, and have a lower level of frustration tolerance in dealing with India. This was evident, for instance, in the strong reactions we got on the "technology re-export" issue, and the lack of distinction (even after some prompting by the interviewer) between re-export of products embodying the technology and re-export of the technology itself. The fact that the relative role of U.S. technology in India is viewed as less important by U.S. executives who have sold technology to India, yet is viewed as extremely important by the receiving Indian firms, should provoke us to ask whether the information gap is not greater for U.S. firms than for European firms.

Part of this difference in raw interview results may be due to the differences in how the interviewees were selected and interviewed. The European executives had been briefed on the objectives of the study, had been selected by higher level executives in their own companies, and had set aside time to be interviewed personally and to think seriously about their answers. Thus, they may have been more knowledgeable, more thoughtful,

and perhaps more polite than their U.S. counterparts. In the telephone interview context, the U.S. executives may have given more abrupt and oversimplified responses.

B. Studies by the Science Policy Research Unit

The Science Policy Research Unit (SPRU) at the University of Sussex has been involved in a number of studies of technology transfer from developed to less developed countries. The interviews of British firms as part of the overall EEC study were conducted by the SPRU. Professors Martin Bell and Don Scott-Kemmis have written up their findings separately from the EEC report, and these are listed in the bibliography in Appendix A.

The three papers by Bell and Scott-Kemmis appeared in 1985, after the field work had been done for both the EEC study and this study. It is a shame that the methodology of the EEC study and this study could not have benefited from the SPRU papers that appeared in 1985, because those papers develop concepts and methodologies that could have been quite useful in designing and implementing interview survey questionnaire instruments.

For example, to SPRU work divides technology transfer up into the following three streams:

Stream A: Engineering services, managerial services, and technology embodied in the sale of capital goods.

Stream B: Skills and know-how for operation and maintenance.

Stream C: Knowledge, expertise, and experience for generating and managing technical change.

It is the contention of the SPRU researchers that Stream C is a far more leveraging type of technology transfer in terms of its effect in accelerating the pace of Indian technology development over time. This approach could have been useful in both the EEC study and this study.

C. Studies by the National Council of Applied Economic Research (New Delhi)

The National Council of Applied Economic Research (NCAER) also published three studies in this subject area in 1985 (see Appendix A bibliography). All three studies were authored by Ghayur Alam.

These were empirical studies that survey Indian firms in much greater detail about the terms of their technology licensing agreements. In two key areas, the NCAER studies reinforced the results of this study.

First, the NCAER studies found that the usual 5% limitation on the ratio of royalties to sales turnover was constraining, and tend to force the terms of licensing agreements in the direction of greater up-front payments tended to make it more difficult for smaller Indian firms to participate in technology licensing.

Second, the NCAER studies tended to reinforce the U.S. interviews on the subject of the Indian government's preference that Indian firms have re-export

rights. The following conclusions from one NCAER study seem to indicate that Indian firms may lose more than they gain from that policy:

One of the important concerns of India's technology import policy has been the restrictions imposed by the technology suppliers on exports of the products manufactured under collaboration. In pursuance of the policy, agreements with export restriction clauses are discouraged and restrictions (mostly permitting exports only to neighboring countries and restricting exports to areas where the licensee has another licence or production facilities) are only allowed when complete freedom to export is not acceptable to the technology supplier. Faced with the need to expand exports this concern is understandable. Our research, however, shows that the role of these restrictions (and their absence) on exports is over emphasized, as they do not effect the export performance as much as is usually suggested.

We find that restrictions on exports by Indian firms continue to be common. In the collaborations studied by us, almost half were found to have these restrictions. The high incidence of these restrictions may lead one to believe that they are largely responsible for the poor export performance of Indian firms. This, we feel, is incorrect. The experience of the Indian firms suggest that export restrictions in a collaboration are often irrelevant for the actual export performance of these firms.

Most of the firms we studied had not exported in the past and did not foresee exporting in the near future. While in half the cases, the collaborators had restricted their freedom to export, none of them considered this as the main reason for their failure to export. Most felt that their products were costly and their quality was inferior; they were not competitive in the international market. Others, who manufactured products which could be competitive in the international market, found the domestic market to be more attractive and did not consider entering the export markets.

Government's insistence that the Indian firms should be free to export is likely to have effected both the supply of technology and its quality, without significantly increasing the possibility of exports. This is specially true in instances when buy-back arrangements are insisted upon by the government. Insistances are not uncommon where the foreign collaborator, though interested in importing from the Indian firm, was not willing to accept contractual obligations to do so. furthermore, it is also

likely that those technology suppliers who agree to transfer technology with little or no export restrictions would charge a higher price to compensate for the risk of losing part of their market to the Indian firm. This obviously will increase the cost of technology import without increasing export possibilities.

If forced to permit the Indian firms to export, the collaborator could also be tempted to withhold crucial aspects of the technology to prevent the Indian firms from becoming competitive in the international market. As the low technological level of the Indian firms is one of the main factor responsible for the poor export performance, the incomplete transfer of technology would obviously further undermine their export potential. The policy, in these circumstances, would not only fail to encourage exports during the period of the collaboration, but, by restricting the flow of information from the collaborator, would also undermine the technological competence and future exports of the Indian firms. It would be more fruitful if the collaboration is primarily considered as a way of building technological competence of the Indian firms and policies which could in any way limit the technological benefits of a collaboration should be avoided. Once the technology is mastered, the firms would have a greater export potential. Our study also indicates that once the firms are competent to export, they themselves are unwilling to accept these restrictions; some, in fact, would only collaborate if no export restrictions are imposed.

As the policy has not been very successful in encouraging exports, but on the other hand is likely to have had a negative influence on the Indian firm's technology competence and future exports, a more flexible attitude towards export restrictions is necessary. We believe that a mere removal of restrictions would not lead to increased exports - sufficient technological capability is a far more important condition for that. Policies which help in maximizing the flow of technology and information through a collaboration, even if it means accepting export restrictions (which, in any case, would not make much difference to the actual export performance of most of the firms) will be more successful in promoting exports in the long run.¹

¹ Ghayur, Alam. "Indian Technology Policy: Its Performance and Implications," (NCAER, 1985), pp. 12-16.

D. Study by India International, Inc.

The U.S. Department of State and the U.S. Overseas Private Investment Corporation contracted with India International, Inc., a Washington, D.C. consulting firm to do a broad survey of "Doing Business in India" (see Appendix A).

This study addresses the broad range of issues that U.S. businessmen face in their dealings in India. Their findings coincide with the U.S. interviews in one key area -- the interaction between technology licensing and patent protection:

The GOI regulation of patents and trademarks also serve as disincentives to some U.S. firms. Whether they do or not usually depends upon the nature of their business.

The GOI will grant patents for foreign firms and individuals up to 14 years with certain exceptions. For the food and drug industry it will only grant patents for five years from the date of sealing of the patent or seven years from the date of the patent, whichever period is shorter. Indians and Americans agree that patents are not fully protected in India. As a result, some U.S. firms are reluctant to offer their latest technology. Others provide incentives to their Indian collaborator to honor the patent rights by offering updated technology along with opportunities for worldwide consortium bids. Most rely on their ability to continually update their technology to be in a position to offer the next generation of technology to the Indian collaborator.

Related to the issue of patent protection is the GOI guideline that requires that the Indian partner be free to produce a patented product after the expiration of the collaboration agreement without making any additional payments. While not a major concern for the U.S. equity investor, this may well be one for a U.S. firm doing a straight technology transfer because its agreement may not be renewed.

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Appendix B: "Conclusion and Policy Recommendations," from the EEC Report, Problems and Perspectives of the Transfer of Technology from the Countries of the European Community and India, prepared by ATW Institute, University of Regensburg, Federal Republic of Germany, 1984.

The findings of this project are reported under four main headings:

- a. level and structure of financial returns to technological collaboration from the standpoint of European firms;
- b. impact and response to some main elements of Indian technological collaboration policy;
- c. responses to administrative procedures in India by European firms;
- d. initiation of contacts between European and Indian enterprises.

It should be noted that at this stage our findings are strongly influenced by the perceptions of European enterprises, since interview results from the Indian studies are not yet available.

RETURNS TO TECHNOLOGY COLLABORATION

A considerable majority of enterprises interviewed has indicated satisfaction with the level of financial returns from their technological collaborations in India. It appears that once firms have established collaborations they are able, in the main, to make them work satisfactorily, and profitably. In part this reflects a

natural bias in favor of collaboration where expected gains are high. Furthermore once firms have an established collaboration they are often able to find means of ensuring a satisfactory level of returns, (for example, by profits on imports to their Indian counterparts in the form of intermediates or machinery). It is noteworthy that European firms in general respond very favorably to the levels of entrepreneurship, management and technical skills in Indian enterprise.

At the same time we have encountered firms which have been discouraged from entering collaborations by officially declared limitations on royalties, lumpsum payments and the duration of contracts. The limitations on contract duration are generally perceived as a considerable disadvantage in the Indian system - as is also the method used in defining the base for royalties and their level. The issue of duration is especially important for "high-technology" which by nature takes longer for recipients to absorb. More generally, short permitted duration biases suppliers towards saving returns in lumpsum payments rather than royalties. With limits on royalty rates and on the duration of agreements, the structure of returns is biased towards immediate lumpsum payments and high profits on goods sold by the technology supplied. This reinforces the risk-averting, short-term perspective of suppliers, and largely removes incentives to provide ongoing technical improvements and other contributions to the longer term development of the Indian business.

RESPONSE TO ELEMENT OF INDIAN POLICY

It is in the nature of technical change that innovative firms will require a degree of monopolistic advantages so as to compensate themselves for R&D and other technical costs. In general, governments seek to monitor and control the

impacts of such monopolistic positions. The firms we have interviewed have systematically expressed preoccupations about the extent of Indian government policies aimed at controlling these impacts, notably:

1. the exclusion of export restrictions from licence contracts;
2. the reluctance towards "repeated" imports of technology;
3. emphasis on diffusion of technology by encouraging sub-licensing;
4. denial of the right to use trade-marks for domestic market sales.

At the same time we have noted that these policy objectives are only very partially achieved: e.g. restrictions on exports and sub-licensing are frequently achieved by "gentlemen's agreement." Nevertheless, some firms express concern that over time their licensed know-how could be threatened by more rigid legal application; some indeed say they would withdraw from India in such a case.

In general equity restrictions on equity are not seen as a major difficulty, though there are firms which would like majority holdings, believing these guarantee better control over know-how.

ADMINISTRATION PROCEDURES

Virtually all firms comment unfavorably on the length and complexity of the administrative procedures needed for approving collaboration agreements. Aside from general inconvenience, there are two specific problems which arise:

1. the negotiation and approval lags can be so long (e.g. 1 - 2 years), that the technology involved becomes overtaken;
2. negotiation and approval procedures involve overhead costs,

At the same time, it is important to reiterate our finding that European enterprises have had generally satisfactory results from technical collaboration in India. In our view it may well stimulate collaborations from new firms if more general information on this was widely available to European enterprise. We understand that data on royalties and on the returns to collaboration agreements are filed with the Ministry of Finance in India. An analysis of such data would provide that "hard" information on profitability, which would be required.

APPROACH TO RESTRICTIVE ELEMENTS IN INDIAN COLLABORATION POLICY

In view of the limited effectiveness of Indian official control over such matters as export or sub-licensing restrictions, the question arises whether the objectives being sought might not be better served by other means. For example, a greater leniency towards "repeated imports" of technology (which tend to happen anyway), combined with more use of royalty systems rather than lumpsum payments may well increase competition in the Indian market for technology without endangering technology transfer or increasing its costs. Furthermore, greater clarity about conditions in which export restrictions are permitted, could facilitate more collaborations.

ADMINISTRATION

The stated intentions of the Indian government to speed up approval procedures is bound to be greatly welcomed by European firms and may well have the desirable effect of encouraging smaller European enterprises to consider

collaboration agreements. In general, there could be gains from greater clarity in the application of procedures. It would be desirable to re-consider the very large amount of information presently required when making an application for approval; in particular it might be possible to define categories of agreement where minimal information is needed for approval and terms are virtually standardized. This could be particularly helpful to smaller European and Indian enterprises, since it could considerably reduce the management time and other overhead costs, which at present may discourage collaboration.

The EEC for its part should give consideration to encouragement of collaborations from small European enterprises. There are, for example, possibilities for supporting their overhead costs - conceivably by financing travel and contact with Indian consultancy groups, and/or contacts between potential Indian and European counterparts in Europe. It may be that past experience with export promotion by small firms in countries such as Germany could provide guidelines for useful action by the Commission.

A final point concerns arbitration procedures which though rarely used are rather heavy. The Indian authorities may wish to consider ways in which more rapid and less costly resolution of conflict can be accomplished.

IMPROVEMENT OF INFORMATION

A good deal could be done to overcome misconceptions which appear to constitute a psychological barrier to collaboration, by improving the flow of information between Indian and European enterprise. If more European firms were aware of the comparative success that others have encountered in the Indian

market, the flow of technology may well be enhanced. It may well be that Indian firms are ill-supplied with information about European sources of technology. More consideration needs to be given to find effective ways of improving the availability of information on both sides.

One important way in which the Commission may approach this problem is by a detailed consultation with various National Chambers of Commerce in the Member States. The objective of this enquiry would be to find an effective basis properly geared to European business, to set up and finance an information system. A European information system may considerably assist the Indian Investment Centre (and the European Chamber of Commerce in Bombay) and provide necessary complementary support to this present effort.

It is plain that - aside from information defects - European enterprises may in some cases be discouraged from collaborations by perceived risks of failure. It is desirable that the EEC should examine this problem and make a detailed study of possible forms of insurance systems to counteract excessive risk aversion.

Finally, the Commission may wish to consult the experience of the European governmental and non-governmental agencies concerned to encourage investments and technology tasks by national firms in Third World countries. These agencies are in some cases linked to Development Co-operation Ministries. It may well be desirable to strengthen the capacities of some of these agencies to transfer technology to India.

Appendix C: Interview Questionnaire Used in U.S. Interviews

TELEPHONE INTERVIEWS WITH U.S. PARTNERS IN
TECHNOLOGY JOINT VENTURES WITH INDIAN FIRMS

Name and location
of U.S. company:

Phone number:

Person interviewed:
(with title)

Date interviewed:

Indian joint
venture partner:

Product or technology:

Brief description of
the purpose of the
joint venture, with
beginning and ending
dates:

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QUESTIONNAIRE B

1. Impediments to Transfer for Companies with Contracts, Companies without Contracts, but with Negotiations, and Companies without Contracts and without Negotiations

Impediment measurement 

very strong impediment	= 3
strong impediment	= 2
little impediment	= 1
no impediment	= 0

1.1 Impediments to the search and negotiation process

1.1.1 Impediments on the Indian side

- Indian regulation policy
- Indian bureaucracy
- reliability of negotiators

1.1.2 Impediments on the home-country side

- insufficient information on the Indian market and Indian Government regulation policies

insufficient support by third-parties:

- home-country government
- international institutions
- consular offices
- chambers of commerce

1.2 Impediment to concluding a contract

1.2.1 Impediment on the Indian side

1.2.1.1 Economic conditions

- Size and growth of the Indian market
- competition on the Indian market
- performance standards of Indian labour
- education of Indian labour force
- qualification of Indian management
- supply of inputs from Indian market
- supply of inputs from imports
- financial compensation for transfer

1.2.1.2 Institutional and policy conditions

- political and policy instability
- nationalisation policy
- policy on employment of expatriates
- labour legislation
- policy of trade unions
- patent policy
- licensing policy
- policy on royalties
- policy on profit transfer
- legal protection
- domestic content requirements
- with respect to
 - equipment
 - other inputs
 - consultancy

1.2.1.3 Other conditions

- reliability and efficiency of bureaucracy
- reliability of Indian partner

1.2.2 Impediments on the home-country side

1.2.2.1

- taxation policy
- technology export restriction
- insufficient public aid and guarantees
- patent policy
- licensing policy
- insufficient training facilities for foreigners
- insufficient mobility of home country skilled labour

1.2.3 Suggestions for improvements

1.2.3.1 On the Indian side

1.2.3.2 On the home country side

ADDITIONAL QUESTIONS FOR THE COMPANIES WHICH NEGOTIATED,
BUT FAILED TO CONCLUDE AN INDUSTRIAL COLLABORATION AGREEMENT:

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2. Agreement with Partners

2.1 Was there an agreement between your company and the Indian company?

___ yes

___ no

If "yes", why was the agreement not approved by the Indian Government?

2.2 Disagreement with partner

2.2.1 Was the disagreement with your partner with respect to

- technical content
- financial terms
- non-financial and non-technical terms

2.2.2 If disagreement on technical content, on which elements of the negotiated technical content was disagreement?

2.2.3 If disagreement on financial terms, on which of the following items did you disagree with your Indian partner?

- provision of loan by your company
- mobilisation of loan by your company
- payments for provision of goods and services
- interest rate on loan
- payment for technology
- investment

2.2.3.1 Would the disagreement probably have been overcome, if there would have been some third-party aid?

___ yes

___ no

2.2.3.2 If "yes", was the lack of such aid decisive for the failure of the agreement?

- yes
 no

2.2.4 If disagreement on control, on which of the following items did you disagree with your Indian partner?

- quantity of production
 quality of production
 not exporting to your home country market
 not exporting to third-country markets
 not communicating the transferred technology to the Indian markets
 not communicating the transferred technology to third-country markets
 access of your company to modifications and adaptations of the transferred technology

2.2.5 Was there a disagreement because of Indian Government Regulations?

- yes
 no

2.2.6 Which factor was finally decisive for the failure to come to an agreement?

2.3 Negotiated the Indian company also with other companies to supply technology?

- yes
 no

2.3.1 If "yes", with how many? Country of origin?

number _____

country of origin _____

2.3.1.1 Was one of your competitors successful?

___ yes

___ no

2.3.1.2 If "yes", which one was successful?

2.3.2 Which factor was decisive for his success?

Appendix D: List of U.S. Firms Interviewed

List of Indian and U.S. Joint Venture Partners in Energy Technology

<u>Indian Firm</u>	<u>U.S. Firm</u>	<u>Type of Technology</u>
Audco India Limited Bombay, India	ACF Industries Inc. Houston Texas U.S.A.	Offshore/Onshore Drilling Systems and Equipment
Shri Govind C. Srivastava New Delhi, India	Gould Inc. Minnesota, U.S.A. U.S.A.	Cylindrical Rechargeable Nickel Cadmium Cells
Raychem Engg. Pvt. Ltd Bombay, India	Chemlex Corporation Redwood City, CA U.S.A.	Insulation/Dielectric Heating Systems, High Voltage Electrical Transmission System
Rathi Industrial Equip. Pune, India	The Ducon Co., Inc. U.S.A.	Air Polution Control Equipment and Systems
Engineers India Limited New Delhi, India	Fluor Ocean Services International, Inc. Houston, Texas, U.S.A.	Offshore Installation
Desein BVI Pvt. Ltd. New Delhi, India	Black & Veatch International Kansas City, U.S.A.	Power Station of 200MW & above
Kamal Electronic & Engg. Bombay, India	Power Sonic Corp. Sandy Lake, PA U.S.A.	Rechargeable Type Batteries
Thristors Controls Pvt Ltd Ahmedabad, India	Magnetics Inc. Sandy Lake, PA U.S.A.	Power Control Units. Regulated Power Supply, Control Amplifier
Khatau Junker Ltd. Bombay, India	H.K. Porter Co. Inc. New York, U.S.A.	Isolators above 220KV
McNally Bharat Bihar, India	McNally Pittsburg Inc. Pittsburg, Kansas U.S.A.	Coal Handling Systems
The Managing Director Heavy Electricals Ltd. Bhopai, India	International General Electric Co. U.S.A.	Capacitors for Power Factor Development
N.K. Vedi New Delhi, India	Prestolite International Co., Toledo, U.S.A.	Storage Batteries

Shri K.P. Singh New Delhi, India	ESB Incorporated U.S.A.	Storage Batteries
The Managing Director, The Wesman Engineering Co.	Bloom Engg. Co. Inc. Pittsburgh, U.S.A.	Combustion Systems
Shri N.S. Sethuraman Madras, India	Westinghouse Electric Corp., Pittsburgh U.S.A. EMP Electric Division USA/UK Joint Collaboration	Medium Voltage HRC Fuse Links
M/s Madras Industrial Satna, India	M/s General Electric Co. International Licensing Dept, New York, U.S.A.	Power Capacitors
M/s Govt. Electric Bangalore, India	M/s Westinghouse Electric Pennsylvania, U.S.A.	1500 KVA/11 KV Transformers
M/s SIMCO Motors Ltd. Tamil Nadu, India	M/s Yardney Electric Corp., Pittsburgh Conn., U.S.A.	High Energy Batteries (Silver Oxide Zinc)
M/s Yesha Electricals Ltd. Baroda, India	General Electric Co. International Licensing Dept, New York U.S.A.	Power Factor Improvement Capacitors
M/s AMCO Batteries Ltd. Bangalore, India	M/s Gould Inc. Illinois, U.S.A.	Lead Acid Batteries
Shrinivas Eng. Co. Calcutta, India	Environmental Elements Corp., Maryland U.S.A.	Pollution Control Equipment (Water and Waste Treatment Equipment)
Blue Star Ltd. Bombay, India	Duall Industries Michigan, U.S.A.	Fume Extraction Equipment (scrubber)
Bharat Heavy Electricals Ltd. New Delhi, India	Combustion Engineering Inc., Stanford, Conn. U.S.A.	Large Sized Boilers 200 MW

Appendix E: Interview Questionnaire Used in Indian Interviews

PROBLEMS AND PERSPECTIVES OF THE TRANSFER OF ENERGY TECHNOLOGY
BETWEEN THE UNITED STATES AND INDIA

QUESTIONNAIRE

1. General Information about the Company

1.1. Name and head office of the company

1.2. Branch of trade:

1. Manufacture of power generation and distribution equipment
2. Solar and other renewable energy equipment
3. Lighting Equipment
4. Ferrous metal industries
5. Non-ferrous metal industries
6. Steam generation equipment
7. Electrical machinery (other than power generation)
8. Combustion & heating equipment
9. Water and Effluent treatment
10. Waste treatment and disposal
11. Refractories, Glass and Ceramic Industries
12. Batteries and Chemical Energy industries
13. Others

1.3. Employment and turnover of your Company:

	Employment		Turnover (Rs. lakhs)		Capital Assets	
	1973	1983	1973	1983	1973	1983
Total (world-wide)						
In India						

1.4. Foreign trade relations of your company (Currency)

	1 9 7 3	1 9 8 3
Total exports		
Total imports		
Exports to developed countries		
Imports from developed countries		
Exports to USA (%)		
Imports from USA (%)		

1.5. Information about company's research and development (R&D) activities.

1.5.1.	Does your firm undertake R & D activities?	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
1.5.2.	(a) R & D Expenditure (Rs.)		
	(b) Nature of R & D (please tick)		
	b.i Quality Control	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
	b.ii Customer services/ technical services	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
	b.iii Adaptation and improvement of product/process	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
	b.iv Development of new product/ process	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
	b.v Basic research	YES	NO
		<input type="checkbox"/>	<input type="checkbox"/>
	b.vi Others (please specify)		

1.5.3. Total R & D expenditure in percent of total rate of turnover (estimated value if necessary)

1973 _____ %
1983 _____ %

...3

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1.5.4. Do you obtain Government support for your R & D activities?

_____ YES
_____ NO

1.5.5. If yes, is it in the form of

- Subsidies
- Income-tax benefits
- Accelerated depreciation
- Government funds - contract
- Grants
- Others

1.5.6. Please describe major R & D successes of your firm.

1.5.7. If R&D is not undertaken, what are the major constraints:

- | | YES | NO |
|---|--------------------------|--------------------------|
| (a) The firm has no problem that requires R&D | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) The firm is too small to support R&D | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) R&D expenditure would not be profitable | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Technical assistance is being given by another firm | <input type="checkbox"/> | <input type="checkbox"/> |
| (e) Any other reasons (please specify) | | |

....4

1.6. Information about Transfer of Technology

1.6.1. Please mention the five most important companies/countries from whom you have imported technology, in the sequence of their quantitative importance as technology providers:

	<u>Company</u>	<u>Country</u>	<u>Year of contract.</u>
1.	_____	_____	_____
	_____	_____	_____
2.	_____	_____	_____
	_____	_____	_____
3.	_____	_____	_____
	_____	_____	_____
4.	_____	_____	_____
	_____	_____	_____
5.	_____	_____	_____
	_____	_____	_____

1.7. Have there been negotiations about transfer of technology with a U.S. company which have not led to contracts?

_____ NO

_____ YES Year Name of Company Brief Reasons.

...5

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2.

Basis for Technology Transfer from USA based companies,

2.1. Which importance for your company have the following items in arranging technology transfer agreements?

high importance 3 medium importance 2
little importance 1 no importance 0

	Level of importance	Existence of such an agreement.	
		YES	NO
buying of raw materials by the technology importer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
supply of pre-products to the technology exporter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
quality controls by the US company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agreements about the promotion of export to third countries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agreements about not exporting to third countries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
re-exports to the parent company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
amount of remuneration for the transferred technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agreement about royalties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
access to technical development by technology importer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
duration of agreements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agreement for communication of technology to the Indian market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agreement for communication of technology to third country markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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2.2. Which are your motives for importing technology from the USA and which of them did you generally reach?

importance of the motive $\begin{cases} \text{high} & = 2 \\ \text{medium} & = 1 \\ \text{small} & = 0 \end{cases}$

	importance of the motives	generally reached
a) protection of existing markets	<input type="checkbox"/>	<input type="checkbox"/>
b) open up new markets	<input type="checkbox"/>	<input type="checkbox"/>
c) adaptation to competitors	<input type="checkbox"/>	<input type="checkbox"/>
d) reaction to import restrictions	<input type="checkbox"/>	<input type="checkbox"/>
e) protection of the import of raw materials	<input type="checkbox"/>	<input type="checkbox"/>
f) labour cost advantages	<input type="checkbox"/>	<input type="checkbox"/>
g) expected gains	<input type="checkbox"/>	<input type="checkbox"/>
h) others _____	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>

....7

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2.3. How do you judge the following Indian policies

	very favourable	favourable	neutral	unfavourable	very unfavourable
economic policy (in general)					
import/export policy					
exchange control policy					
taxation policy					
repatriation policy					
infrastructure policy					
energy policy					
tariff policy					
industrial licensing policy					
legal policy including MRTP act					
technology policy					

3. Informations about the Particular Technology Transfer Agreements

3.1. For which type of product is the transferred technology being used.

Year of contract	Type of product

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3.2. Search and Negotiation Process

3.2.1. Who took the initiative for negotiating an agreement?

(year of contract)

- a) your company
- b) the US partner
- c) third party

3.2.2. How were the contracts with the U.S. partner established?

(year of contract)				
announcements, advertisements etc.				
trade fairs				
Indian Investment Centre				
direct contact with the U.S. company				
Chambers of Commerce				
Business/industry association				
own office in USA				
other companies				
private consultants/Indian embassy				
others				

3.2.3. Duration of Process

3.2.3.1. How long did it take to find the right U.S. partner?

Year of contract	months

3.2.3.2. How long did the negotiation process last?

Year of contract	months

3.2.3.3. How much time elapsed between the submission of the agreement to the Indian Government and approval?

Year of contract	Months	Was any renegotiation involved?

3.2.3.4. Reasons for the choice of the collaborator.

3.3. Type of Technology and Form of Transfer

3.3.1. Which forms of technology transfer were included in the industrial collaboration agreement?

(Year of Contract)				
Purchase of Technology only				
Joint ventures				
turnkey agreements				
international sub-contracting				
management and service contracts				
Patent Rights				
product-in-hand contracts				
collective r & d				
Agency contract				
training of Indian labour				
providing US skilled labour				
others				

3.3.2. What is the duration of your industrial collaboration agreement?

Year of contract	Years	Automatically renewable or not

3.3.3.1. Were the Technologies generally

(year of contract)		

transferred without modification.

modified for the use in india much modified

or in other developing countries little modified

specially developed for the use in developing countries

specially developed for the use in India

3.3.3.2. Please indicate which of the following types of activity were concluded in the agreement?

(year of contract)			
Provision of documentation covering the technical issues involved (e.g. drawings, formulae, design, procedures)			
Provision of equipment, instruments, etc.			
Provision of materials and components for ongoing production			
Provision of initial advice on the technical issues involved by short visits (up to 1 month) of the U.S. company's staff to your organisation.			
provision of <u>initial</u> advice on the technical issues by U.S. Company's staff for periods longer than a month to your organisation			
Provision of <u>initial</u> advice on the use and application of the technology by short visits (upto 1 month) to the U.S. Company staff from your company			
Provision of <u>initial</u> advice on the use and application of the technology by visits to the U.S. Company of staff from your company for periods longer than a month			
Provision of <u>subsequent</u> advice and information in response to your request during ongoing use of technology			
Provision of <u>subsequent</u> advice and information on a regular ongoing basis			
Provision for your company staff to acquire experience in product development, process improvement and modification etc. through periods of training or secondment in U.S. company research laboratories and engineering offices.			

2x2x2x

3.3.4.

How long was the period between application on the U.S. market and application on the Indian market:

Year of contract	Years

3.3.5.

How was the supply situation for the transferred technology in general?

Year of contract	No competitors	Domestic Competitors		Foreign Competitors		Home Country of the Competitors
		Large Companies	Medium or small companies	Large Companies	Medium or small companies	

--	--	--	--

Unknown

3.3.6. : Mechanism of Control

3.3.6.1. Production Control

3.3.6.1.1. Are there any arrangements about the quality of the products?

Year of contract	Yes	No

If "YES" how do they work?

3.3.6.1.2. Are there arrangements about the quality of production?

Year of contract	Yes	No

If "YES", which?

3.4. Benefits and Costs of Transfer

3.4.1. Payment for Technology

3.4.1.1. Which terms of payment were concluded?

Year of-contract

Lumpsum

Royalty

Lumpsum/Royalty

3.4.1.2. How many years after concluding the contract did payment of royalties start?

Year of contract	Years

3.4.2. Indirect Benefits

3.4.2.1. Extent of the investment of the US company in your company:

(Year of contract)

no

less than 25% share of your company

25% to 40% share of your company

40% to 50% share of your company

more than 50% share of your company

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3.4.2.2. Have you already repatriated profits out of this investment?

Year of contract	Yes	No

3.4.2.3. If "yes", do you consider them to be

(year of contract)

Very high
High
succicient
low

If low, state reason

3.4.2.4. Was a loan from the US company involved?

Year of contract	Yes	No

3.4.2.4.1. If "Yes", is the interest rate paid on the loan?

Year of contract	higher	lower	the same

as in the U.S.

3.4.2.5. Financial or other support from third parties

3.4.2.5.1. Have you mobilized a loan from third parties?

Year of contract	Yes	No

3.4.2.5.2. Has the U.S. government or a private U.S. bank provided a loan which was essential to enter into the contract?

Year of contract	Yes	No

3.4.2.5.2.1. If "Yes", was the interest rate paid on this loan?

Year of contract	higher	lower	the same

as the US interest rate?

3.4.2.5.3. Is a subsidy from a third party involved in the agreement?

Year of contract	Yes	No

3.4.2.5.3.1. If "Yes", by whom is it provided?

3.4.2.5.4. Of which importance were the subsidy or the loan for concluding the contract?

(Year of contract)			
high importance			
medium importance			
little importance			
no importance			

3.4.2.6. Was the payment for all goods and services provided by the US company?

Year of contract	Less than cost recovering	Cost recovering	more than cost recovering

3.4.3. Cost of Transfer

3.4.3.1. Which percentage of the total cost was connected with the

(Year of contract)				
search-process				
negotiations-process				
transfer-process				

(please estimate!)

3.4.3.2. Were the costs of the transfer of technology compared with the costs for r & d of this technology in India

(year of contract)	very high	high	low

3.4.3.2.1. If possible, please mention transfer-costs as a percentage of the r & d costs.

Year of contract	per cent

3.5.

Success of Transfer in your view

3.5.1.

Please indicate your views regarding the success or failure of the collaboration (use the following numbers):

1 = successful, 2 = satisfactory, 3 = so-so, 4 = unsatisfactory, 5 = failure

	Number
(a) Sales achieved	
(b) Profits	
(c) Share of the market	
(d) Price of the collaboration	
(e) Technology stimulus	
(f) Relationship with the collaborator	

3.5.2.

Which were your very positive experiences in the implementation of the particular contracts?

3.5.3.

Which were your negative experiences in the implementation of the particular contracts?

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3.5.4.

Has the involvement of the Indian Government prevented the choice of an "inappropriate technology" in terms of labour intensity, or the choice of a technology that would have overreached the technical capabilities of the end users?

3.5.5.

Do you find the U.S. firms to be less interested in equity interests than other OECD countries?

- No

- Yes Reasons: _____

3.5.6.

In what ways do you feel that the issues of technology transfer from the U.S. to India differ for energy technologies, as compared with other technologies?

4.

Impediments to the Transfer of Technology to India

	Very strong impediment	= 3
Impediment measurement	strong impediment	= 2
	little impediment	= 1
	no impediment	= 0

4.1

Impediments on the Indian side

- _____ Size and growth of the Indian market
 - _____ performance standards of Indian labour
 - _____ education of Indian labour force
 - _____ qualification of Indian management
 - _____ supply of inputs from Indian market
 - _____ financial compensation for transfer
 - _____ political and policy instability
 - _____ nationalisation policy
 - _____ policy of trade unions
 - _____ licensing policy
 - _____ policy on royalties
 - _____ policy on profit transfer
 - _____ reliability of US partner
 - _____ others
-
-

4.2.

Impediments on the US side

- _____ insufficient information on the Indian market and Indian Government regulation policies
 - _____ insufficient support by the U.S. government
 - _____ insufficient support by international institutions
 - _____ insufficient support by Indian and the US consular offices
 - _____ insufficient support by the chambers of commerce
 - _____ taxation policy
 - _____ technology export restriction
 - _____ insufficient public aid and guarantees
 - _____ patent policy
 - _____ licensing policy
 - _____ insufficient training facilities for foreigners
 - _____ insufficient mobility of US skilled labour
 - _____ others
-
-
-

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4.3. Please make suggestions for improvements for the transfer of technology to India from USA

4.3.1. On the Indian side:

4.3.2. On the US side

Any other relevant issues not covered above.

Appendix F: List of Indian Firms Interviewed

LIST OF INDIAN COMPANIES WITH US COLLABORATION/TECHNOLOGY IMPORT

S.No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
1.	Madras Refineries Ltd. Manali Madras 600 038 Rep. Office in Delhi K-79 Hauz Khas Enclave New Delhi 110 016	Amco International Oil Co. 500 N. Michigan Ave. Chicago, Ill. 60690	Petroleum refining	Mr. M. S. Nadkarni Chief Exec. & M. D. Mr. L. D. Punjabi Resident Representative New Delhi
2.	Khatau Junker Ltd. Datta pada Road Borivli East Bombay 400 066	General Electric Co. 570 Lexington Ave - New York, N.Y.1022 H. K. Porter Co. Inc. New York	Power factor correction capacitors Isolators	Mr. Nalin D. Dalal M. D.
3.	The Mysore Lamp Works Ltd. Old Tumkur Road Malleswaran West P. Box No. 1209 Bangalore 560 055	General Electric Co. Far East Business Div. 570 Lexington Ave. New York, N.Y.10022	Incandescent, fluorescent & mercury vapour lamps	Mr. R. C. Manchanda M. D.
4.	Universal Cables Ltd. P. C. Birma Colony Satna, MP Pin 485 005	General Electric Co. International Licen- sing Division	Rolypropylene film power capacitors	Mr. V. D. Jain President
5.	Yesha Electricals Pvt. Ltd. C2-18 Industrial Est- ate, Gorwa Road, Baroda 390 003	General Electric Co. USA	Power factor improvement capacitors	Mr. S. H. Patel M. D.

4/1

S.No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
6.	Sylvania & Laxman Ltd. 68-2 Najafgarh Road New Delhi 110 015	General Telephone & Electronics Inc. 1 Stamford Forum Stamford, Conn. 06904	Fluorescent tubes, GLS and mercury lamps	Mr. Laxman S. Agarwal Chairman & M. D.
7.	Chemicals and Plastics India Ltd. Dhun Building 175/1 Mount Road Madras 600 002	B.F. Goodrich Chemical Company Inc. 6100 Oak Tree Blvd. Cleveland, Ohio 44131	PVC plastics and resins	Mr. N. Sankar M. D.
8.	Kumardhubi Fireclay & Silica Works Ltd. GPO Box 46 Chartered Bank Bldg. Calcutta 700 001	A.P. Green Refracto- ries Co. Green Blvd. Mexico, Missouri 65265	Refractories	Mr. J. G. Kumara- mangalam M. D.
9.	Ingersoll Rand (India) Ltd. Maybaker House S.K. Ahire Marg Bombay 400 025	Ingersoll Rand Co. 200 Chestnut Ridge Rd. Woodcliffe Lake New Jersey 07675	Air and gas compressors, construction and mining equipment	Mr. J. K. Sethna M. D.
10.	Pibco Ltd. Punj House M-13 Connaught Circus New Delhi 110 001	Johns Manville India Ltd. 22 E, 40th Street New York, N.Y. 10016	Mineral wool thermal insu- lations materials	Mr. V. P. Punj Director
11.	Mr. Ram Lashaya Arora & Sons 161/1 M. G. Road Calcutta 700 007	Leeds & Northrup Co. Dept. MD 337 North Wales, PA 19454	Expandable thermal devi- ces, process control instruments	Mr. B. P. Arora Partner

S. No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
12.	McNally Bharat Engg. Co. Ltd. Chartered Bank Bldg. Calcutta 700 001	McNally Pittsburg Mfg. Corp. Pittsburg, Kansas 66762	Coal washeries and handling systems	Mr. A. K. Dasgupta Chief Exec.
13.	Portex Electric Controls E5 Narain Vihar New Delhi 110 028	Portage Electric Products Inc. 7702 Freedom Avenue, N.W. North Canton, Ohio 44720	Thermal protectors	Mr. L. Mohan Proprietor
14.	Desein (New Delhi) Pvt. Ltd. W-1, Greater Kailash New Delhi 110 048	Soros Associates Inc. 575 Lexington Ave. New York, N.Y. 10022	Consultancy - parts, thermal power plants	Mr. K. P. S. Nair Chairman Mr. D. P. Gupta President
15.	GTZ India Pvt. Ltd. GPO 452 9 Brabourne Road Calcutta 700 001	Van Dorn Works Co. 2685/2700 E. 79th Street, Cleveland, Ohio 44104	Gas fired heat treating equipment	Mr. K. V. A. Nair Chairman & M. D.
16.	Indabrator Ltd. NSE Estate Goregaon East Bombay 400 063	Wheelabrator Frye, Inc. 299 Park Avenue New York, N.Y. 10017	Shot blasting collection equipment	Mr. J. V. Patel Chairman
17.	Mytimasters Engg. Pvt. Ltd. L'amour 79 Guru Nanak Road Bandra Bombay 400 050	Advanced Vacuum Systems 30 Faulkner Street Ayer, Mass 01432	Vacuum melting, casting, heat treating fur- naces; preci- sion creep testing machines	Ms. Shyamala Harve M. D.

S.No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
18.	Bharat Heavy Electricals Ltd. Hindustan Times House 18-20 Kasturba Gandhi Marg New Delhi 110 001	Air Pre-heater Co. Inc. Andover Road Wellsville, N. Y. 14895	Air preheaters- rotary type, steam boilers	Mr. K.L. Puri Chairman & M. D.
19.	The Indure Pvt. Ltd. W-1 Greater Kailash New Delhi 110 048	Allen Sherman Hoff Co. 1, Country View Road Great Valley Centre Malvern, PA 19355	Ash handling plants for thermal power stations	Mr. O. P. Gupta Chairman
	A sister company of Desein (New Delhi) Pvt. Ltd. - at S. No. 14			
20.	Hydrotherm Pvt. Ltd. 44 Maulana A. Gaffoor Rd, Worli Bombay 400 018	American Hydrotherm Overseas 479 Park Avenue New York, N.Y. 10016	Consultancy and engg. services in heating systems	Mr. Ramchandra Dalal Director
21.	National Thermal Power Corp. Kailash Bldg. 26 Kasturba Gandhi Marg, New Delhi 110 001	Block & Veatch International 1500 Meadow Lake Parkway Kansas City, Missouri 64114	Consultancy for thermal power projects	Mr. A.K. Sah Chairman
22.	Wessman Engg. Co. Pvt. Ltd. Allenby Court 1/2 Allenby Road Calcutta 700 020	Bloom Engg. Co. Inc. Horning & Curry Roads Pittsburg, PA 15236	Combustion control equip- ment burners, industrial furnaces	Mr. A. Vaswani M. D.
23.	Instrumentation Engineers Pvt. Ltd. B-4 Cooperative Industrial Estate Balanagar Hyderabad 500 037	Brooks Instrument Division Emerson Electric Co. 407 W. Vine Street Hatfield, PA 19440	Rotameters	Mr. N. G. Reddy M. D.

S.No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
24.	Air Control and Chemical Engg.Co.Ltd. Khetan Bhavan 198 J. Tata Road Bombay 400 020	Burgess Industries, A & R Division 8101 Carpenter Freeway Dallas, Texas 75247	Fans, blowers, air handling equipment	Mr. R. Venkataswamy Naidu Chairman
25.	Carborundum Universal Ltd. Tram House 11-12 North Beach Road Madras 600 001	The Carborundum Co. 117 State Street Anondale PA 19311	Super refract- ories and electrocast refractories	Mr. N.V. Arunachalam M. D.
26.	Westerwork Engineers Pvt. Ltd. 5 D, Vulcan Insurance Bldg. Veer Nariman Road Bombay 400 020	Clayton Manufacturing Co. P. O. Box 550 El Monte, CA 91734	Industrial and heat treatment furnaces, steam boilers, indus- trial oil/gas firing systems	Mr. B.R. Thadani M. D.
27.	Engineers India Limited 4 Parliament Street New Delhi 110 001	Crest Engg. Inc. 4343 South 118th East Avenue, Box No. 1852 Tulsa, Oklahoma 74101	Offshore oil field development	Mr. N.P. Agarwala Manager, Business Development
28.	Industrial Cryogenic Chemical Plants Ltd. GPO Box 342 15 Ganesh Chandra Ave. Calcutta 700 001	Cryogenic Consultancy Services P.O. Box 215 Westport, Conn. 06880	Air separation plants	Mr. Tejendra Garg M. D.

S.No.	INDIAN COMPANY NAME AND ADDRESS	COLLABORATOR OR TECHNOLOGY PROVIDER FROM USA	PRODUCTS	CHIEF EXECUTIVE OF INDIAN COMPANY
29.	Borosil Glass Works Ltd. 44 Khanna Construction House Maulana Abdul Gaffar Road, Worli, Bombay 400 018	Corning Glass USA	Glassware for domestic, pharma and scientific uses	Mr. A. K. Rao Executive Vice-President
30.	Sitronics (India) Ltd. Army & Navy Bldg. 148 M. G. Road Bombay 400 023	Sittech Corporation Manlopark California	Silicon wafer for solar cells and semi-conductor devices	Mr. N. D. Sidhva
31.	United Carbon India Ltd. NKM International House, Backbay Reclamation, Bombay 400 020	Ashland Chemicals Co. P.O.Box 2219 Columbus, Ohio 43216	Carbon black	Mr. Ashok Desai Vice Chairman & M. D.
32.	Audco India Ltd. Mount Poonamallee Rd. Manapakkam Madras 600 089	Crane Company 300 Park Avenue. New York, N.Y.10022	Industrial pipelines valves	Mr. V. S. Sharma General Manager
33.	Ainsworth Balances Ltd. 501 Janmabhoomi Chambers W.Hirachand Marg Bombay 400 038	Denver Instrument Co. 2050 South Pacos St. Denver, Colorado	Single/dual pan, electro-mechanical electronic balances	Mr. V. S. Rajan Promoter
34.	Thyristors Controls Pvt. Ltd. 77 GIDC Estate, Naroda Ahmedabad 382 330	Magnetics Industrial Control Division Magnetic Bldg. Sandy Lake, Pa 16145	Electronic equipment	Mr. Gautam Shah Director

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35.	Kirloskar Cummins Ltd. Kothrud Poona 411 029	Cummins Engine Co. 1000 Fifth Street Columbus, Indiana 47231	Diesel marine engines	Mr. C. S. Kirloskar M. D.
36.	Hindustan Dorr-Oliver Ltd. Dorr-Oliver House Chakala, Andheri East Bombay 400 093	Dorr-Oliver Inc. 77, Havemeyer Lane Stamford, Conn. 06904	Chemical fertiliser and sugar plants	Dr. B. V. Shrota Chairman
37.	Petrosil Oil Co. Ltd. Steelcrete House 3, D. Yacha Road Bombay 400 020	Gulf Oil Corporation Gulf Bldg. Pittsburgh, Pa 15230	Blenders of special purpose lubricants	Mr. K. J. Lawyer Executive Director
38.	International General Electric (India) Ltd. Nirmal, Nariman Point Bombay 400 021	General Electric Co. 570 Lexington Avenue New York, N.Y. 10022	Lighting arrestors heating elements	Mr. R. N. Dass M. D. & President
39.	International Power Semiconductors Pvt. Ltd. 6 Unit, SDF, SEEPZ Marol Industrial Estate, Andheri Bombay 400 096	PPC Products Corpn. Eaton Town New Jersey	Semi-conductor devices	Dr. K. L. Rao Chairman Mr. K. Vijay Rao M. D.
40.	Blue Star Ltd. Kasturi Bldgs. J. Tata Road Bombay 400 020	Duall Industries Michigan, USA	Fume extraction equipment (scrubber)	Mr. Ashok Advani Vice Chairman

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41.	Ion Exchange (India) Ltd. Tiecicon House Dr. E. Moses Road Bombay 400 011	Chemed Corporation Cincinnati, Ohio	Chemical additives for the treatment of boiler water, return condensate line treatment	Mr. G. S. Ranganathan Proprietor
42.	Crompton Greaves Ltd. Kanjur Village Bhandup Bombay 400 078	Westinghouse Electric Corporation Pennsylvania	Power and distribution transformers	Mr. S. K. Mohile President & M. D.
43.	Coen Bharat Ltd. 86, Dr. A. B. Road Worli Bombay 400 025	Coen Co. Inc. California	Burners	Mr. J. D. Udeshi Chief Executive Mr. R. Dalal M. D.
44.	Greaves Cotton & Co. Ltd. 1 Dr. V. B. Gandhi Marg, Bombay 400 023	Mid-West Conveyor Co. Inc. Kansas	Materials handling system for coal handling at thermal plants	Mr. G. Mathrani President & M. D.
45.	Larsen & Toubro	- Struttors Scientific International Corp. P.O.Box 3081 Brick Church Station East Orange, N.J. 07019	Nuclear power plants	Mr. N. M. Desai
		- Whiting Corporation Harvey, Illinois	Evaporators & Crystalliser plants	Mr. N. M. Desai
		- Zimpro Inc.	Water pollution control equipment systems	Mr. N. M. Desai

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46.	Thermax Pvt. Ltd. Poona 411 019	Thermax	Boilers	Prof. T. R. Sarkari Technical Director
47.	Indian Petrochemicals Corporation Ltd. P.C. Petrochemicals Dist. Vadodara Gujarat 391 346	B. F. Goodrich U. S. A.	Suspension resins	Dr. S. Ganguli M. D.

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