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CASE STUDIES ON TECHNOLOGY TRANSFER IN THE MANUFACTURE  
OF MECHANICAL AND ELECTRICAL EQUIPMENT 1/

by

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Acquisition of foreign technology in the manufacture of mechanical and electrical equipment assumes various forms, ranging from copying of foreign machines, which may not be patented or where patents may have expired, to various types of technological collaboration, with or without foreign capital participation. A few examples of different technology supply arrangements are cited in the case studies briefly discussed in this paper.

2. The brief description of these cases is primarily to illustrate certain aspects and implications of acquisition of foreign technology in this sector of manufacture. The examples that have been discussed are all related to the manufacture of specific mechanical and electrical equipment in the medium-scale range. The manufacture of heavy mechanical and electrical equipment has deliberately not been covered as the techno-economic aspects of such manufacture have to be viewed on a somewhat different basis. On the other hand, it is necessary to emphasise that a very wide range <sup>of</sup> equipment and products can be manufactured in the small and medium-scale sector and this is one of the aspects sought to be highlighted in respect of these cases. No detailed and elaborate discussions of the various projects have been attempted and it is only intended, through such case-analysis to pin-point one or other aspect of technology acquisition in the equipment- production sector.

CASE - STUDY NO. 1.

Manufacture of tea processing machinery.

1. In 1949, Company X was incorporated as a Public Limited Company in India and commenced operations mainly as a repair workshop employing only 6 persons and having only one lathe and one drilling machine. The Company took up the manufacture of tanks and wire fenceings in 1950 as raw materials were readily available, and there was considerable demand from tea gardens in the area. A grey iron foundry was also established in 1951.

2. In 1952, the Company set up a sharpening unit for CTC rollers, extensively used in the tea industry. This proved very popular, particularly from the smaller tea gardens who had no workshops of their own.

3. With considerable experience gained in the course of sharpening and repairing CTC rolling machines, Company X took up production of CTC machines (cutting, tearing and curling machines) in 1957. The machine undertaken for manufacture was a copy of a British machine imported in a number of tea gardens during the pre-World War II period. A case for infringement of patents was filed against Company X but the Company won the case as the patent rights had expired. This was accompanied by manufacture of tea leaf trailers.

The trailers developed an immediate and ready market in the tea industry and continue to be steady demand even at present. Company X also took up the production of steel doors and windows under a local brand name, which products also proved popular. By 1955, the Company took up production of pressed steel tanks which was a new product in this part of the country. This was made possible when a 500 Tonne press was made in the plant of the Company from their own resources by a veteran foreman, who had no formal education or training. Till date, a heavy capacity press of this capacity has rarely been manufactured in India. These P.S. Tanks made way to tanks assembled at site of any capacity by bolting standard-size pressed and jibbed sheets of uniform size with bolted flanges. Bigger size overhead tanks could now be made, transported and erected easily and developed considerable demand.

4. In 1956, a second manufacturing unit was set up by the Company to cover another region of the State. This unit started manufacture of small tea-machine components, and supply, installation and servicing of other machines manufactured in Plant No. 1.

In 1957, a third unit went into production in another location. This unit was started as a structural fabricating unit to meet the rising

demand of fabricated steel structures etc. in the region, besides governmental establishments. Later the P.W. Tank production section was also transferred to this unit, while Plant No. 1 started production of CTC machines on the basis of regular manufacture under the brand name of "TEAMASTER". A hot dip Galvanising Plant was installed in Plant I in order to meet the demand of mainly galvanised steel culverts in road projects. Large quantities of such galvanised culverts were supplied to different road projects.

8. By 1959-60, Teamasters were accepted as a quality machine by bigger tea groups such as Brooke Bond and these were supplied to their tea gardens. By 1961, this product penetrated the tea market in South India. In 1963, a new Jungle and Shrub cleaning machine under the brand name of 'JUNGLE JIM' was successfully developed, trialled and followed by commercial production in Plant I though the basic design was similar to a foreign machine, a number of local adaptations were made to suit tea garden requirements. Consequently, this machine holds its own patent. The machine proved very popular for tea planters who could reduce considerable man-hour in cleaning shrubs and thick bushes in the planted areas. This equipment developed considerable demand and is now used by different government installations also.

6. By 1964, the mechanised fermentation process had been introduced in tea processing and the Company obtained a licence for manufacture of a range of fermentation equipment from a British Company. A technology agreement was entered into and 5% royalty was paid for a few years. Subsequently Company X made certain modifications in the product and sold it in their own name.

7. By 1966, the Teamaster CTC machine started being exported to KENYA, for Brooke Bond Estate in that country on recommendations from their counterparts in India. A new "KILOMATIC" D.P. Heater was developed by the Company as a cheap and efficient means of producing heat for Tea drying. This equipment was also based on a foreign machine but contained a number of local modifications. This machine also proved popular with the tea industry as an efficient and economic source of heat. In 1968, a tea fibre extractor was developed of indigenous design in Plant II.

8. By 1970, the Company commenced manufacture of industrial fans, both AXIAL and CENTRIFUGAL FLOW types under the brand name of 'AIREX'. These fans were designed locally and no foreign technology was acquired. Manufacture of these fans were taken up since the process of tea manufacture had been modernised by utilising artificial withering, fermenting etc. These fans were utilised in the withering troughs and fermenting



troughs to supply the required air draft. These fans have had a steady demand since then, though stiff competition is faced from manufacturers with foreign designs and brand names.

9. In 1972-73, the Company took up production of a Continuous Tea Drier under the brand name "DRYCON" under licence from a local Research Station for which a royalty of 5% is being paid by the Company. The production licence of this machine was earlier given to another Tea Machinery manufacturer in Calcutta which started marketing of the dryer in the early and mid sixties. During the late 60's however, this company was closed due to labour troubles and the production of this dryer was discontinued. Later, TRA offered manufacturing licence to two parties at a time, one being Company X and the other a reputed firm in the line at Calcutta. Company X remodelled and modified the machine and marketed the machine under the brand name of "DRYCON" which is now a very popular machine in its own circles. A new machine named LTP for tea processing is manufactured under Licence from M/S Alex Lawrie Ltd., England. Dryers are also being exported to IRAN and BANGLADESH.

10. By 1974, the Company set up a Tea Processing Research Centre in order to carry out Research and Development work of tea machinery under actual and full scale process of tea manufacture.

This unit opened a new era in the industry and the unit has been duly recognised as R & D Centre by the Department of Science & Technology of the Government of India.

11. A new Tea Grading and Sorting Machine, the "SINGLE TRAY CTC SORTER" was developed at the Company's Tea Processing Research Centre and successfully introduced in the tea industry. This machine was also based on an imported machine used several years earlier by the Tea Industry but was developed by the Company with several modifications.

12. The 3 Plants of the Company, all of which are located in the North East Region of India, now employ over 1000 persons. The total value of sales has risen from Rs. 400,000 (₹) in 1950-51 to over Rs. 30 million in 1975-76. Foreign exchange earnings are expected to average around Rs. 5 million annually in future. Profits have been steady & despite considerable investments in new plants and expansions, dividends have been of the order of 15 to 20% annually for most of this period.

13. The case study serves to illustrate the possibilities of adaptation of foreign equipment to indigenous needs, entirely through indigenous efforts. All the 3 plants are located in areas where there is comparatively little large or medium scale industry, though the location of plant I has been in an area where there are a considerable number of small-scale industrial units. The pool of labour has been, for the most part, trained locally by a few experienced foremen brought from other parts of the country. No foreign personnel have been utilised by the company at any stage.

14. The equipment products of the Company, while not very complex, are nevertheless of considerable sophistication. The fact that these are commanding export markets indicates that they are on a par with similar equipment from industrially-advanced countries. Though designs were adapted from the designs earlier used in the tea industry, such adaptation has proved very successful & the lack of foreign technology costs has been an important factor in rendering such products competitive in the international market.

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(\*) Dollar-rupee conversion rate may be assumed at US \$ 1=Rs.7 .8

CASE STUDY NO: II

Manufacture of industrial furnaces

Company Y was set up in the early 1960s for the purpose of design and manufacture of furnace components, modifications of existing furnaces in the country and for supply to various furnace builders. The Company's objective was to develop import substitution in the field of industrial heating equipment. In 1967, the Company started designing and manufacture of such furnaces and special heat treatment furnaces were supplied to some of the steel plants in India:

2. In 1971, Company Y entered into technological collaboration with a French manufacturer for reheating and heat-treatment furnaces of medium size required by the steel and aluminium industries and sophisticated furnaces for certain metal-working industries. Royalty payment was limited to a certain maximum level of production based on a particular year's prices. In 1975, Company Y entered into a further technology agreement with a West German manufacturer for the production of Annular shaft kilns. This technology covers vertical shaft lime and dolomite kilns for capacities over 100 tonnes/daily.

3. Both the technology agreements have proved quite successful, though the second agreement is still in an early stage of implementation. The first agreement has enabled the Company to develop designs for a large number of furnaces of various types. The nature of the Company's activity is primarily engineering and designs and their own expertise in this field has been considerably buttressed by foreign technology and engineering knowhow.

4. The acquisition of technology by Company Y has assisted the Company considerably in extending and diversifying its scope of engineering services for the manufacture of different types of industrial furnaces, without foreign capital participation.

CASE STUDY NO. 171.

MANUFACTURE OF INDUSTRIAL REFRIGERATION EQUIPMENT.

Company A was the sales and distribution agent in India of a major U.S. manufacturer of refrigeration equipment since the 1930s. Apart from marketing and distribution, the Company provided servicing facilities for the refrigeration equipment imported from the U.S. Company. Around 1965, the Company decided to take up manufacturing activities in respect of refrigerators, air conditioners and other refrigeration equipment and parts. A technology agreement was entered into with the U.S. Company with whom there was a long-standing relationship and manufacture was commenced in 1967-68 of open-type compressors, refrigerators and window airconditioners. Apart from designs and manufacturing drawings, the licensor provided considerable assistance by way of training and technical management during the initial period. The growth of production in the Company was fairly rapid and value of production rose to over Rs. 20 million \* within five years of commencement of production of these products. By 1975, no foreign technology was considered necessary for the major products which had been undertaken by the Company during this period. These products included refrigerators of 100-160 litre capacity, refrigeration units for trucks and marine craft, window airconditioners and air conditioners for buses, trucks etc, bottle coolers and other similar products. Many of these products were able to compete in a number of foreign markets and exports rose to over Rs. 5 million by 1974-75.

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\* Dollar - rupee conversion rate may be assumed at US \$ 1 = Rs. 7.8.

2. By 1975, foreign technological assistance was required from the US Company only for refrigeration equipment of complex designs and for hermetic compressors instead of open-type items. Since the original technology agreement had lasted for 10 years already, negotiations were taken up with the licensor not to continue to charge royalty for the products initially licensed for which no technological assistance was, in any case, required. The approval of government would, in any event, have been highly unlikely for extension of royalty payments on the initial products, in such a case. After prolonged negotiations, it was agreed that no royalty would be paid to the licensor on current models being manufactured by Company A and which were covered by the original licence. A new technology agreement was entered into which provided for (a) royalty payment only on hermetic units which were exported and (b) royalty payment for new and more complex products such as centrifugal chillers, hydraulic-drive transport refrigeration equipment and the like. Company A also furnished to the Government an export commitment of a certain percentage of additional production of packaged refrigeration units beyond a certain size.

3. The technology-supply arrangements in this case proved very successful. The absorption of technology for the initial products was rapid and efficient and Company A was able to compete with its products both in the national market and in some export markets. In terms of products, Company A covers a wide range at present, including (i) hermetic compressors in a number of sizes with a production of about 20,000 units annually, (ii)

(ii) liquid chillers in 10 sizes upto a capacity of over 1000 T (iii) packaged cooling units in 9 sizes and going up to a capacity of 60 T (iv) water coolers nearly 2000 units annually (v) room airconditioners over 15000 units annually and (vi) refrigerators around 11000 units annually besides other refrigeration products. The total value of production of the Company is over Rs. 800 million annually at present.

4. What is of particular significance is the shift in the pattern of foreign technology supply from relatively simple refrigeration items, to start with, to more sophisticated products within a period of 10 years, with suitable adjustments, both in respect of technology inflow and consequential payments for foreign technology.

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CASE STUDY NO : IV

MANUFACTURE OF PNEUMATIC EQUIPMENT

Company B was set up in the 1960s for the manufacture of pneumatic equipment of various types. The products included (i) airbrake compressors (ii) power transmission equipment e.g. torque converters, gears etc. (iii) centrifugal refrigeration and (iv) air and gas compressors. The production programme included refrigeration units for trucks, buses and trailers. In the next phase, similar equipment for railcars is proposed to be undertaken. The Company commenced manufacturing activity with an equity capital of Rs. 14 million and loans of Rs. 6000,00. The value of production achieved in the first year of production was Rs. 2.3 million (including Rs. 4000,000 worth of imported components) for 41 units manufactured. This rose to Rs. 6.3 million (including Rs. 3000,000 worth of imported components) for 115 units in the third year of production.

2. The Company's acquisition of technology was significant in that, with the wide range of products, technology had to be acquired from different sources. The basic technology and knowhow for pneumatic equipment was secured from a West German manufacturer, on a combined lump-sum fee cum royalty basis. Technology for airbrake compressors was secured from an U.S. manufacturer. For centrifugal refrigeration equipment as also for air and gas compressors, however, technological knowhow was obtained from a Japanese group of international

repute.

3. The need for obtaining technology from various sources arose because of the nature of the product mix and because the most suitable technology was sought to be secured for each major product group. Since projected demand and market penetration was not expected to be adequate for these product groups separately, the items were combined into one integrated project as the machinery requirement was found to be similar, to a great extent.

4. The fact of a number of foreign licensors in a medium -size equipment manufacturing enterprise has not posed any serious difficulties. In fact, the various technologies have been effectively linked with their respective product group and are in the process of being fully absorbed by the Company.

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Dollar-rupee conversion rate may be assumed at  
U.S. \$ 1 = Rs.7.8

CASE STUDY NO. V  
MANUFACTURE OF ELECTRICAL MOTORS

Company C was a small-scale manufacturer of electrical and mechanical parts, besides undertaking machinery repairs. In the late 1950s, the Company entered into a technology agreement with a major West German manufacturer of electrical equipment. The range of products intended to be covered by Company C were general-purpose, single and 3 -phase flame-proof induction motors with squirrel cage, crane motors, motors for textile and other industries universal motors for electrical appliances, coolant pumps and certain other allied products. The Company commenced production 1960.

2. The technological assistance received from their licensor proved quite adequate though in the initial years, some foreign technicians had to be employed. The licensor also provided considerable support in technical operations and management for the first 3-4 years. Company C was able to build up a total production capacity of 250,000 h.p. of electrical motors of various categories within a period of 12 years and undertook expansion in 1973-4 for a further total capacity of 150,000 h.p. By 1973-4, the imported material utilised by Company C was less than 1%. The equity capital of the Company had exceeded Rs.10 million by this time while loans were of the order of about Rs.20 million.

3. The technology agreement had lasted for over 12 years. This should have been more than adequate to absorb technology in respect of most of the categories

of meters listed above. Payments for technology would largely be justified only in respect of new types of meters or those categories which had not been undertaken for manufacture by Company C till the time that the technology agreement came up for renewal. Certain contractual provisions, particularly relating to sales territory etc, were considered restrictive and have since been modified.

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(\*) Dollar -rupee conversion ratio may be assumed at  
45 \$ 1 = Rs.7.5

CASE STUDY NO. VI.

Manufacture of electric motors and other  
electrical products.

Company D commenced trading and manufacturing operations as a subsidiary of a company manufacturing electrical equipment in the U.K. The Company gradually came under national majority control and took up major expansions in manufacturing activities thereafter. During its period as a subsidiary, the Company had taken up the manufacture of electric ceiling fans and fractional H.P. motors, besides motor control gear, plugs and sockets and other such items. After the Company came under national entrepreneurial control, major expansion was effected during the 1960s in respect of the capacity and range of electric motors, together with the production of certain other electrical equipment and products. The new products included (i) H.T. and L.T. circuit breakers (ii) Load-break switches, power and distribution transformers ( taken up in 1972-73) and on-load tap changers (iii) power-driven pumps, (iv) steel stampings and (v) moulded case circuit breakers (1974).

2. Technology was acquired from the original parent Company in the U.K. for most of the products, particularly electric motors in the higher ranges, going upto 1000 hp including a number of categories, such as oil-pumping motors, above 250 h.p. For on-load tap changers, a separate technology contract was entered into with another U.K. firm while, for moulded case circuit-breakers, technology was acquired from a

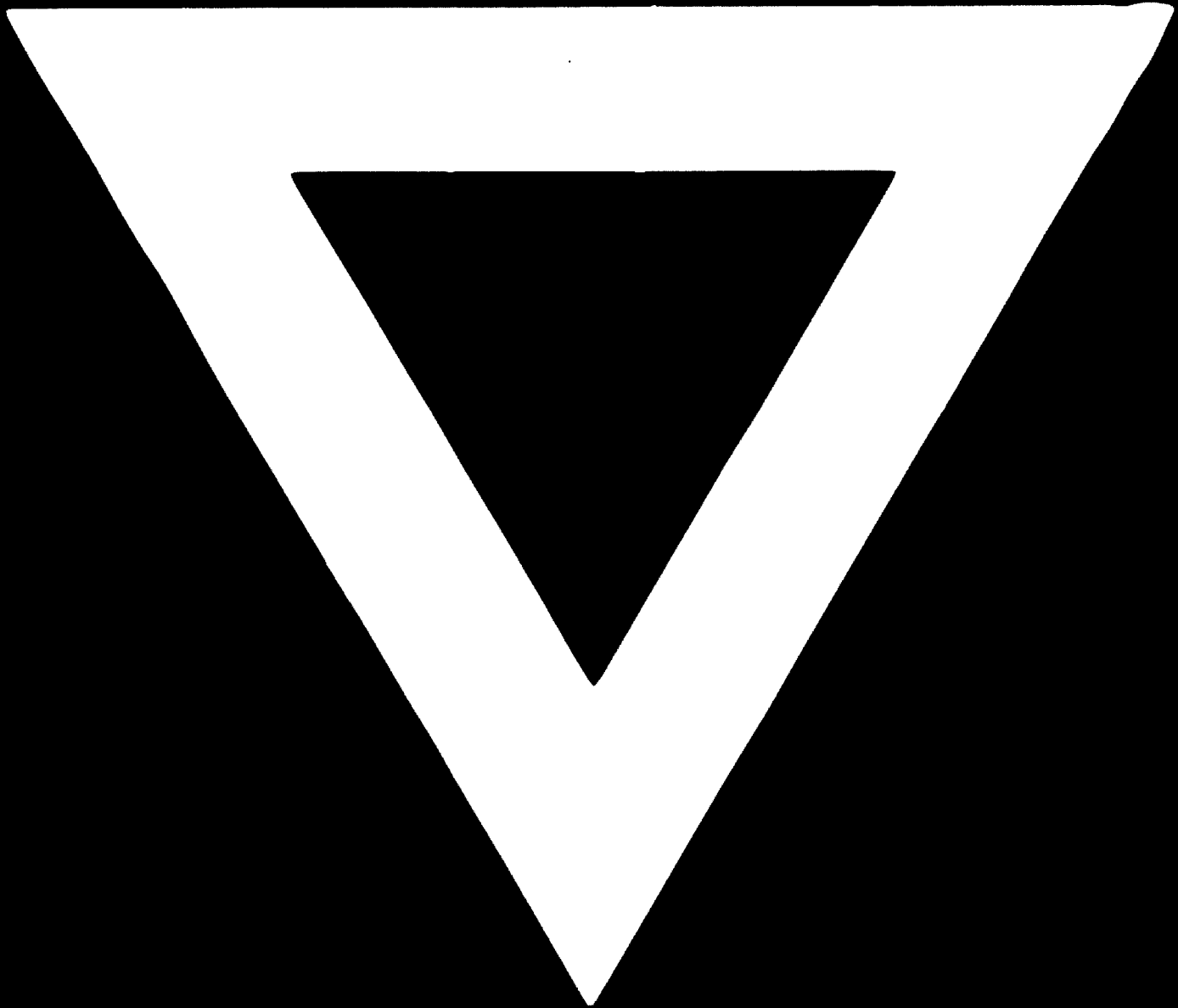
**Japanese electrical-equipment manufacturer.**

3.           Though the Company had a manufacturing base as a foreign subsidiary, the growth and expansion of the Company took place at a much more rapid pace after it came under national entrepreneurial control in the private sector. Despite the change of ownership, the licensee- licensor relationship between Company D and its former parent Company continued quite satisfactorily and Company D was able to obtain technology for electric motors in the higher ranges without difficulty. Some sharing of export territory has also taken place and Company D was able to export electrical products worth over Rs. 30 million in the 5 year period 1968-72 in areas normally covered by their former parent Company. The technology agreement with the U.K. Company has also been revised to exclude royalty payments on products produced for over 10 years, particularly consumer products and fractional h.p. motors. The technology contracts with the other U.K. Company and the Japanese company are working satisfactorily.

4.           As a result of the expanded operations of the Company, sales of the company are projected at around Rs. 80 million annually. The profitability and dividend payments has averaged about 10% over the last 10 years. All in all, technology transfer has proved successful in this Company, particularly during its period of expansion under national entrepreneurs.



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