

EXECUTIVE SUMMARY

1. INTRODUCTION

- 1.1 As part of the promotional measures, undertaken by the Department of Scientific and Industrial Research, for upgradation of imported technology, the study, on technological status, of the tractor industry was undertaken under the National Register of Foreign Collaborations.
- 1.2 This involved sending questionnaire, to all Indian tractor manufacturing units, leading foreign producers, technology suppliers and visits to all the tractor manufacturing units, in the country, for personal discussions, in order to obtain, detailed, technical and other information, about the source of technology, general performance and, their present technological status. The report was compiled, on the basis of the data collected during the visits and, information received, in replies to the questionnaire
- 1.3 The draft study report was discussed, by an evaluation committee and, a revised draft was discussed, at a workshop, held in October, 1988. The recommendations, of the Workshop, have been suitably incorporated in the report.

2. DEVELOPMENT AND GROWTH OF THE TRACTOR INDUSTRY

- 2.1 At the time of the study, 13 tractor manufacturing units were in production, out of which, 10 were set up with foreign collaboration and, 3 with indigenous, technology and know-how. The actual development, of the tractor industry, has taken place, over 2 decades, beginning from 1960. In the first decade, the following, five units were set up, all with foreign collaboration.

TABLE 1
INDIAN COMPANIES AND THEIR FOREIGN COLLABORATORS (FIRST PHASE)

S.No.	Name of the Unit	Collaborator	Year of Commencement of Production
1.	Eicher Tractors Ltd	Gebr Eicher Tractorenfabrik W. Germany	1959
2.	Tractors & Bulldozers Ltd/Hindustan Tractors	Motokov Praha Czechoslovakia	1963
3.	Tractor & Farm Equipment Ltd (TAFE)	Massey Ferguson U.K.	1963
4.	Escorts Ltd	Motoimport Ursus, Poland	1964
5.	International Tractor Co. of India Ltd/Mahindra & Mahindra Ltd	International Harvester U.K.	1965

Between, 1970 and 1980, the following six units, were set up, four with foreign collaboration and, two with indigenous technology.

TABLE 2
INDIAN COMPANIES AND THEIR FOREIGN COLLABORATORS (SECOND PHASE)

S.No.	Name of the Unit	Collaborator	Year of Commencement of Production
1.	Escorts Tractor Ltd (ETL)	Ford U.K.	1971
2.	HMT Ltd	Motokov Praha, Czechoslovakia	1971
3.	Kirloskar Tractor Ltd	Klockner-Humboldt Deutz, W. Germany	1974
4.	Punjab Tractors Ltd (PTL)	Indian Know-how	1974
5.	Pittie Tractors Ltd	Indian Know-how	1974
6.	Harsha Tractors Ltd	Motoimport, USSR	1975

Two more units, as follows, came up, between, 1980 and 1985, one with foreign collaboration and, the other with indigenous knowhow.

TABLE 3
INDIAN COMPANIES AND THEIR FOREIGN COLLABORATORS (THIRD PHASE)

S.No.	Name of the Unit	Collaborator	Year of Commencement of Production
1.	Auto Tractors Ltd	British Leyland, U.K.	1981
2.	Partap Steel Rolling Mills Ltd	Indian Know-how	1983

2.2 The annual production, of tractors, in the year 1987-88 had reached almost 90,000 nos, per annum. Out of, the above, 13 units which were in production, seven units, (Eicher, TAFE, Escorts, Mahindra & Mahindra, Escorts Tractors, HMT and Punjab Tractors), accounted for 99% of the tractor production, while, the rest of the six units, shared, between them, the remaining 1%. Long term growth, of the tractor units, appears to have been, primarily, dictated, by approach of the local management, rather than, the collaborators, or the technology, or the model of the tractors selected. There are successes and failures, in units with:

- (1) Both imported and indigenous technologies.
- (2) Technologies imported, both from western and eastern block countries.

- (3) Units belonging to both, public and private sectors.
- (4) Both, where well known, or, less known, models were selected, for local manufacture.

Strong technological base of the group and, the support provided by their own R & D, have, also, played an important part, in the growth of individual units.

- 2.3 The most popular size, of the tractor, in the country is, 35 H.P., followed by, 25 and 45 HP : the percentage production, of the three sizes, being 55% ,20%, and 15% respectively. The farmer's choice, of tractor size, is a compromise, between, the utility of the tractor, for multiple uses, including, haulage and, it's price. The accent is on sturdiness and reliability, rather than, sophistication, which usually means a higher price. According to the present indication, the demand for, higher priced and sophisticated, tractors above 60 HP, is likely to be limited, in the immediate future.

3. **TECHNOLOGICAL STATUS OF THE TRACTOR INDUSTRY.**

- 3.1 The tractor industry, in India, has completed, more than, 25 years. During this period, there has been a large growth, in it's production capacities and capabilities. A wide choice of competitive models, ranging from 12 to 75 HP, is now available, to the farmer. The tractor industry, represented by the successful units, has now attained a maturity, as judged by it's, capacity and capability, to expand production, as and when, needed, to meet any sudden surge in demand. The successful units have, also, developed, expertise and capability, for effecting horizontal transfer of technology, to other developing countries.
- 3.2 The ancillary and support industries have, also, grown with the tractor units and, have developed necessary capabilities, to supply components and subsystems in the required quantities. The servicing and maintenance, facilities, have also, been well established.
- 3.3 Indian tractor industry, by and large, has yet to develop capacity and capability to innovate and create new basic designs, of tractors, on it's own. The time and expense, involved, in indigenous development, of these products, have acted as a deterrent to their innovative efforts. Most of the successful units have set up R & D facilities approved by the DSIR. Though the R & D in industry lacks the standards and the depth commensurate with Indian's standard as a leading tractor manufacturing country, which India is today. Manufacturers appear to be satisfied with, the limited role, of their R & D establishments, in improving the

existing products by minor modifications, in the aggregates to bring out new models, prefer the case with the units who have a substantial foreign equity participation. Choose, an even earlier route of entering into collaboration, for new models. Some progressive units, generally without foreign equity, have developed capabilities to innovate and, have introduced new models, by improving and/or upscaling some aggregates, in the tractors.

4. LATEST DEVELOPMENTS IN TRACTOR TECHNOLOGY ABROAD

4.1 The recent developments, in tractor technology, that have taken place abroad, are not always relevant under Indian conditions. Some of the developments, for instance, those which aim at increasing driver comfort, making tractors suitable for large land holdings etc., are not necessarily appropriate under Indian conditions. More sophistication means higher price which may not be acceptable to the local farmers. On the other hand, developments such as those aimed at improving fuel economy and, those aimed at improving, reliability, ease of operations, are suited to the Indian conditions.

4.2 Tractor engines:

Developments, relating to the engines, are: improvement in fuel efficiency, which is important for us also and turbocharging of engines, to reduce the weight, of the engines, which is not relevant under local conditions, as, turbocharger is a delicate high speed mechanism which is difficult to maintain and, requires careful operation. Development aimed at increased life of critical engine parts, such as the use of ceramics, substituting diesel fuel, wholly or partially, by fuel like compressed natural gas, may be suitable to Indian conditions.

4.3 Transmission and final drive :

The developments relating to transmission system are :

- i) More number of gears and, higher maximum speed,
- ii) Synchromesh gears
- iii) Hydrostatic hydrodynamic transmission
- iv) Four wheel drive

The developments listed at iii, & iv are not quite suitable to Indian conditions, where unlike in the advanced countries, high initial cost of tractors, employing these features, may not be acceptable to farmers. There is however, scope for increasing the haulage speed, upto, a maximum of 40 Km/hr.

4.4 **Hydraulic system :**

Hydraulic system, of implements control, is now well developed in India. Electronic sensing devices have now come into use, abroad, for sensing movement of the linkages draft load and depth of operation. This is being developed, by some units, in the country.

4.5 **Steering system :**

Hydraulic or power steering is now common, on tractors abroad. This is a useful development which reduces the turning effort. ZF steering have taken up their manufacture in the country and this would be available to the tractor manufacturers. However, its application may be limited on tractors because of its extra cost.

4.6 **Ergonomics and operator safety :**

Ergonomics and, operators, safety and comfort, have received considerable attention abroad, particularly, noise and vibration control and, operator seating and space. Transmission gear teeth are now ground abroad, to reduce noise. Exhaust muffle design have received attention here, but grinding of gears is not likely to be introduced, as this is expensive. Studies for reducing vibrations are quite relevant, under Indian conditions. Since most of the tractors used, in the country, are designed abroad, the operator space and controls have been designed to suit the anthropometric measurements, of 95% of the driver population, in those countries. It is necessary to redesign the operator space, to suit the operators, in our country.

4.7 **Size and weight of tractor :**

In some of the advanced countries, particularly, U.S.A, there is a trend for using higher H.P. tractors, the current popular size being 100H.P. Efforts are also being made to reduce the weight of the tractor. These are not relevant under local conditions, because of the small land holdings of the farmers, which cannot sustain a higher priced tractor and weight is not a problem for those tractors, which are mainly used for dry land cultivation. There may be a need to develop low weight models for wet land cultivation in India.

5. **RECOMMENDATIONS**

- 5.1 Apart from the suggestions given above, for adapting certain developments relating to the tractor technology, other measures are necessary, to improve the

efficiency of the tractors, as well as, to encourage the tractor industry, to concentrate on developing new designs and products with their own efforts, rather than, looking for foreign collaboration, whenever a need arises for introducing a new model in the market.

5.2 Improvement in fuel efficiency :

Improving fuel efficiency, of the tractor engines, is a matter of national importance, as any saving effected in fuel consumption would reduce the drain on foreign exchange and therefore should receive utmost priority from all concerned. Reducing the specific fuel consumption is an expensive and time consuming exercise and requires a specialised expertise and knowledge, which is not readily available with the industry. It is suggested that assistance from organisations like ARAI, Ricardo UK and AVL Austria, which conduct research, of this type would be desirable, to get the desired results, quickly.

Studies covering suitability and optimum utilisation of tractors, of different HPs, for different sizes of land holdings, different soils or different crops should be sponsored. Such studies could be the base for incentives for encouraging, techno-economically efficient, tractor models.

5.3 Improvement in quality of tractor implements :

All the benefits, that one can expect, from a fuel efficient engine, can be nullified, if matching implements are not used, with the tractor. If, properly designed implements, matched to the tractors are used, 20% to 30% improvement, in performance efficiency and, proportional fuel economy can be achieved. Production, of tractor implements, is reserved by the Govt, for the small scale sector, which, in many cases, need upgradation, in respect of design and materials used. To achieve this, it is suggested, that each tractor manufacturer, should design implements properly matched to their tractors and, of standardised quality and, make the knowhow for the same, available to the implement manufacturers and, adopt a system, of quality audit and monitoring, to ensure production of desired quality implements.

5.4 Incentives for innovation :

Because of, the expensive and time consuming, steps required, for developing original design of tractors and, introducing them in the markets, entrepreneurs choose the easier option of importing the designs. Suitable incentives, for indigenous development, of new tractor model, should be provided. This is necessary to encourage R&D, in tractors, in India.

5.5 Development of accessories :

Development of accessories, for the following operations needs encouragement :

- i) Potato planting and harvesting
- ii) Rice transplanting
- iii) Sugarcane harvesting

Fiscal incentives, suggested, in 5.4 above, may, also, be made available for their development.

5.6 Tractor industry, having achieved the level of development, of being able to cater fully to the indigenous market, should now concentrate also, on development of tractor models suitable for exports :