
Active transfer of technology in the automobile industry: Indian experiences

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Abstract: After independence in 1947, India started implementing its developmental plans by acquiring technology in various sectors of industry. Technologies were acquired in the infrastructural and utility industry in selected ways. A few firms in the country were allowed to borrow technology to manufacture automobiles. Technology started flowing freely into the Indian automobile industry from various parts of the world after 1983 when the process of economic reforms began. Technology acquisition took place using a variety of models. Firms acquiring technology from abroad had to abide by technology absorption norms as laid down by the Government of India till fierce liberalization began in May 1991. The study presented in this article analyses the technology management practices of three leading joint ventures in the Indian automobile industry which have acquired technologies during 1984 using similar models of technology transfer and are now facing competition from other players entering the Indian market. Profitability, liquidity and turnover ratio analysis was carried out to assess the firms' financial health. Input from the industry-wide questionnaire survey is presented to compare the perception of the firm's performance with respect to industry on selected variables. The situation-actor-process-learning-action-performance (SAP-LAP) paradigm was used to analyse the cases. Learning issues have been synthesized. The study took nearly 10 months and was concluded in October 1996.

Keywords: Active transfer of technology; technology strategy; technology absorption and economies of scale and scope.

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1 Introduction

Investment in the Indian automobile industry will be on an unprecedented scale in the late 1990s as a result of the entry of numerous multinationals for producing automobiles of different descriptions and the execution of modernization and expansion plans of existing automobile manufacturers. According to industry reports, Rs 100,000 million is likely to be invested in fiscal year 1997-98. The Tata Engineering and Locomotive Company (Telco), Hindustan Motors Limited (HML), Premier Automobile Limited (PAL), Ashok Leyland Limited (ALL), Bajaj Automobile Limited (Baja), and Bajaj Tempo Limited (BTL) along with several other companies were allowed to borrow the technology for manufacturing automobiles to cater to the growing needs of different segments of the automobile industry immediately after independence in 1947. The technology transfer arrangements were worked out according to market demand, the needs and capabilities of the industry and the availability of technology across developed countries. This arrangement continued for 35 years and thereafter the need was felt to dismantle the restricted flow of technology and to acquire financial resources to speed up the process of industrial and other developments in India, which paved the way for economic reforms.

The process of economic reform started in 1983, which was followed by fierce liberalization in 1991. The Indian market was opened up for foreign firms and Indian organizations were allowed to compete in overseas markets with local and multinational organizations. In the wake of the globalization of trade, commerce and industry, and the liberalization of the economies of the various countries of the world, it has become mandatory for all players to have a sound technology base, without which accomplishing operational and strategic goals would become not only uneconomical but almost impossible. The increasingly demanding global business environment calls for a separate management function which looks after corporate interests on the technology front.

Many strategic alliances came into existence across a variety of industries to make Indian firms compete not only in domestic but also in international markets. The industries which could attract direct foreign investments and the maximum number of joint ventures include electronics, communication, information technology, and automobiles. Several Indian organizations have acquired state-of-art technology from their foreign collaborators. Various modes of technology acquisition have been tried out. These include joint ventures, long-term collaboration (8-15 years), short-term collaboration (up to 8 years), a one-time basis, through the sale of designs and drawing, manufacturing plants, and product designs, through personnel training (in soft technology areas), and on an on-call basis (problems or consultations). Equity participation may or may not be a part of the deal in many such technology acquisition deals.

The active transfer of technology has been considered as a model of technology acquisition in the article, in which the technology provider and borrower have almost the same stake in equity holding, both having equal management control, and therefore equal

commitment to make the firm a commercial and technological success. The technology provider chooses borrowers on the basis of their strengths in the proposed country and the technology borrower has an opportunity to choose from technology providers in the context of the opportunities and threats that exist and as envisaged in the global environment transfer of technology takes place on a continuous basis. Acquisition of technology-related logical extensions and incremental innovations may or may not be subject to charges on the terms mutually agreed by the partners. To resolve the conflicts of interest arising from time to time and to ensure the sound technological and financial health of the firm, there may exist a written document which can be renewed after a fixed period of time, of course with need based modifications. Though technology has been the basis for such emerging joint ventures, the technology management function does not preclude finance, marketing, personnel, and other classic functions of an organization, because the active transfer of technology model affects them in a big way.

At the global level there are perceived advantages of technological collaborations which are taking place all over the world. Developed and developing countries stand to gain from legislative and economic reforms. Technology transfer is now taking place in India with organizations from many developed countries like the USA, Japan, the UK, Germany etc. When we talk about a global scenario, it does not mean that India is only at the receiving end and technology has to flow in one direction only. There can be a market for the technologies which India has developed in many core areas in recent years. The firms providing technology to other firms are not charitable organizations. Technology transfer is the main process but commercial and profit calculations must make sense before it can be performed.

The competitiveness of an organization can be assessed from various parameters, the most important of them being technological innovations and breakthroughs which the organization realizes or has the potential to realize over a period of time. It may be difficult to measure the impact of adopting an innovation or rejecting it, but over a period of time overall financial and marketing results can definitely help in drawing conclusions regarding technology-based decisions. Technological changes and decisions to adapt to changes in the environment can make or break an organization. Examples of the significant impact of commercializing a technology on the overall performance of the organization are numerous, from the invention of the steam engine to intelligent cars.

In the changing global scenario, those organizations that integrate technology related decisions into business strategies have considerably improved their chances of reaping benefits from technological innovations. There is always an element of risk associated with the adoption of a new technology. This indicates that technological innovations cannot be adopted without prior analysis in the context of a particular organization. Technology involves moderate to high investment, and it also has a limited lifetime, after which the same technology may not remain commercially viable and hence, needs either upgrading or total replacement. Under the circumstances where total replacement is called for, previous technology which was in use must generate enough revenue so that the investment in the new version may be wither totally or partly funded from operations.

New organizations must consider all these factors quite carefully, and the choice of technology becomes an extremely crucial decision for them. For existing organizations a watchful approach will help not only towards survival and growth but also in taking and maintaining technological leadership in their industries. For those organizations who are already technology leaders in their respective industries, technology management strategy becomes a more crucial weapon by which they can sustain their positions in the existing

businesses and also explore new markets, thereby restricting the entry of competitors and exit of customers in different parts of the world.

The study reported here covers three cases of Indian automobile firms where active transfers of technology have taken place and addresses issues related to the strategic management of technology in developing countries in general, and within Indian industry, in particular. The objective of the study was to assess the technology management practices in the Indian automobile industry with special emphasis on clarity in technology acquisition, developing capabilities to adopt, adapt, and implement new technologies, indigenization, competitiveness, and the effectiveness of technology alliances. During the course of the study the issues addressed also included the technology strategy of the firm, the technology transfer model followed, technology as a powerful tool for competitive advantage, innovation culture in the organization, technology development, supplier development, research productivity, building core competencies [1]. And the technology strategy framework being evolved and followed.

The study also aims at ascertaining the perception of the corporate world about the strategic management of technology. What do the top and middle management of technology-based or technology intensive organizations expect from technology management strategies? What instructions, directives, and guidelines are desired in pursuit of a technology management strategy? How can a corporation maintain its technological supremacy? How helpful can the technology strategy be in promoting a culture of innovation in an organization? Apart from strategic technology management, are there other applicable strategies for surviving in a competitive environment? The study also addresses many of these questions.

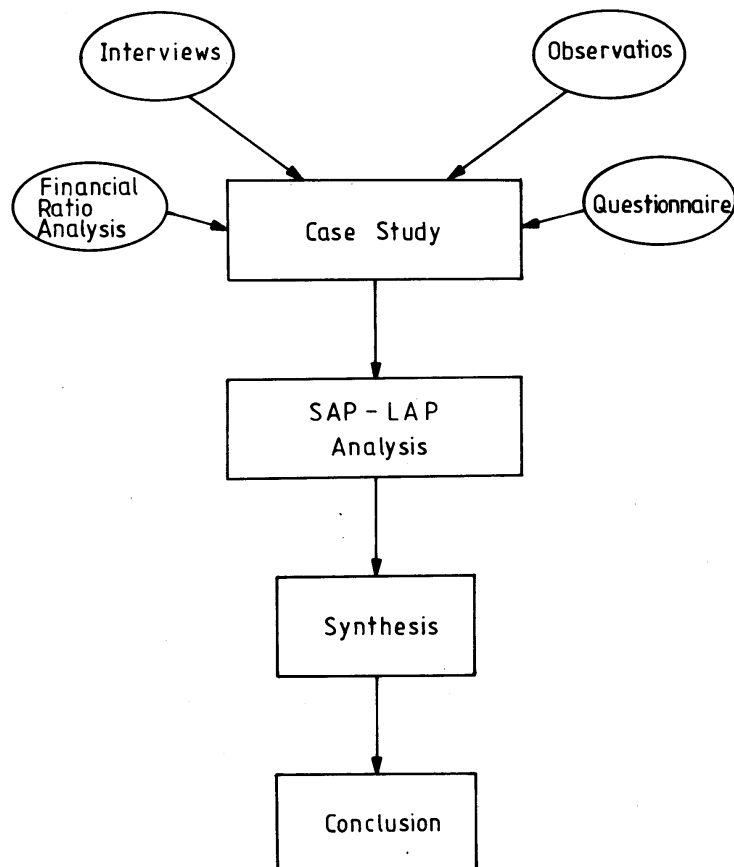
It should be noted that technology management is an area of very recent origin in comparison to other functions of management, and there is relatively little literature available about technology management in the Indian context. Much research on technology management in developed countries has been conducted, but most of it does not give any insight into the technology management practices in India

2 Methodology

The cases of Maruti Udyog Limited, Hero Honda Motors Limited, and Kinetic Honda Motors Limited were selected as they have acquired technology from abroad and have joint venture partnerships with their respective collaborators on an active transfer of technology basis. A questionnaire survey was undertaken in the Indian automobile industry covering 16 automobile manufacturers and 17 automotive component manufacturers. A total of 152 respondents with an average (16.83 years) of experience replied to a questionnaire measuring 25 variables quantitatively. Tables one and two present the profile of the respondents to the questionnaire. Table three presents the profile of the executives interviewed. A profitability, liquidity, and turnover ratio analyses exercise was carried out on the previous three fiscal years' data of each firm, assuming that after strong liberalization, the impact on finances was felt from the fiscal year 1993-94. A brief past history of the organizations studied was obtained to understand their technological backgrounds. Interviews focused on the perspectives of the decision makers of the technology management function. The relationship of the effective technology management to organizational growth was emphasized. The cases were

analysed applying the situation-actor-process-learning-action-performance (SAP-LAP) paradigm [2] to bring out the finer issues. Syntheses of learning issues were then performed to ascertain the commonalities and diversities in the approaches of these firms (Figure 1). Stratified sampling was used for the questionnaire study while selection of the firms for the case study was based on purposive judgement.

Figure 1 Methodology used for the study



The combination methodology covered the following attributes: collaborators; products; market; technological history of the organization; corporate philosophy; technology strategy; technological strengths and weaknesses; integration of corporate strategy with technology strategy; effectiveness of technology alliance, clarity in technology acquisition; innovation flexibility; flexibility in technology strategy; research productivity; technology waste; resource leverage; relationship with technology providers; technology absorption model and supplier development and indigenization. The input from the questionnaire survey results was compared with firm averages on selected variables.

The SAP-LAP analysis was used to explore the handling of the technology management function in the firms constituting the sample for case studies. In each case the context of the situation has been identified.

Table 1 Designations of the respondents of questionnaire

<i>Code</i>	<i>Designation description</i>	<i>Number of respondents</i>
01	Chief Executive Officer (CEO)	8
02	Chief Technology Officer (CTO)	23
03	Chief Production Officer (CPO)	13
04	Senior General Manager	3
05	General Manager	14
06	Deputy General Manager	4
07	Assistant General Manager	20
08	Senior Manager	24
09	Manager	18
10	Deputy Manager	9
11	Assistant Manager	5
12	Senior Engineer	7
13	Did not mention	4

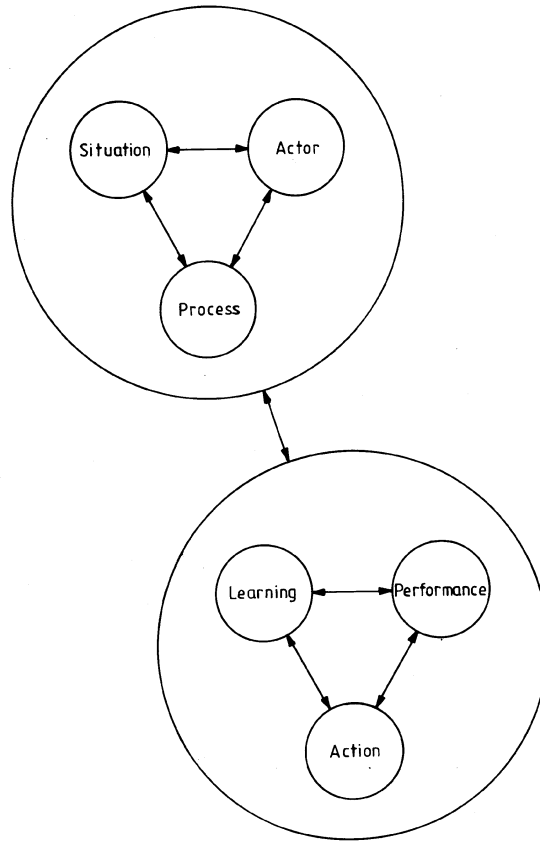
Table 2 Questionnaire respondents' functional areas

<i>Code</i>	<i>Department description</i>	<i>Number of respondents</i>
01	R&D / Engineering	44
02	Product Engineering / Product Development	11
03	Manufacturing / Production	60
04	Supplier Development	02
05	Marketing	12
06	Corporate Planning	3
07	New Projects	10
08	Quality Assurance	3

The roles played by various people and parties involved have been described. The current situation of the organization and the operating environment have also been described. The learning issues have been outlined, possible actions have been suggested, and expected performance has been envisaged. Figure two shows the interaction of situation, actor, and process with learning, action, and performance in the SAP-LAP paradigm. Conclusions and limitations of the study are noted.

Table 3 Length of experience of executives interviewed

<i>Length of experience</i>	<i>Number of respondents</i>
25 years and above	12
20 – 25 years	10
15 – 20 years	9
10 – 15 years	9
Less than 10 years	5
Total	45

Figure 2 SAP-LAP paradigm

3 Maruti Udyog Limited – exploiting economies of scale

It was in 1981, when the government of India (GoI) decided to institute a public sector company to manufacture cars. The initial questions requiring answers included, 'should it manufacture big or small cars and luxury or economy cars?' thus the process of assessing consumer requirements and market demand for the cars in the country was triggered. Government representatives visited the manufacturing facilities of several car manufacturers worldwide. They visited Japan and many countries in Europe. The USA was not considered as an option because it was famous for manufacturing big sedans. The assessment of product and process technologies was the basic motive behind these visits. It was then decided that small, fuel efficient, and economy models would best suit most of the requirements of the people in India, and the benchmark was cost, which should not exceed Rs 50,000. Having decided this, they found that expertise in small and fuel efficient cars was the domain of the Japanese.

This is not to conclude that European firms were not or are not capable of manufacturing small and fuel efficient cars, but the Japanese are perceived to be the pioneers of this segment of the market. In Europe there was a single manufacturer of

small cars which was Fiat, while there are four to five manufacturers of small cars in Japan. Negotiations were held with all of them and equity participation was one of the important points. The basic reason behind the invitation towards equity participation was to 'borrow' the work culture along with the technology which could be subsequently fostered in Indian manufacturing organizations. The Gol was very particular about acquiring Japanese management practices in general and quality philosophy in particular. It was also anticipated that technology experts from Japanese collaborating companies would work in India alongside Indian personnel and that these latter would reciprocate. Lump sum payments would secure technology acquisitions options.

The Suzuki Motor Corporation in Japan (Suzuki) were prepared to enter into a joint venture with Gol. Renova was another company which was also interested but the vehicle it was offering was not as appropriate for Indian conditions and priorities as Suzuki's 800cc car. The deal between Gol and Suzuki resulted in Maruti Udyog Limited's (MUL) coming to fruition and was instituted by an act of parliament. The objective was to modernize India's automobile industry. Initially, the joint venture had 26% equity held by Suzuki with a provision to go up to 40%. However, after strong liberalization in 1991 Suzuki increased its stock to 50% of the total equity. MUL is one of Suzuki's sixty production bases which are located in twenty eight countries. MUL ranked fourteenth among Suzuki companies on the basis of sales in the fiscal year 1995.

The basic premise was that MUL should manufacture a car which is a common man's choice, it should be as per common man's taste, and a necessity vehicle which a common man can afford. In consideration of this market, the SS800 which was then Suzuki's contemporary model, was chosen for manufacturing in India. This was the smallest car manufactured in the world and was suitable for four passengers. This car was re-branded as 'Maruti' for the local market. The first 'Maruti' car rolled out of MUL in December 1983. Thereafter MUL has never looked back.

In 1984 the Maruti Omni 800cc high roof van was introduced. In December 1985 the Maruti Gypsy, a multi-utility vehicle, was launched. In 1986 Suzuki brought out a new model of the 800cc car, MUL also switched over to the same model ceasing production of the original. The Maruti 1000cc was introduced in 1990 which was followed by the launch of the Maruti Esteem in 1991, a 1300cc premium car. In 1993, the Maruti Zen (Alto) was introduced. 1994-95 has seen many variants of the 'Esteem' on Indian roads. MUL has always tried to stay as close to Suzuki as possible with respect to new models. Suzuki's policy is radically to amend models every five years.

MUL is one of the progressive Indian companies where the chief technology officer (CTO) is on the board of directors and designated as Director (Engineering).

"MUL has a very widely discussed technology strategy which provides the technology management practices for components, sourced and manufactured in-house, and processes being performed in MUL", says the CTO.

MUL is in sound financial health as depicted by the financial ratios presented in Table 4, in the Profitability group, rate of return on total assets, on capital employed, and on equity are way ahead of the industry average. Liquidity ratios are marginally better because MUL is investing in expansion projects through debt financing, still ensuring timely payments to vendors and suppliers. High total assets, fixed capital, and current asset ratios indicate better utilization of fixed capital, and current assets. Very high values of working capital and inventory turnover indicate effective working capital management and application of just-in-time (JIT) inventory management principles.

Table 4 Financial ratios for MUL

<i>Financial Ratio</i>	<i>Fiscal Year</i>			<i>Industry Average</i>
	<i>95-96</i>	<i>94-95</i>	<i>93-94</i>	<i>1993-94</i>
Rate of return on total assets (%)	31.36	23.00	10.01	5.6
Rate of return on capital employed (%)	31.71	24.28	10.19	5.04
Rate of return on equity (%)	40.58	38.76	20.18	12.60
Debt asset	0.72	0.39	0.71	0.3
Debt service coverage	4.20	4.72	2.46	1.96
Debt equity	1.23	0.66	1.55	2.164
Current	3.31	4.42	3.01	1.208
Acid test	0.23	0.57	0.66	0.43
Total asset turnover	4.70	3.85	3.25	1.066
Fixed capital turnover	5.30	4.69	4.28	2.512
Current asset turnover	4.75	4.07	3.31	2.087
Working capital turnover	13.63	17.94	17.17	3.48
Inventory turnover	8.89	7.26	8.11	4.049

4 Technology transfer arrangement

The technology transfer arrangement for all Japanese firms is practiced in a similar manner. Vertical integration is generally around 25%. Whatever technology provider manufactures in-house, the technology borrower should replicate and should also use the same vendors for components as used by the technology provider. In the case of MUL, vendors have been persuaded to have tie-ups with the vendors sourced by Suzuki Japan. The local partner monitors the manufacturing process and quality of the end products. MUL has set up joint ventures for manufacturing a variety of components such as steering systems, seats, glass, fuel tanks, and sheet metal components. MUL has followed the same model which Suzuki has itself used as far as vendor development is concerned in Japan.

For other components such as air-conditioners, electrical components etc. many firms came from Japan looking for joint venture partners or technology borrowers and many organizations went to Japanese firms for technology acquisition in order to manufacture various components. In most cases it was MUL which motivated the component manufactures/vendors to tie up with firms which manufacture quality products in Japan. Ultimately supplier development is a crucial activity for any auto manufacturing firm; if the components are not of the required quality, they will adversely affect the whole market image and demand for the vehicle.

5 Suppliers: important parts of MUL

It was in the interest of MUL that the technology acquired by vendors should be backed up by technology providers so that the indigenization process could be effective and speedy. MUL had very stringent quality standards and Suzuki personnel were on site to evaluate the components.

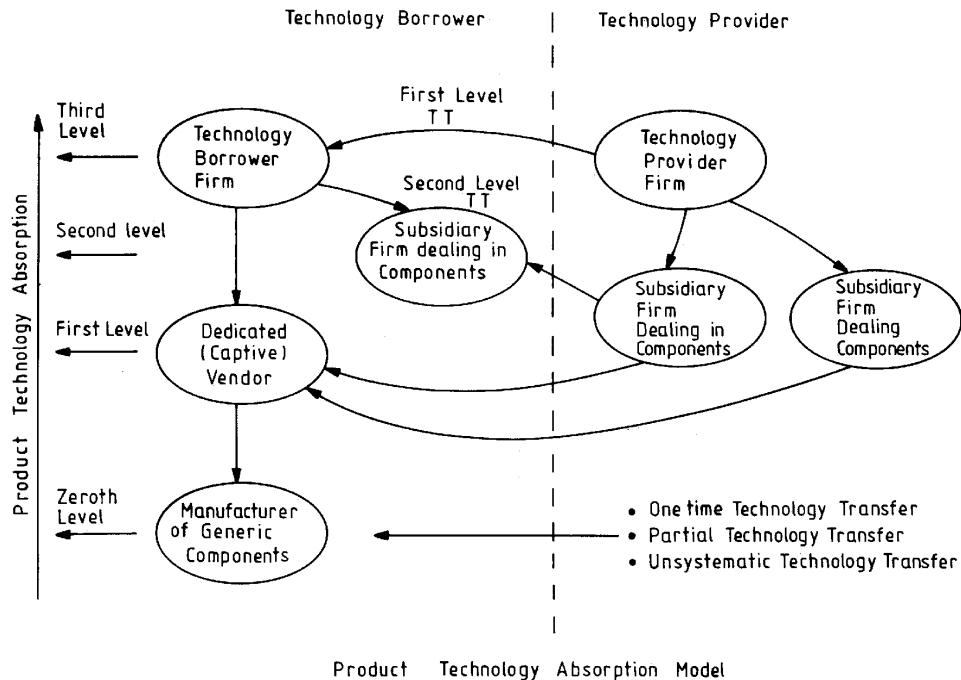
“In the event of a problem, spending time with the supplier, guiding him, telling him where things are going wrong, and through an interactive process, he can be brought to a level where he can deliver us the components(s) of the required quality and quantity” says the CTO of the firm.

The same processes all continue today. Whenever any supplier faces a problem MUL prefers to work jointly to resolve the issue. MUL has gradually stepped up the process of indigenization through vendor development.

On the 800cc vehicle barring the gear box, everything has been indigenized. The key areas of indigenization are plastics, seats, radiators, steering, sheet metal components, brakes, electrical fittings and equipment, suspension systems, electric wiring, switching systems and latches. In the process 34 of Suzuki’s business partners have started joint ventures with ‘Indian automobile component manufacturers and many other Japanese firms are now represented in India through other arrangements of technology acquisition. Many of them have fully owned subsidiary companies.

At MUL the supplier is considered as a part of the organization. The suppliers are encouraged, problems related to manufacturing and product technologies are jointly dealt with, and the emphasis is on building a long-lasting relationship. This is one of the important reasons for the success of the Japanese in the global automobile industry. Obviously, unlike US automobile firms, when companies operate on a slim level of vertical integration, they cannot afford to take suppliers lightly, and they therefore become a very crucial part of the organization.

Collaborators or joint venture partners of Suzuki suppliers are suppliers to MUL in India. Should problems occur, these are referred to Suzuki in Japan, where there is a policy of carrying out spot checks on suppliers working on feedback from dealers and customers. They identify the problem areas and continually refine technology and quality of the various components. MUL has also prepared a large database for the availability of technology for component manufacturing. Suppliers are supported by making information available to them as to where they can obtain the best manufacturing technology for a particular component. MUL suppliers are encouraged to make use of this facility. A supplier consultancy cell is being promoted, on a self-financing basis, to help suppliers on technology acquisition, ISO 9000 certification, and capacity enhancement and expansion projects. Figure 3 shows how MUL has planned the product technology absorption at four distinct levels. It starts from generic component manufacturers and runs to the automobile manufacturer’s level. The other intermediate levels identified in the model are dedicated suppliers and fully owned subsidiaries.

Figure 3 Levels in product technology absorption

This is one of the models of technology absorption. The technology borrower is in receipt of designs and specifications. Its suppliers are acquiring manufacturing technology. The components are manufactured, tested, used, improved and refined, and this process is on a continuous basis.

6 Striving to maintain technological leadership

“Growing competition helps in developing technology leadership,” says the CTO of MUL.

He justifies his stance by the fact that one becomes a technology leader by knowing what kind of technology will be required in the times to come. Knowledge is likely to be generated when there are more manufacturers. They launch their products and you get an opportunity to study their products. In the process, you try to innovate on your products and try to come up with even better ones. Slowly a firm develops this culture of innovation and the motive behind that is to beat the competition. If you keep innovating, your innovations are appreciated by the end users, they perceive satisfaction in the innovated products and you tend to become technology leaders. Asked about the strengths of MUL in the present scenario, the CPO says:

“I think biggest strength that we have is our people, in terms of skills developed, and more than skills, they are able to suggest improvements in their own areas, even workers, to make their work simpler, of better quality, and in less expensive manner”.

Other strengths are of course low cost, fuel efficiency, marketing and service network, and availability of spare parts.

The innovation could have been realized because of product or cost differentiation. MUL is striving to maintain its technological leadership in the Indian market by using these techniques. It is setting its sights on new firms and products being launched in India; MUL is pro-actively innovating its existing product range to make competitors' lives difficult.

"I don't think there is any option for any company of the MUL's size other than to maintain technology leadership" says the CTO.

State-of-art technology and customer satisfaction makes for a firm technology leadership. Technology leadership and effective marketing strategies produces a firm market leader. MUL is trying to balance both the technology push and market pull to maintain its leadership. To beat the competition, MUL is gearing up to explore economies of scale and scope. Competitors are also eyeing the supplier base which MUL has created, but their capabilities to support new manufacturers will have to be carefully explored. With growing competition, the supplier base is also likely to expand. Every manufacturer will need its captive supplier base. But the volumes which new entrants in the Indian automobile market are planning, is cause of worry for both the manufacturers themselves and their perspective suppliers. Indigenization is obviously going to be a problem if volumes remain low. The luxury car segment in India has shown very small growth in the last couple of years. Nevertheless new entrants to the market in general are in this luxury car segment.

MUL's management is of the opinion that although new entrants will initially test the market, few of them will find a niche in which to position their product. Once they are successful only then will they expand. That gives sufficient response time to MUL to react to the product technology which the competitors will be offering to customers and it tends to be progressive in the manufacturing technology area.

Another important dimension in maintaining technology leadership in a competitive market is the innovated 800cc car. MUL's market has grown to the size it is, because of semi-monopolistic conditions. Until late 1994, a protected market existed and it has only recently been opened up for other manufacturers. So far there have been no entrants into this segment of the car industry in India, thus MUL's technological strengths will be tested only when there are more players in this field.

"Thus far the objective for which MUL was instituted, has been fulfilled to a large extent, and we have been able to revolutionize manufacturing technology in India", says the chief production officer (CPO).

Developing a car on our own is an expensive and resource consuming task, and requires the kind of volumes to recover investment, which the CPO thinks are not yet achieved within MUL.

"We can always think in terms of making incremental innovations which I think we are capable of doing now", says the CTO.

"In the fiscal year 1995-96, we saved roughly Rs 400 million through small incremental innovations in manufacturing technology", says the CPO.

Initially, a firm has to be in good financial health in order to be a technology leader. MUL's balance sheet speaks for itself as far as profits and financial reserves are

concerned. Now by exploiting the scale of integration it wants to consolidate its position further.

7 Technology management agenda

MUL's core competence lies in rapid indigenization, technology absorption, and after sales service. Becoming quicker and technologically independent is the highest priority agenda within MUL's engineering division. As the Yen (Y) is becoming more and more expensive, market response time shorter, and innovation life cycle shrinking, dependence on Suzuki Japan may bring the competitiveness of MUL down. Rapid indigenization of the design and testing of technologies has been undertaken in recent years. Considerable progress has been made in this direction. There is no fixed budget for local R&D and the resource allocation strategy is worked out as the need arises. MUL's balance sheet shows a spending of 0.26% in the financial year ended 31 March 1995.

"We have been successful in inculcating innovation culture in our people", says the CTO.

He supports his claim by giving examples of a fuel injection system, the design of new plant coming up shortly, and the replacement of the existing paint shop with a state-of-the-product-art one. The new plant has been designed entirely by local technologists and expert help has been sought from Suzuki in only limited circumstances.

As regards the modification in manufacturing technology, MUL has developed the capability to change any process or design new processes to cater to the requirements of modified products for the export market. Another area where MUL has achieved success is downsizing. For example, a component which previously required three work stations for six operations, now needs to only one work station for all six operations, and this has been done by designing a new fixture and making drastic changes in the design of jigs. Examples of modifications adopted by Suzuki includes lightweight 'fingers' in the press shop for operators, and welding jigs for automatic welding machines. The change in manufacturing technology in Japan is much faster than in India, yet the Japanese are open to new ideas and believe in increasing the speed with which they are implemented. Japanese organizations will change their entire manufacturing shop in a couple of year's time. While the life of manufacturing technology is comparatively longer in India, cost-effectiveness is one important criterion in adopting the manufacturing technology. Production volumes provide the required leverage.

Both CTO and CPO are of the opinion that the investment in state-of-the-art manufacturing technology is not a constraint, what restricts firms from adopting the latest developments are lack of foresight and lack of a strategic attitude to technology management. In MUL, every shop manager has funds allocated for implementing and adopting new processes or technologies. This does not require any prior approval from the CPO or CTO. Technological empowerment has improved creativity among employees. The CPO accepts that the quality of suggestions generated by the Japanese workforce are better than that of Indian workers. One reason could be that this kind of innovation culture is there in all Japanese industries while this culture is slowly picking up in India and is steadily on the rise. An improvement in the quality of suggestions is obviously the next step.

Since 1991 the maintenance of manufacturing equipment has been done by local engineers and technologists and results have improved over time. Now, there are 80 Japanese expatriates in MUL and there is only one expert working on the shop floor who advises on quality problems.

“Developing of competence in manufacturing technology will help MUL in improving its competitiveness”, says the CPO.

MUL has a practice of preparing capital investment budgets on a yearly basis, wherein two types of investments are budgeted. Firstly, the equipment needing to be replaced because it may become very expensive to maintain. Secondly, the equipment and machine tools which will increase throughput by overcoming bottlenecks or can improve the quality of the product or both. This gives the firm an opportunity to update its manufacturing technology on a regular basis. Suzuki highly encourages capital investment in manufacturing technology on a continuous basis and gives innovative ideas to do the same. While making proposals for buying capital intensive equipment, care is taken to buy the best technology available in the world.

Process technology audit is also a regular feature in MUL.

“We have been able to increase throughput of 4500 vehicles per annum without the investment of a single Rupee, courtesy of our process technology audit section”, says the CPO.

As regards testing, MUL has procured and developed a testing facility for individual systems, but integral testing is done at Suzuki’s main plant in Japan. There is nothing which MUL people don’t know what to do, how to do, and why. It is only a question of a little more experience.

MUL has stationed five engineers for long duration training at Suzuki. On coming back from Japan they will be required to train others in India. Another batch of five engineers will then be sent for training in some other area. This is how MUL plans the technology training of its people.

Research productivity is proved in cost saving and customization of the vehicles. Major areas where customization was done included suspension, air-conditioning, and braking systems. There are some more incremental innovations which are yet to be tested and launched, hence research productivity seems to be alright and obviously there was almost no technology waste. To incorporate incremental innovations in manufacturing technology MUL does not have to seek prior approval from Suzuki.

“Everyday we make 25 to 30 improvements in manufacturing systems, it is just not possible for us to seek approval for”, opines the CTP.

A Kiazen workshop has been established where anyone gets any new idea can go and test it. The results can be discussed and decisions for adopting that idea or process or practice or product can be made there and then. Once the workers see ideas implemented, they generate more ideas, and this is how ideas are multiplied.

Suzuki’s technology strategy is to remain number one in the small car segment keeping its presence felt in the large car segment. It also wishes to maintain and consolidate further its strengths in the small car segment and develop core competence in manufacturing small car engines.

Another strategic aspect is, instead of concentrating on foreign markets, MUL is concentrating mainly on domestic markets. Small cars may have a favourable market in developing and oil-scarce countries. Zen, Suzuki’s ‘Alto’ model has been drastically

modified to be manufactured by MUL. It has proved to be a great success in the domestic as well as in the export market. The waiting time for Zen is three months in countries like Germany and The Netherlands. There is tremendous scope for quality products in European and Latin American countries in the modestly priced car segment.

8 Competitiveness through technology management

MUL has attained the capability to cater to niche markets. It has developed the competencies to make more than cosmetic changes in the vehicles being manufactured. Recently it has started eyeing the markets in many developed countries. Modifications in vehicles according to emission, road, and safety and homologous conditions in various countries are being done by MUL technologists.

Product technology innovation is seen as a one-time activity or at least spread over a fairly long period of time, while process technology change is something which occurs on a continuous basis.

“The philosophy which MUL follows as far as technology is concerned, no one makes an invention nowadays, small innovations put together makes it is a big one” says the CPO.

“Mul’s product and process technologies are far better than any other firm in the Indian automobile industry. Japan, of course world leader in automobile technology. In Asia, of course Korea is ahead of India as far as small cars are concerned”, says the CTO.

But Koreans are being beaten on the concepts of quality and reliability.

After sales service and technological support which MUL has experienced from Japanese speaks for itself. Recalling one incidence in the installation days, the CPO says,:

“we rang up a Japanese engineer at 12 midnight, he asked us to document the problem and send it on facsimile. He was awake till two. Then he replied back. At three we conveyed him that the problem is not solved. He told us that he is taking a flight to New Delhi next day morning and no cost is charged to MUL”.

9 Market leadership through technology

What market share MUL will be able to retain in the Indian car market will be decided by the market growth rate. If the market growth is to be high then all new entrants are able to sell all the manufacture, and then MUL’s share is going to remain the same. But market growth is not going to be the same as it has grown from 1991 to 1996, and competitors are entering in large numbers and if they get good initial response their volumes are also going to be large. MUL’s marketing people appreciate that they will be losing their market share. The question is what MUL’s bottom line is going to be as far as market share is concerned?

MUL’s management thinks that its bottom line in financial statements (earning per share) is going to be much better because of its intrinsic strengths in engineering and technology which it has developed over time. Until and unless the new entrants in the Indian car market develop local people to take up this challenge they will not be able to stand straight in front of MUL and it’s going to be a real tough time for the competitors of MUL. Many of them will even have to struggle for their survival in the initial years.

When a new manufacturer enters the market, it has a ‘novelty value’, which MUL will have to overcome by its proactive technology and business strategy. MULs’s strategy to beat competition is to innovate its existing products drastically. MUL has

introduced six models in the last 13 years but is now planning to introduce 15 new models in the next five years to maintain its leadership. Even if not all of these appear, then a good number of models which Suzuki Japan manufacturers are likely to roll out of MUL as an answer to the competition which is building up rapidly. Engineering projects of an ambitious value have been taken up to bring the cost down to the level which will be difficult for a competitor to match.

The performance of engines, colours, appearance, and safety features are being worked on. Apart from people, MUL's core competencies lie in small car engines, and fuel and braking systems. MUL has realized and plans to innovate further in fuel and braking systems of small cars.

10 MUL's aspirations

As regards the technological (total) independence is concerned, it seems to be difficult even for old players in the global automobile industry. It is an age of collaboration and collaborative research. For example, three US automobile giants General Motors (GM), Ford Motors (Ford), and Chrysler Motors (Chrysler) have formed a cartel for R&D. MUL believes in working independently and this philosophy is imbued in each and every MUL employee quite effectively. MUL takes help from Suzuki only in the case of intricate problems where detailed analysis is required. And it is not that Suzuki works out the details and gives it to MUL, but technologists from both the firms work jointly.

“Developing a technology base in a developing country is like putting water on stone. Slowly grooves will be carved. You put more water, the grooves will get deeper and deeper. And one day will come when you will emerge as a technology leader. India has all the capability to become one”, says the CTO.

The government norms should change and liberalization should be practiced in the real sense. While opening the doors for foreign multinationals, existing firms should also be encouraged to expand their technology and manufacturing base. Leave everything for entrepreneurs to develop. Healthy competition should be allowed to grow. Competition has been instrumental in improving quality, cutting costs, increasing productivity, developing a technology base, and making incremental innovations. Eventually, the customer gains from all these activities. In a healthy competitive situation nobody can afford to take customers for a ride.

The government's job should be to fix directions and not to run business. There are examples in which government controlled economies have failed and market-driven or competition-driven economies have survived. Government controlled economies when they become market-driven, enjoy phenomenal growth.

11 MUL compared with the industry

It is evident from Table 5, that MUL is doing extremely well on corporate growth, level of indigenization, supplier development, investment in technology, and effectiveness of the technology alliance. High equity participation by the joint venture partner is also distinctly visible. It is marginally better than the industry average on technology leadership, capability to adopt, adapt, and implement new technologies, technology waste, exploiting economies of scale and scope and the conduciveness of innovation culture.

It lags behind considerably on research productivity, degree of technology planning, degree of technology push, technology innovation flexibility, and technology pay-back period. The phenomenal growth may be because of poor customer awareness of MUL's technology and the smaller number of competitors in the 800cc car market. High technology acquisition flexibility indicates the freedom of acquiring state-of-art technology by MUL.

Table 5 Values of variables for MUL, HHML, and KHML compared with automobile industry

Code	Variable Description	Average Optimistic Value (For Industry)	Average Most Likely Value (Industry Average)	Average Pessimistic Value (For Industry)	MUL's Average	HHML's Average	KHML's Average
01	Technology leadership	8.68	6.76	3.34	6.90	6.35	6.99
02	Corporate growth	9.15	4.35	0.85	8.52	5.18	2.43
03	Technology pay-back period	9.15	5.95	2.86	5.21	5.78	6.18
04	Value of the firm	9.15	7.10	2.40	7.08	6.35	6.35
05	Capability to adopt, adapt, and implement new technologies	8.52	5.70	2.72	5.99	5.46	5.70
06	Level of indigenization	9.15	8.48	2.40	9.15	9.15	8.61
07	Extent of supplier development	9.15	8.06	2.40	8.99	9.15	7.80
08	Capability to exploit economies of scale and scope	9.15	6.58	0.85	6.95	6.11	6.87
09	Degree of technology planning	9.15	6.33	0.85	4.94	6.27	7.18
10	Effectiveness of technology alliance	9.15	6.18	2.37	7.25	6.72	7.62
11	Research productivity	8.86	6.21	2.45	5.40	5.73	6.10
12	Technology Waste	0.85	2.78	5.80	3.44	2.86	2.68
13	Investment on technology	7.25	3.58	0.85	6.84	4.00	3.82
14	Extent of technology development	7.80	5.42	2.25	5.41	5.17	5.18
15	Success of technology acquisition	6.80	3.95	0.29	3.85	4.41	4.70
16	Equity participation	5.80	2.93	0.85	6.33	3.87	5.43
17	Technology availability	5.80	3.88	0.29	4.33	2.92	3.58
18	Customers' technology awareness	6.92	4.78	0.66	2.93	4.46	5.37
19	Customers' needs satisfaction	7.41	4.94	0.41	4.42	5.14	5.25
20	Degree of market pull	7.48	3.54	0.29	4.39	4.13	3.00
21	Degree of technology push	8.80	4.62	2.06	5.15	5.02	4.95
22	Conduciveness of culture for making innovations	6.26	3.82	1.11	4.15	3.98	4.59
23	Strategic flexibility	9.00	7.33	3.44	7.35	7.33	7.58
24	Technology innovation flexibility	8.38	7.13	2.07	6.08	6.54	6.93
25	Technology acquisition flexibility	8.27	6.81	1.26	6.99	6.17	7.07

- All values are measured on a 10 point scale.

Number of respondents from Indian automobile industry = 152
 Average length of experience across the industry = 18.28 years.
 Number of respondents from MUL = 12
 Average length of experience of respondents from MUL = 12.6 years
 Number of respondents from HHML = 8
 Average length of experience of respondents from HHML = 18.50 years
 Number of respondents from KHML = 7
 Average length of experience of respondents from HHML = 22.2 years

11.1 Context

Exploiting economies of scale as a strategy to restrict competition.

11.2 Prevailing situation

- MUL has 74% share in passenger car market in India.
- New players in 800cc car segment have not made any dent so far.
- MUL, being an early bird, has done considerable indigenization by way of vertical integration and supplier development.
- Competitor suppliers are facing dilemma of volumes.
- MUL gearing up to face competition in 800cc car segment.
- In anticipation of stiff competition, investments in R&D have been hiked.
- The firm is in excellent financial health.

11.3 Main actors

- CEO of MUL as the key source of motivation.
- Government of India and Suzuki Motors as joint venture partners.
- Employees approximately (4800) of MUL putting in their valuable efforts.
- Suppliers approximately (430) of MUL providing support to exploit economies of scale.
- Competitors as the braking force to MUL's journey to market leadership.
- Customer as choosy user in the face of increasing competition.

11.4 Process of technology management

- MUL has now formulated a technology strategy.
- Impressive indigenization level capability developed.
- Planning to compete only on the basis of marketing strategies.
- Advertisements are being released for the first time for 800cc cars in September 1996.
- Ambitious value engineering (VE) projects are taken up to bring cost down to competition – restrictive levels.
- No major breakthrough realized in product technology.
- Introduced five models in the last 12 years, now planning to introduce 15 models in the next five years.
- Dependence on technology providers continues for product technology.

- On the whole, MUL is quite effective in revolutionizing the Indian automobile industry initially.

11.5 Learning issues

Technological dependence on a single firm may become an impediment to emerging as a leader. Changing preferences of the customer calls for exploiting economies of scope along with economies of scale. To be able to exploit economies of integration [Noori, 1990], a firm needs a strong technology base within the organization. Technology support from outside does not come to the firm's rescue in a competitive business environment. Learning issues outlined in MUL's case have been presented in Table 6.

Table 6 Learning issues in the case of MUL

Technology strategy and technology leadership	Clear and unambiguous statement of technology strategy paves the way for technology leadership. Dependence on technology providers is no strategy.
Economies of scale and scope and market leadership	Being able to exploit economies of scale and scope puts a firm in an advantageous position for market leadership in early maturity stage in the technology life cycle. To be able to exploit economies of integration in the long run, a firm should be in sound technological health.
Cost effectiveness of technology and adoption of new technologies.	Cost effectiveness of technology is to be decided by its useful life and adoption of expensive technologies may prove to be more cost effective in the long run. Quality friendliness also has a bearing on cost effectiveness.
Cost effectiveness of technology and product differentiation	Economies of scale give a firm cost advantage while economies of scope give the benefit of product differentiation. Economies of scope have to be achieved without sacrificing the cost advantage to get economies of integration.
Capability to explore economies of scale and scope and cost effectiveness	High capability to exploit economies of scale and scope improves cost effectiveness of technology which also helps in restricting the competition by reducing the overall cost of manufacturing and improved utilization of fixed assets.
Customers' technology consciousness and backup support from technology providers.	Improved customers' technology consciousness demands active backup support from technology providers.
Helpfulness of technology providers and technology development capability.	Helpfulness of technology providers helps in cultivating technology development capability and improves the effectiveness of technology alliance.
Capability to adopt, adapt, and implement new technologies and technology waste.	High capability to adopt, adapt, and implement new technologies helps develop technology absorption capability which in turn helps in reducing technology waste.

Table 6 Learning issues in the case of MUL (continued)

Indigenization and technology absorption.	Indigenization is a prelude to technology absorption. Capability to make innovations is the next step after technology absorption. Technology development is a big step ahead of having built innovation capability.
Backup support from technology providers, technology availability, and customer technology consciousness.	Backup support from technology providers strengthens customers' 'faith in firms' technology. It also promotes the technology consciousness of the existing and new customers. Customers expect that the latest development at the technology provider's end should be passed on them through technology borrowers.
Technology availability and customers awareness of technology status.	When a technology based product is available to the customers, their needs and preferences are communicated to the marketing people through comparison with other products. In the process customers' knowledge of technology status obviously improves.
Technology availability and technology phase-out.	Availability of advanced technology for commercial use pushes hard the existing technology to rapid maturity and subsequent obsolescence.

11.6 Suggested actions

- MUL needs to sort out an unambiguous technology strategy and indicate the areas where core competencies are to be cultivated.
- MUL needs to develop its R&D and bring in more models of the small car.
- It needs to develop state-of-the-art testing facilities.
- Economies of scale should be exploited along with economies of scope.
- Needs to expand its market in fuel scarce countries of North Africa, Latin America, and Asia Pacific regions. Making MUL's product to adapt to these conditions helps in developing R&D capabilities.
- MUL needs to look for state-of-the-art product technology available from any of the technology providers.
- MUL develops strategic intent and designs strategic action to emerge as the world's largest small car manufacturer.

11.7 Expected performance

MUL's technological strengths will be tested when there are many players in its dominated segment of 800cc cars. MUL is expected to defend its market share, and the most crucial role is to be played by the technology of the end products.

12 Hero Honda Motors limited – market leadership through technology

It was in the early eighties, when the Indian economy was opening up and foreign technologies were allowed to come in sectors of strategic importance. Many automobile manufacturing firms were finding their way to the Indian market. TVS-Suzuki, Maruti Udyog Ltd, Birla Yamaha Motors Limited, Escorts Yamaha Motor Limited, and many others came into existence in the automobile sector and Honda Motors of Japan (Honda) were also looking for partners to venture into the Indian market. Before Honda started looking for business partners in India, it assessed the transportation requirements of the masses and anticipated a growing market for two-wheelers.

A Honda team of experts visited more than 50 destinations in India including the metropolis, small and big towns, hilly and rocky terrains of the country and gathered the data for modifying their existing vehicles to suit Indian road and environmental conditions. Based on the data collected in India and nearby countries like Thailand, Pakistan, and Indonesia, Honda developed two-wheelers which were based on two different technologies. A scooter based on two-stroke and motor bicycle based on four-stroke technology. The reasons for this were that India then was predominantly a scooter market and a four-stroke motorbike with 100cc engine capacity category was unavailable in the domestic market. Honda saw great potential in 100cc four-stroke technology in India. Fuel efficiency, environmental friendliness (in comparison to two-stroke vehicles), and load conditions in urban and rural parts of the country were a few of the important reasons which contributed to their decision to bring out a drastically innovated vehicle. The vehicles designed for the other three countries in the neighbouring region were not a great deal different. But of course modifying an existing vehicle/designing a new vehicle needs massive investments in terms of money and efforts along with the other business risks associated with technology development.

All this happened before Honda entered into a joint venture partnership or technological collaboration with any firm in India. Having done this they started looking for a business partner for a four-stroke motorbike venture. On the other hand Hero Group also undertook a market survey project on almost similar lines and the findings of both the studies delivered comparable results.

13 Hero group

The Hero Group made a humble beginning in 1956 with bicycle manufacturing. The founding father, the late Mr. Dayanand Munjal, laid the foundation of the Hero group with a dream to provide technologically advanced and affordable transportation solutions. Becoming the number one bicycle manufacturer was the first step in the process. The first group company is known world over as Hero Cycles Limited which manufactures 14,500 bicycles every day which are delivered to customers through a network of nearly 3,750 dealers in India and approximately 250 dealers abroad. The second group company was Rockman Cycle Industries Limited which came into existence in 1961 as a part of indigenization and backward integration. Continuing with the same process Highway Cycle Industries Limited was floated in the year 1971. The Hero group promoted Majestic Auto Limited in 1978 and Munjal Castings in 1981 to manufacture mopeds and health care equipment and non-ferrous castings respectively.

This was followed by a rapid growth phase in promoting Hero Honda Motors Limited (HHML) (a joint venture with Honda Motors of Japan) in 1983, Munjal Showa Limited (a joint venture with Showa of Japan) in 1985, Sunbeam Castings in 1987, Hero Motors (a division of Majestic Auto in collaboration with Steyr Daimler Puch, Austria, and very recently entered into collaboration with BMW of Germany), Hero Cycles Limited (Unit 11) and Gujrat Cycles Limited (a joint venture with Gujrat Industrial Development Corporation) in 1988, and Hero Cold Rolling Division in 1990.

Starting from bicycle to moped to 100cc four-stroke motorbike, to 650cc the most coveted BMW solutions, the group has thirteen companies and fifteen manufacturing units to manufacture a full range of two-wheeler transportation options and world class auto components. Today Hero is a popular name in bicycles not only in India but in sixty countries including Europe and North America. HHML is an undisputed market leader in the four-stroke 100cc category. It is also famous for the name 'Fill It, shut It, and Forget It' vehicle because of its efficiency and environmental friendliness which are of utmost concern to automotive vehicle users all over the world.

The group has recently promoted two more companies, Hero Exports in 1993, which deals in trading Basmati rice, garments, bicycles, bicycles components, steel, and wheat in the international market, and Hero Corporate Services, established in 1995, which deals in management services related to Strategic Business Plans, Information Technology, HRD, and Project Management.

The group turnover in the financial year 1995-96 was approximately US\$ 455 million and exports account for about 16% of the total. The Group Chairman, Mr. Brijmohan Lall, was adjudged as the Business India 'Business of the Year' in 1994, and had conferred on him the prestigious Economic Times – Harvard Business School Association of India Award for corporate excellence. He is the sitting (1996-97) Chairman of Association of Indian automobile Manufacturers (AIAM).

14 Technology history of the Hero group

The Hero Group of companies has an impressive track record in indigenization, exploring economies of scale and scope, and product innovation. Their bicycle business has provided them with an opportunity to learn about the changing choices and preferences of customers in different parts of the world. The group's corporate management has a tradition of keeping in touch with the state-of-the-art technology in their field of interest. They have also learned to innovate on existing products to attract customers which has also helped the group in developing a sound customer base not only in India but also in other countries. In the process of indigenization and product innovations the company has strived to develop technology based products in-house or in the group companies.

There are many group companies based at Ludhiyana, the headquarters of the Hero group, which have come into existence as import substitute units. Instead of continuously importing a component or components from developed countries, the group has always preferred to manufacture or buy an Indian product. In the process the group has acquired and developed technology to manufacture various components.

15 What impressed Honda about the Hero group?

Honda Motors had received 150 applications and shortlisted nearly twenty companies in India for a joint venture partnership. The Honda team visited the existing plants and manufacturing facilities of their potential joint venture partners. When the Honda team of experts visited the Hero group companies, they were surprised to learn that management practices were quite on a par with the management paradigms taking shape in Japan.

“The team was quite impressed with the Indian version of Just In Time (JIT) inventory system then practised in Hero Cycles and other Hero companies. The overall interpersonal relationship between workers and management was another bright spot in the managerial practices. It is quite in place to mention that the team was particularly impressed with the open door policy of the then group chairman, the late Mr. Raman Kant Munjal, who knew several of his workmen by their first names and also knew a lot about their families. The same was valid for dealers and C&F agents in the marketing set up. The Honda team was also impressed with the productivity of Ludhiana factory and unprecedented record of quality”, says the chief executive officer (CEO).

The same style of functioning has been picked up by his successors in the group. Honda experts found Hero companies practising the state-of-the-art Japanese management principles and hence found the group most appropriate for a long-term business relationship. The subject company HHML, is the result of this joint venture coming into existence in April 1983. The total equity capital was Rs 120 million (Y360 million, Yen *versus* Rupee Rs 100=300 Yen, as on 31 March 1996) and total investment in the project was for 290 million. The authorized equity capital was Rs raised to Rs 300 million in the 1992-93 fiscal year.

The Honda and Hero group have 26% of shareholding each and the remaining 48% is with financial institutions, employees and the Indian public. The plant is based at a place called Dharuhera (Haryana), nearly 60 Km from New Delhi. It took nearly a year to bring up this facility and the first motorbike rolled out of the plant on April 13, 1984, the auspicious day of ‘Baisakhi’. Sales turnover was Rs 492 million in 1985-86 compared to nearly Rs 7,000 million in 1995-96. Table 7 presents the financial ratio analysis for the last three fiscal years of the firm. In 1996 the net worth of the firm was around Rs 1,700 million, share capital went up to Rs 300 million, and debt to asset ratio was 0.33 indicating its equity orientation. Debt service capacity ratio was 3.93, further indicating high debt taking capacity. The firm exhibits a healthy rate of return and turnover ratio, particularly the high fixed asset turnover ratio indicating its efficient utilization of fixed assets, and rate of return on equity is also fabulous (26.82%). Financial ratio analysis indicates that the firm is in sound financial health.

Table 7 Financial ratios for HHML

<i>Financial Ratio</i>	<i>Fiscal Year</i>			<i>Industry Average</i>
	<i>95-96</i>	<i>94-95</i>	<i>93-94</i>	<i>1993-94</i>
Rate of return on total assets (%)	16.06	14.45	11.94	5.6
Rate of return on capital employed (%)	33.83	23.61	21.62	5.04
Rate of return on equity (%)	26.82	25.50	25.01	12.60
Debt asset	0.33	0.33	0.41	0.3
Debt service coverage	3.93	3.21	1.97	1.96
Debt equity	0.55	0.58	0.86	2.164
Current	1.35	1.25	1.55	1.208
Acid test	0.69	0.46	0.84	0.43
Total asset turnover	3.91	3.60	2.86	1.066
Fixed capital turnover	15.25	27.85	9.89	2.512
Current asset turnover	8.23	5.87	5.18	2.087
Working capital turnover	20.19	20.65	11.32	3.48
Inventory turnover	10.66	6.57	8.72	4.049

Source: The data for calculations were obtained from HHML's Annual Reports of fiscal years 1994-95 and 1995-96.

16 HHML before 1991

This was the time when Kawasaki, Yamaha, and Suzuki along with Honda entered the Indian market and everyone was under strict government regulations.

"Everyone was supposed to import valuewise only 40% of components from abroad in the first year, 30% in the second year, 20% in the third year, 10% in the fourth year and by the fifth year the vehicle should be 95% indigenized. This was the arrangement with Director General of Trade Guarantees (DGTG). A lot of time used to be spent on moving papers from one place to another. Because of this reason HHML could not produce more than 42,000 vehicles while it had a booking of nearly 500,000 vehicles", says the CEO.

"The government regulations helped in working out an effective indigenization schedule which Honda would not have otherwise allowed HHML to implement" says the CTO. Another difficulty was in producing the number of vehicles per year.

"It was license regime and decision making process use to work backwards depending upon the licensed capacity. Where as after liberalization there are no restrictions on indigenization as well as number of vehicles to be manufactured. The government policies do not change, even if they change then they change for good. Market forces determine the price and quantity of the vehicles. Things can be planned ahead of time and policy changes are no impediments in the way of a firm" says the COP.

17 Post liberalization strategy

"Japanese are forward looking people and never fall in short term traps. They have always believed in investing in the projects which yield rich dividends in the long run. Earlier Honda was having a department for east and south Asian countries. After fierce liberalization in India in 1991, Honda Motors Japan has created a separate wing to target India and has worked out a strategy to attach Indian market. Earlier the strategy used to be for the whole of the region, but now Honda is focusing on India in particular" says the CEO.

The strategy basically focuses on how many vehicles are to be manufactured and sold in which country, what profits are coming to Honda from which market and so on. After liberalization Honda strengthened the HHML technology and has plans to go for four-wheeler production in India. They have also identified a joint venture partner for their car unit. Honda is also planning to set up an R&D centre in India, which clearly indicated that it is taking the Indian market seriously.

18 Technology Management at HHML

The Hero group believed in Honda technology, particularly the four-stroke option and entered into a joint venture partnership without really assessing the same.

“Honda had taken up a massive exercise to know the customer preferences and had concluded that a fuel efficient and cost effective motorbike could be the solution to which Hero group agreed” says the CTO.

As far as technology assessment is concerned the group thought that Honda was way ahead in automobile technology particularly four-stroke and has established credentials and there is no need for technology assessment.

As regards technological leadership, Honda is the undisputed world leader in the four-stroke motorbike and of course, HHML in the Indian market. The leadership is visible in the market share, customer preference, in meeting environmental norms, and investment in technology.

The firm believes that its high market share is largely because of better technology and aggressive and well thought out marketing strategy. Mr. Brijmohan Lall Munjal has set the agenda for HHML as continued effort for the development of the motorbike industry through new product development, technological innovation, investment in equipment and facilities, and efficient management.

HHML sees its core competence in absorbing process technologies. Honda has 83 manufacturing facilities in 39 countries in the world and its nearly \$40 billion (year ending 31 March, 1996) company operates in approximately 160 countries.

“But HHML is a manufacturing unit which has absorbed the technology very effectively and has modified several process technologies to save cost and also to realize product differentiation. The group management thinks that their core competence lies in effective indigenization and absorption of technology” says the CTO.

The innovations in process technologies, cost reduction in indigenized components, and valued addition to the product without extra cost are clear indications of its technology absorption capabilities.

HHML spends nearly 1% of its total revenue on in-house R&D which is significantly low in worldwide standards, but reasonably high by local (Indian) industry standards. The most important thing is that the chief technology officer (CTO) does not feel that they are starving for resources, but thinks that they get the resources they need. At present they are not in a position to absorb more resources because the technology agenda which the firm has laid down for itself does not ask for more. There is no point in pumping financial resources without having a solid foundation for technology development.

A firm needs to develop enough technological capabilities to take maximum leverage from the resources committed to the technology of the firms products and processes. Capital investment in technological projects involving imports of equipment are discussed in the joint consultative committee which has given useful suggestions on many occasions in the past. Honda experts help in choosing the state-of-the-art solutions. As far as indigenous equipment is concerned, HHML has enough expertise available. HHML has identified certain leverage points where little investment (or other resources) yielded fabulous benefits in the long run. One such activity was the testing of engine components.

A larger part of manufacturing technology has been supplied to HHML by Honda Motors only. Many precision and intricate parts are manufactured on these machines. Many other machines have been bought from other manufacturers as suggested by Honda. The Production Engineering Department (PED) has evolved processes which are more cost-effective, of high quality and operator-friendly.

It has been a case of active technology transfer in which HHML is banking on Honda for prompt and effective technological solutions.

“The ‘CD100’ vehicle after its launch have had many problems but solutions to them have been generated in record time without even letting the customer know about the problem”, says the CTO.

What Honda really insists on is the requirements of data for analysis and fault finding. Even today all design, material, and manufacturing aspects are decided by Honda. The acceptability of the innovated product is jointly discussed by the marketing team of Honda and HHML. Presently, one such exercise is going on in connection with a new model which HHML wishes to bring out in the current year i.e., in 1996.

The technology borrower always needs sound and state-of-the-art testing facilities for analysing product performance and process characteristics. It is an important step in technology absorption.

HHML has developed a testing facility in which 90% of the testing is done locally. They need to depend on Honda for critical tests for which Honda has developed testing technology, rarely available from other manufacturers in the world, i.e., at any other Honda company or Honda joint venture. All Honda collaborators are using the processes the corporate testing centre or at the plants which a particular company is attached to. HHML is attached to Komamoto Japan and gets 10% of testing done there itself. These tests need special skills and equipment which HHML does not have at present.

As regards adoption of new technology, both partners have decided to do this jointly. Being joint venture partners they sign an MoU and clauses related to adoption of new technologies figure in it prominently. In the case of new technologies Honda has to decide upon the choice and train HHML people. To support his point, the CTO gives an example that HHML is putting up another plant in Gurgaon (nearly 20 km from New Delhi). The manufacturing technology there will be quite different from the technology being used at its Dharuhera plant. HHML aims to use Flexible Manufacturing Systems (FMS) in which the motorbikes will be produced in small batches without sacrificing economies of scale.

At the new plant most of the machines will be computerized numerically controlled (CNC) and changing setting from one model to another will be a matter of seconds. Anticipating the increasing effect of market pull, and customers becoming more demanding, small batches of many models will be required in future. Doing this with the

existing manufacturing technology will be highly uneconomical. The firm plans to synergize the manufacturing activities of both the plants.

HHML management is pro-technology, they have evolved systems to adopt and adapt to new technologies. The chaos occurring because of new technology implementation is reduced to the minimum because of this approach. They form teams/task forces and go through a very meticulously designed and structured program by HHML technologists. Their Japanese counterparts also actively support them in these ventures. HHML has been able to develop confidence in their people that whatever new manufacturing technology may be brought in, they will be able to understand and implement. While choosing a new technology, several attributes are considered and cost-effectiveness, of course, is one of the most important ones. The other parameters considered are environment, quality, and user-friendliness, useful life, investment involved, and helpfulness in consolidating core competencies.

Since HHML is the market leader in this category of vehicle and technological capabilities are made use of to sustain this position. Increasing component/material cost is carefully looked into, serious thought is given to accommodate increased cost by better capacity utilization, product and manufacturing innovations, and rigorous value engineering exercises. Suppliers are also motivated to take up innovative ideas for implementation to bring down or maintain costs and to improve quality. raw material conservation, energy conservation, and cost reduction in newly-launched components are also tried. HHML is an extremely environmentally friendly firm internally with process technologies and internally with product technology.

The strategic alliance which Honda as with Hero group believes in promoting its corporate image in India as well as in the world market. They undertake a lot of image building exercises which are based mainly on technological breakthroughs. Neither of them can afford to compromise with the technology management function in order to stay as market leaders in the two-wheeler segment of the automobile industry in their respective territories.

As far as product technology in concerned, Honda's approval is a must for any innovation, HHML, R&D and PED have implemented many innovations in manufacturing technology like induction brazing in place of the gas-based operation. In manufacturing technology HHML enjoys complete freedom in innovation and can apply its creativity to make it more efficient and cost effective without adversely affecting the quality of the end product.

As regards technology waste, there has been almost no incidence in which the technology was developed but could not be utilized. HHML has developed four models so far in the last thirteen years, and all of them have been received well by Indian customers. Their degree of success may be different. As regards product technology, plastics are used extensively in many parts of the world in Honda bikes. But looking to the usage conditions of the vehicles and environmental concerns, plastics have not been adopted in India. Technology waste has been avoided by carefully and proactively selecting the product and process technologies.

The need for a high powered core technology group was felt, to undertake assessment of state-of-the-art and world class technologies in the automobile industry. Sincere approach to technology forecasting and a proactive response to future requirements are the key elements of the technology strategy of a firm striving for global leadership. Production pressure has dominated people and the exercise of inculcating a strategic

attitude among people has obviously taken a back seat. Peoples creativity has not been fully exploited.

As regards clarity in technology acquisition, PED and R&D prepare the plans to be implemented in consultation with the Projects division. They work out several options and the advantages and disadvantages of each one. The technical director chooses one of them depending upon the firm's long-term business objectives. The choice of option may or may not be revealed to the planners. The decisions related to technology are not transparent even to top management executives.

The definition of state-of-the-art is different for different people and countries. HHML took a technology which was nearly thirty years old and adapted it to Indian conditions. Now they have developed a capability wherein changing to any new technology or adopting incremental innovations would not be difficult at all.

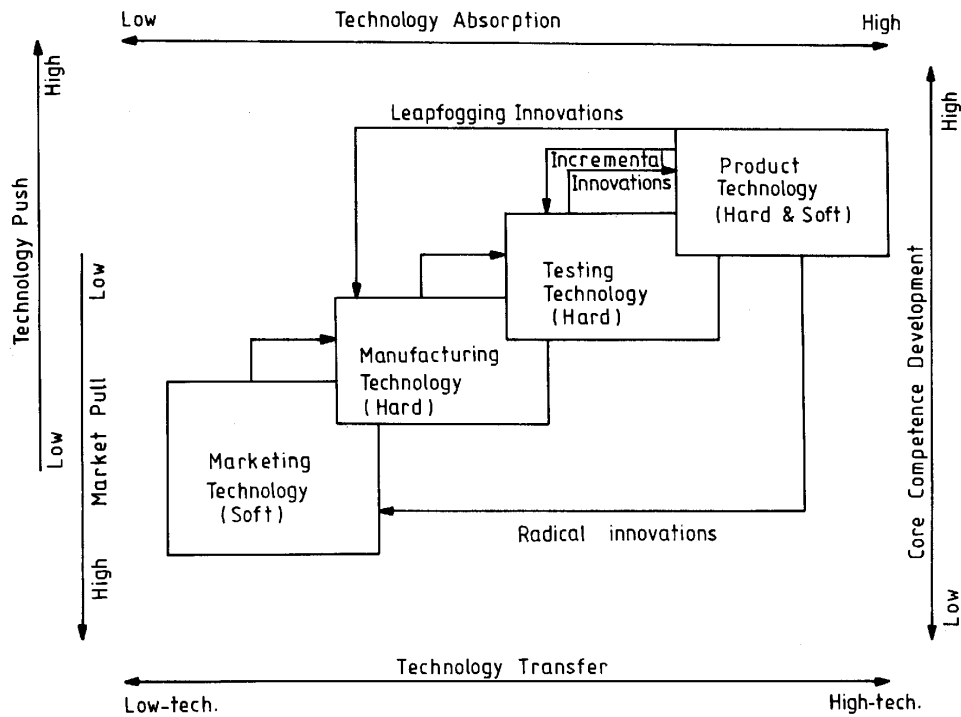
“Every time when the MoU with Honda is renewed, new clauses are added to the benefit of both partners. Similarly old clauses which become irrelevant over a period of time are excluded. For example, earlier only 100cc motorbikes were open to HHML, but they can manufacture any bike which Honda manufactures. This is a measure of technology absorption capability which the firm has developed over time and the confidence which Honda has shown in their joint venture partner (JVP)”, says the CTO.

19 Levels of technology absorption

When HHML began to absorb Honda technology, they decided to design an altogether new engine. Honda persuaded them to revise their agenda of technology absorption. The automobile technology is divided into four distinct categories, which are design, product testing, manufacturing, and marketing and after sales. The first and last categories are classified as soft technologies, and second and third as hard technologies.

“Honda made a point to HHML, that if you start developing an engine now, you will take two years time and even after that you will not be sure whether you will be able to do that or not. While Honda can do it in three month's time with a high probability of success. Similar things were told about the testing technology. HHML was convinced about their strengths in manufacturing and marketing and after sales. Honda made them exploit on these two strengths”, says the CEO.

While in the design and testing process HHML was assured of full support from Honda. This revision, Honda suggested, was based on their experience in Nigeria, Brazil, Argentina, and other places. Figure 4 depicts the stepping stone model HHML has adopted for technology absorption.

Figure 4 Technology absorption model adopted by HHML

HHML did very well on these two fronts and absorbed the manufacturing and after sales technologies quite effectively. In after sales Honda trained HHML personnel in maintenance and repair of the motorbikes. Because the four-stroke is a sensitive engine, if it is maintained well with proper tooling and adequate training, it gives a wonderful performance, otherwise it fails measurably. HHML, following the advice of Honda, revised its priorities and concentrated on the training of roadside mechanics, dealers, and authorized service stations. For rural markets mobile workshops were introduced. The Japanese were not available for after sales service and manufacturing, of course this was a field left open only to Indians. Manufacturing technology also included making the product in the same way as has been described in the design and thereby assuring its performance.

Next in the agenda was supplier development and development of a testing facility. HHML does work out design modifications but does not develop original designs. In technology transfer, there are two parts, one of know-how and the second is know-why. No technology provider will disclose to its collaborator or joint venture partners the know-why part and neither does Honda. Most of the know-why is with Honda R&D which is a separate firm altogether and it sells its intellectual information to Honda companies and joint venture partners the world over. Honda pays Honda R&D for intellectual information and joint venture partners pay Honda. Hence Honda partners do not have a direct dialogue with Honda R&D. Honda is a fairly open global player but some of the technologies are very closely held.

20 Classification of parts

A motorbike has 480 to 500 parts which are classified in A to E categories. Category 'A' parts are those which are responsible for vehicle safety and pollution norms. Category 'B' parts are directly responsible for performance of the engine. It may not have anything to do with safety or pollution norms. Categories 'C', 'D' and 'E' are related to other functions including the aesthetics of the vehicle. In category 'A' and 'B' items Honda has elaborate arrangements with its suppliers or manufactures them in-house. The problem is further complicated when a supplier manufactures components up to the mark but others do not. The overall quality of the vehicle becomes diluted. The Honda strategy focuses closely on developing technology based quality-conscious suppliers. The motivation behind establishing R&D centre in India is to help suppliers and supplier development process.

HHML is on a par with Honda in 'D' and 'E' category parts but still far behind in A, B, and C category components. HHML looks quite healthy on the know-how part but not on the know-why. The know-why part of technology is crucial in developing core competencies.

21 Indigenization a serious agenda

HHML imports 14% of its components (valuewise) from Japan for two reasons. Firstly the cost effectiveness of those components. HHML's consumption level of these components does not justify a separate plant for them in India. Secondly there are some key components which cannot be compromised. When the consumption level improves further, suppliers may be asked to bring technology from Japan to India and start manufacturing in India. In that case imports are likely to go down further.

The Hero group has a fascinating history of indigenization right from the beginning. Hero Cycles Ltd indigenized imported components quite early and took over the leadership of this industry. The same philosophy prevails in HHML also, as far as indigenization is concerned. The group has gone to the extent of promoting separate companies to manufacture crucial components. The group firms promoted are Munjal Showa Ltd which manufactures shock absorbers, Sunbeam Casting Private Cycle Industries Limited which manufactures motorbike chains. Except for Sunbeam Castings which is based on indigenous efforts, the technologies for the rest have been acquired from various foreign collaborators. HHML has encouraged closely held (captive) ancillary units and many of them have located in nearby areas. Highway Cycles has developed the capability to fabricate special purpose machines and has manufactured the same for the group companies.

"Vendors, those who have already brought in the technology from other firms from abroad and meeting our quality and performance standards, HHML goes ahead and sources components from them. But in case a particular vendor needs improvement in technology then HHML not only suggests but plays a mediator in getting the technology from the firm which is supplying the same component(s) to Honda in Japan" says the CTO.

HHML is the world number one plant in Honda joint ventures all over the world in level and speed of indigenization.

"Thanks to the local manufacturers and management's vision", says the CEO.

It is also the world's number one plant in manufacturing basic model 'CD100' in such a large volume (800 motorbikes per day, which will be 1000 motorbikes per day very shortly).

HHML thinks that they brought in the product (four-stroke) technology a little ahead of time while others are now going in for the same. Hence they have not so far thought of phasing out the product technology. In process technologies, incremental innovations keep coming and they have been incorporated from time to time. There is very little scope envisaged for a radical change, and if it happens, HHML would like to adopt the radically changed process technology before it is forced or imposed on it.

The local R&D team has proved itself to be highly productive in terms of developing new models. It has developed 'CD100 SS' model on its own which is a great success in the Indian rural market. Similarly 'Sleek' is another model which is a roaring success for high-income clientele. Together with Honda's corporate R&D, it takes up Value Engineering (VE) exercises which improve the quality and performance of the products without increasing the cost, so it can also be termed as cost savings in a sense. The CTO of the firm is an international authority in VE and makes use of VE techniques quite effectively and innovatively.

In the absence of faith in the technologists and technological capabilities of the firm only hardware and a very little software is utilized, of the human beings capabilities. Faith in local technologists will improve human capacity utilization (hardware, software, and brainware) and will boost research productivity tremendously.

Honda provides prompt backup support for technology related problems and also a backup guarantee in the international market. Because of heavy demand in the local market, HHML has not yet fully explored overseas markets. But with new plant coming up it will be in a position to do so. The new models which HHML is planning to bring out in the Indian market, are supported quite actively. by Honda Motors. Another model which is the same 100cc capacity but uses a different technology is called 'Centrifugal Clutch' which enables the rider to change gears without pressing the clutch lever. At the same time there will be no power transmission losses because there will be no slip in the transmission links. It will give better performance, more safety against clutch failure and high fuel efficiency to the customer.

HHML has also contributed to the product technology of Honda Motors in more than one way. It has so happened that a typical dust cloud formation was reported in a particular part of the country. The higher dust level was causing damage to car engines, as it was passing through the filter and entering the engine. HHML worked out a solution and resolved the problem. After this several Honda teams came and visited the place to study the formation of the dust cloud and its process of spoiling motorbike engines. Later on the solution was refined further and implemented in all Honda motorbikes all over the world. Similarly by using value engineering they modified the design of steering and later on it was passed on to Honda for application in all motorbikes sold across the globe. HHML also receives design modifications for various parts of the vehicle. This is a regular process and they exercise a large degree of innovation flexibility.

There have been enquiries for technology transfer from HHML to other third world countries. But at present HHML is delivering Completely Knocked Down (CKD) kits to countries like Bangladesh and Mauritius. There is no written or unwritten technology strategy of HHML. But it wants to sustain its market leadership in the four-stroke motorbike market. It started off as a technology-driven firm but now it is more a market-driven or customer-driven company.

22 Supplier development and Honda's strategy

Honda products are expensive because they are based on better technology and superior quality. The problem comes in the technology which the suppliers have. Honda suppliers have the world's best technology in the parts which they supply to the parent company in Japan. Any automotive vehicle has easily 60% - 80% of its components sourced. If the suppliers do not have the appropriate technology and not able to meet high quality standards, obviously the final product's quality will also be affected. This becomes the weakness of the JVP's in India. Honda is very confident that the technology which it has transferred can be easily absorbed by HHML.

The absorption strategy has been reversed and suppliers have been asked to collaborate with Honda suppliers in Japan and many suppliers have done the same independently. The focus of attention of Honda's technology strategy in India is to improve the technological capabilities of suppliers. Honda invests substantial amounts of money in supplier projects in Japan. They enter into long term purchase contracts with suppliers.

Honda also helps suppliers in working out solutions to technological problems and also writes off 5% - 10% of their capacity and investments in suppliers. This kind of understanding has not been reached with suppliers in India. This is a very potent area, where Indian firms can develop their core competence because we have knowledgeable engineers and hard working manpower who can assimilate technology. India can emerge as one of the leading auto component manufacturers in the world.

23 Commercial and technological viabilities

When HHML was deciding upon the models to be marketed in India, a very wide range of models were available for HHML to choose from. The high price of state-of-the-art technology could not attract Indian customers in those days and things would have been different for HHML. A golden path of compromise was chosen and drastically modified versions of existing vehicles were selected for the Indian market. Technology if it does not suit the market will not succeed. It has to have regard for usage conditions, buying habits, and purchasing power of the target market. The Indian market is now ripe for state-of-the-art motorbike technology and now it makes a lot more sense to venture into this developing niche.

HHML is all set and capable to take maximum advantage of the scenario likely to emerge. A firm's technological capabilities developed over time make it commercially stronger for making use of dynamic situations to be best utilized to its advantage and maximize the assets of shareholders. This is an important commercial angle to be looked at in the technology management function.

24 HHML compared to industry

Table 5 presents the comparison of values of 25 variables measured in HHML and across the Indian automobile industry. HHML is way ahead in corporate growth, level of indigenization, supplier development, effectiveness of technology alliance, success of technology acquisition, equity participation by technology providers (as it is a joint venture) degree of technology push, and degree of market pull. Its performance is quite

comparable with the industry mean on technology leadership, technology pay-back period, capability to adopt and implement new technologies, capability to exploit economies of scale, technology waste, investment in technology, extent of technology development, customers' needs satisfaction, conduciveness of culture for making innovations, and strategic flexibility.

HHML lags behind on technology acquisition flexibility, technology innovation flexibility, research productivity, value of the firm, and capability to exploit economies of scale and scope.

Technology acquisition flexibility suffers because the dependence on technology providers has not reduced in many of the areas. The same reason is valid for the low values of technology innovation flexibility and research productivity. After its product was established in the Indian market, the firm had to pass through a phase of severe labour productivity problems, that may be a cause of lower value of the firm. HHML needs to exploit economies of scope without sacrificing economies of scale which it hopes to do in its new plant.

Context

Technology leadership through effective technology absorption.

Prevailing situation

- Hero Group has an impressive track record as far as indigenization is concerned.
- HHML is the only player in the four-stroke 100cc motorbike market in India.
- Enjoys a market share of 45% and 43% in fiscal years 1993-94, and 1994-95 respectively, in the 100cc motorbike segment.
- Competition is setting in after fierce liberalization took place in 1991.
- Customers have become more demanding as they have more to choose from.
- Import components of the vehicle are increasing after the withdrawal of government restrictions on indigenization.

Main actors

The Chairman of HHML as a visionary leader.

- Top management executives as decision makers.
- Honda as technology providers and joint venture partners.
- Engineers, technologists, and workers as heart and soul of HHML.
- Customers and competitors as the guiding force.

Process of technology management

- Technology absorption agenda has been revised by HHML on the advice of Honda.
- Indigenization through vertical integration and supplier development has been successfully attempted. A few subsidiary firms have been floated for this purpose.
- Captive vendor experiment has proved to be successful once again.
- Honda providing active support on product and testing technologies.
- Innovations in process technology need no approval from Honda.

Learning issues

Absence of a technology strategy does not help in sustaining technological leadership. Choice of technology must be justified from the commercial angle to bring success. An important question needs to be answered by the developing countries; can they afford to implement innovative ideas in the first five or ten years of technology acquisition?

Technology transfer methodologies vary from country to country. The receiver countries exhibit the same set of characteristics as far as indigenization and technology absorption are concerned. Every time you ask for technical information, you need to answer several queries from the other end. Eventually you may or may not get details and the excuse could be that its proprietary intellectual information. The same technology provider may choose a different JVP for entering into a different segment of the same industry. The commercial success of technology alliance in one segment of an industry may not necessarily motivate the technology provider to enter into another JVP with the same technology borrowing firm to cater to other segments of the same industry. The learning issues identified in HHML's case are presented in Table 8.

Table 8 Learning issues in the case of HHML

Technology leadership and core competence	Core competence in technology absorption will lead a firm to follower and not leader. But core competence in switching from one technology to another and developing technology within will keep it fighting fit on technology front. Existence of core technology group is a pressing need of a technology leader organization.
Technology leadership and competitiveness	Firm striving for technology leadership should not contain itself with only technology absorption capabilities. It must create developmental capabilities to be more competitive. Sustainable market leadership stands on the foundations of technology leadership.
Core competencies and corporate image	Building core competencies changes the customers' perception of a firm from a mundane manufacturing unit to a technology based organization.
Helpfulness of technology providers and effectiveness of technology alliance	Helpfulness and prompt support provided by technology providers improves the effectiveness of technology alliance.
Chaos handling capability and adoption of new technologies	Adopting and implementing new technologies create disturbances of regular patterns. Capability to handle these kind of disturbances allows the continuous updating of the product and process technologies.
Innovation culture and innovation flexibility	Faith in technologists and local people improves their research productivity. People apply their creativity to make innovations. Innovation culture in the organization is essential for technological leadership.
Technology forecasting and technology planning	Technology forecasting helps in making technology acquisition, absorption, innovation, and phase out decisions.
Economies of scale and scope and cost effectiveness	Exploitation of economies of scale and scope keeps the volumes high and cost low. It also helps in making incremental innovations because the cost of doing that is spread over a large volume.
Strategic attitude and technological leadership	Building and nurturing a strategic attitude helps in achieving and maintaining technological leadership. Production pressures should not be allowed to be so dominant that people tend to lose sight of the long-term technological goals.

Suggested Actions

- HHML needs to strengthen itself on product and testing technology fronts.
- Direct interaction with Honda R&D should be encouraged.
- R&D budget to be enhanced as the firm is in good financial health.
- State-of-the-art testing facilities should be installed locally to perform all types of testing for the 100cc and more powerful vehicles.
- Import components to be reduced to 3-4% in order to avoid the effect of Yen fluctuation on the cost of product in local market.
- Market expansion in the countries where HHML has not ventured so far.
- Exploit economies of scale and scope to improve the volumes and bring the cost down.

Expected performance

- Dependence on imported components should reduce over time.
- Build core competencies in technology acquisition, and subsequent indigenization in the shortest period of time to stay ahead in competition and emerge as technology leader in the Indian two-wheeler market,
- Dependence on other firms should only be for acquiring radical innovations in technology.
- Wealth maximization through effective technology management.

25 Kinetic Honda Motors Limited struggling to indigenize

Kinetic Honda Motors Limited (KHML) came in to existence as a joint venture of Kinetic Engineering Limited (KEL) and Honda Motors (Honda) Japan in 1984. When Honda wanted to enter the Indian market with two-wheelers, scooters and motorbikes, the firm designed them for Indian road conditions. This was the time when many automobile manufacturers were entering the Indian market with vehicles tuned up to suit to local conditions. As discussed earlier, Honda had short-listed Indian firms for joint venture partnership. The first opportunity was given to KEL to select one of the two vehicles. KEL chose scooters and this was how KHML was floated.

KEL then was doing remarkably well in the moped market. The reason KEL was chosen by Honda as a joint venture partner was the similarity in the technology on which KEL's then products were based. KEL was in the business of constant-driven (with no clutch and no gears) vehicles and Honda had also brought in the same technology in their scooter. KEL is owned by India's long-standing industrialists, Firodias. Firodias were promoters of Bajaj Auto Limited (Bajaj). Later on Bajaj was divided into two firms, the parent firm Bajaj went to Rahul Bajaj's family and Bajaj Tempo Limited (BTL) (a new firm was made) was taken up by Firodias. The product range was also divided into two and three-wheelers went to Bajaj and three wheelers and light commercial vehicles (LCVs) were given to BTL. Bajaj eventually became the market leader in two-wheelers,

and even in 1996, it is a market leader and enjoys more than 70% market share in scooters and 41% in all two-wheelers put together.

26 What impressed Honda in KEL?

Like the Hero group, KEL was also in the moped manufacturing business and was doing extremely well. Its success was founded on some basic principles which were really very close to Japanese management systems. Firodias are well known for devising and implementing effective cost control techniques. Even HHML personnel have been persuaded by Honda executives to study KHML's cost control techniques. Mass manufacturing techniques were very well known and effectively practiced in the group companies. In 1983, KEL was manufacturing 35,000 mopeds per month. Supplier development and outsourcing policies and systems which KEL was using, were quite comparable to Japanese firms. Low levels of inventory and close association with suppliers for solving technological as well as quality problems, were highly appreciated. KEL had an impressive dealer network, which could be useful for making the Honda scooter reach remote parts of the country. Lastly, the capability to do process simplification and innovation impressed Honda executives.

KHML was floated with an equity holding of 28% by Honda, initially. Later on, in 1994, Honda increased its holding to 51% and now KHML has become a Honda company. It is one of the 83 companies in the world. Like HHML, KHML is also attached to Honda's Komamoto plant in Japan.

27 Technology transfer arrangement

Honda had designed a single passenger, self start, 100cc cylinder volume, and fibre body scooter for the Indian market. When the joint venture came into existence, Indian technologists and marketing people made them understand that such a vehicle would succeed in Indian conditions.

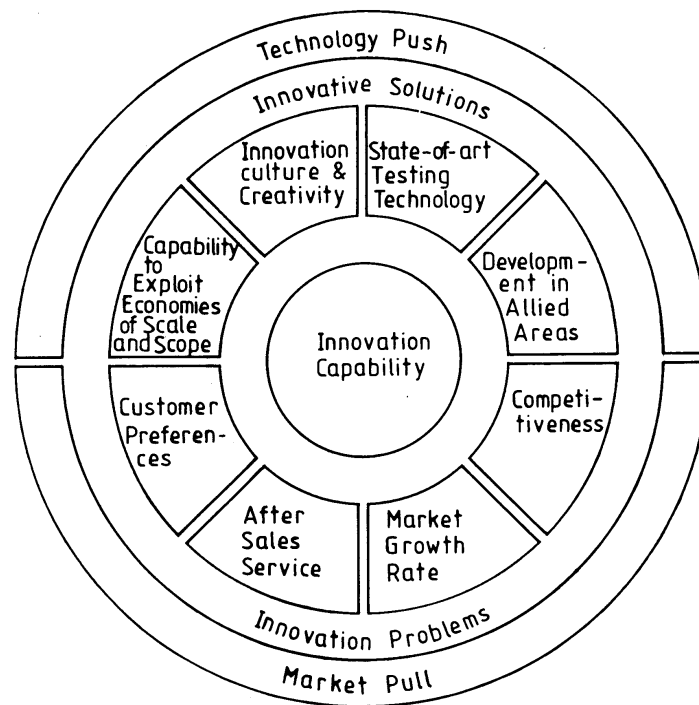
"Honda's vehicle was based on very sophisticated technology and designed for comfortable ride. But Indians were not used to that kind of comfort. The people preferred mechanical start to electronic start mechanisms. Then another important requirement was that the vehicle has to accommodate two passengers instead on one. Body parts made up of fibre sheets were difficult to indigenize and would not prove to be durable" says the CTO.

All these features were making its product more expensive than that of the vehicles it was positioned against. Honda manufactures a similar vehicle with 75cc, 125cc, and 175cc engine capacities in European and Latin American countries.

To provide driving comfort, Honda had made compromises on fuel efficiency and maintainability of parts. As a result, the product which was offered to Indian customers through KHML, was not suitably positioned against existing products. In 1984, when the first batch of 'Kinetic Honda' vehicles came out onto Indian roads, they underwent drastic design changes because of the very different requirements of the Indian people. All these problems occurred in the case of a scooter, because Indians were used to a different scooter, and changing the people's mindset was indeed a very difficult task. In

comparison to the motorbike, the scooter took more time for Honda R&D to understand the very special requirements of Indian customers. The determinants of innovation capability take into account customer preferences and local usage conditions apart from innovation culture, state-of-the-art testing facilities, capability to incorporate recent development in allied areas, and urge to be competitive as depicted in Figure 5. Any delay in identifying these determinants leads to delay in developing innovation capability.

Figure 5 Determinants of innovation capability



“The entire product technology was provided by Honda. KHML was to undertake phased indigenization of components being imported that time. The complete manufacturing technology facility was to be designed and implemented by Honda as part of technology transfer agreement. KHML people were to be trained in all organizational functions. The plant capacity was designed to be 300,000 scooters per year”, said the CPO.

A detailed supplier development program was designed to identify and promote suppliers for manufacturing body, suspension, and brake system parts initially, and engine and electrical parts subsequently. Crucial parts which determine the safety of the passenger and engine performance were to be indigenized in the later phase. As per the regulation laid down by GOI, a time-bound complete indigenization schedule was prepared. However, there was no mention of exploring the export market in the technology transfer agreement.

28 KHML's technology strategy

"Banking on Honda R&D, and modest product and process innovation locally has been its technology strategy" says the CTO.

India, being predominantly a two-wheeler users' country, KHML was rightly hoping to expand the market to a phenomenal size of two million two-wheelers per year by 1990. It entered into the Indian market with a very highly innovative product. The product cost was high initially, because of novel features and low volumes in comparison to other manufacturers. During the same period Lohia Machines Limited (LML) entered with a technological collaboration with Piaggio of Italy (Vespa). LML was offering a much better product than the one Bajaj was marketing at that time. Scooter riders had relished Vespa technology when it had a collaboration with Bajaj which was over by 1971. Bajaj had absorbed Vespa technology effectively and was operating on its own in the Indian market thereafter. Bajaj had effectively entrenched the Indian market and had successfully restricted the entry and subsequent survival of scooter manufacturing firms. In 1983, Lohia Machines Limited (LML) entered the Indian market in technical collaboration with Vespa. Bajaj was in the 150cc scooter segment, while LML and KHML were in the 100cc scooter segment. LML's vehicle could not do well initially because it was less powerful in comparison with Bajaj's vehicle. Hence LML had immediately to enhance it to the 150cc category to make it acceptable to the Indian market.

"KHML's technology strategy was to dominate Indian scooter market with a good looking, easy to drive, and rugged vehicle. KHML was not allowed to keep a separate R&D in India to reduce the fixed cost down and banking on Honda R&D for product and process innovations. Framing a technology strategy was a very crucial activity and a priority task for KHML", says the CTO.

29 Technology absorption

Technology absorption is in full swing in KHML. The product and process technologies have been understood and modified to suit Indian conditions. For example, wheel removal for puncture repair was a major problem. The scooter was designed to use a tubeless tyre, which had to change to suit Indian roads. When a tubed tyre was used then obviously, removing the wheel for repairs caused a lot of problems to customers. To solve this problem, major changes were incorporated into the design of engine and body parts. This was done by Indian technologists jointly with Honda people.

30 Technological performance

KHML started with a technologically sound product which was doing satisfactorily in Japan and many European countries. It had initial hiccups while tuning it to Indian conditions. Honda provided active support for solving teething troubles. Technology management has never been a serious agenda in KHML. One of the basic reasons for its widespread failures is the absence of a technology strategy. KHML did not develop an

R&D locally and banked heavily on Honda's R&D. It developed its testing facility also quite tardily and always had a reactive approach to technological problems.

KHML has incorporated many innovations to reduce cost on the various products and processes.

"Ideas conceived by any of our colleagues are thoroughly tested and if found suitable, get quickly implemented" says the CTO.

Some of the examples where process innovations have been carried out by local technologists to reduce cost by increasing productivity and quality include oil tank welding, body cover blanking, brake system, suspension system, and materials handling equipment.

"Massive customer education program was taken up by technologists of KHML to promote awareness of technology of the vehicle immediately after the launch. Roadside mechanics were trained and provided with a toll kit as a Honda strategy" says the CTO.

A comprehensive dealer training program was also worked out and conducted jointly by technology, manufacturing and marketing (sales and support) departments.

KHML has developed a testing facility in which 85% of the tests are performed in-house. They need to depend on Honda for critical tests for which Honda has developed testing technology which is rarely available for other joint venture partners. All Honda collaborators have such crucial tests performed either at the corporate testing centre or at the plant which a particular company is attached to.

With regards to the technology management function, the CEO expressed concern on two counts. Firstly, security against technology pilferage, which, according to him, is not there in India. Technology is copied without paying due charges to the parent firm. Secondly, return on capital employed (ROCE) has to be assured before a firm brings in state-of-the-art technology.

"The commercial angle of the strategic alliances should be looked into carefully. In fact, these two problems are interrelated, if technology gets copied, there is an immediate problem of ROCE", observes the CEO.

The firm's annual report shows spending of Rs 31.57 lakhs in the current fiscal year, 1995-96, on R&D which results in 0.18% of the total sales.

31 KHML's overall performance

KHML's performance right from the beginning has not been very satisfactory. The main reason has been the poor acceptance of its product by Indian customers. KHML has delivered a vehicle which offered tremendous driving comfort, but costs far more than other competitive brands. The vehicle is very sturdy rugged but not fuel efficient in comparison to the products in the same segment of two-wheelers. As a result volumes could not pick up and the indigenization schedule has suffered. Until 1987, the firm was growing slowly. In 1988, when marketing people started positioning the firm's product as a vehicle for working women and housewives, it picked up once again because there was no scooter in this segment.

In 1991, an increase in the Yen price raised the cost of the vehicle even higher, and picking up market share started diminishing. Only recently, from 1994 onwards, the

entire automobile market has had a new impetus and KHML started to gain lost ground. In early 1995, Firodias lost control over management to Honda. Honda took over KHML to save its worldwide image of a successful multinational company, and it believes that the product is technologically sound and will find a niche in the Indian market after a small upgrading. KHML believes that there is good export potential and it is now exploring the international market.

On the competitiveness issue, the firm is not able to make a mark in the market which it was aiming for before entering.

“The KHML’s product is based on altogether different technology, hence its market cannot be compared with others. There is no other player in India with the similar type of vehicle based the same technology, i.e. 100cc gearless constant-driven scooter”, argues the CEO.

KHML is a very open firm where strategic flexibility in technology management is concerned.

“We are always open to the best of ideas, both from within and outside, for making innovations in our existing product. KHML is striving hard for competence-orientation in scooter technology and to emerge out as a leader in Indian market” says the CTO.

“KHML is using the best scooter technology in the world, it will take some more time to convince the customer that its product is the best solution available for them in the Indian market”, hopes the CEO.

32 KHML compared to industry

Table 5 presents KHML’s averages on 25 variables along with industry averages. The firm is doing marginally better on technology leadership, capability to adopt, adapt, and implement new technologies, degree of technology planning, and success of technology acquisition. It is lagging behind on market share growth, value of the firm, research productivity, extent of technology development (locally) and technology innovation flexibility.

Now being a Honda company, effectiveness of technology alliance, success of technology acquisition, and level of indigenization have improved. Its product is technologically superior, which is reflected in the value of degree of technology push while the firm is being beaten on the degree of market pull. The firm’s performance on rest of the variables is quite comparable with industry averages.

Table 9 presents the financial ratios of KHML for the last three fiscal years. The rate of return on total assets is continuously shrinking along with the rate of return on capital employed and rate of return on equity. Debt to asset ratio and debt service coverage ratio have deteriorated in the last three years. The firm is attempting a recovery from long-term borrowing as indicated by the debt to equity ratio. KHML’s liquidity has strengthened in 1995-96. The firm is showing improved utilization of assets as indicated by improving (total, fixed, and current) asset turnover ratios. Working capital and inventory management have improved marginally in the last two fiscal years. KHML is doing better in comparison to the industry average but it is not able to sustain its performance of the fiscal year 1993-94. This clearly indicates when the impact of liberalization started showing on the financial performance of the firm.

Table 9 Financial ratios for KHML

<i>Financial Ratio</i>	<i>Fiscal Year</i>			<i>Industry Average</i>
	<i>95-96</i>	<i>94-95</i>	<i>93-94</i>	<i>1993-94</i>
Rate of return on total assets (%)	5.13	6.52	9.66	5.6
Rate of return on capital employed (%)	20.02	22.40	30.82	5.04
Rate of return on equity (%)	12.06	12.74	16.94	12.60
Debt asset	0.22	0.08	0.09	0.3
Debt service coverage	2.90	4.26	3.77	1.96
Debt equity	0.52	0.15	0.14	2.164
Current	2.06	1.72	1.99	1.208
Acid test	0.72	0.82	0.98	0.43
Total asset turnover	3.14	2.34	2.87	1.066
Fixed capital turnover	11.60	7.97	9.00	2.512
Current asset turnover	12.27	8.06	9.16	2.087
Working capital turnover	8.35	7.91	7.91	3.48
Inventory turnover	6.61	6.30	8.30	4.049

Context

Facing problems of delayed absorption of technology.

Prevailing situation

- KHML is not able to make headway in the two-wheeler market in India.
- Technology absorption was delayed because Honda took quite some time to respond to the requirements of Indian customers.
- Low volumes causing further problems in indigenization.
- Import component of the vehicle manufactured by KHML is comparatively higher.
- KHML is surviving because its market growth rate is high and but KHML's share is shrinking.

Main actors

- The CEO of KHML demonstrates a fresh initiative from Honda to revive KHML.
- Honda as a parent company.
- The employees of KHML as change agents.
- Customers as end users of KHML's products.
- Competitors of KHML as technology watchmen.

Technology management process

- KHML's product was adapted to suit Indian conditions rather late.

- In the absence of volumes, economies of scale are not being exploited. This has affected the indigenization process.
- KHML has not gone for the captive supplier base. Initially, it depended on imported components and later on suppliers of other manufacturers.
- It started and remained as a manufacturing unit.
- R&D in KHML began very late. Earlier it was totally banking on Honda for all types of technology support.
- Since KHML was eating away the existing market of the Indian parent firm KEL, the responsibility of technology absorption was not entrusted to local technologists.
- Concerns expressed by the CEO are highly appreciated. Technology pilferage is to be done away with and return on investment should be assessed before entering any new market.

Learning issues

To compare the competitiveness of a firm, product technology is not compared with other firms, but what is compared is the benefit(s), which customers receive from the product of the firms under comparison. KHML is an interesting case in the sense that it is struggling to survive in the market despite superior technology, which indicates that better technology alone does not ensure success of a product in the marketplace. The learning issues in the case of KHML are presented in Table 10.

Table 10 Learning issues in the case of KHML

Technology strategy	Adapting the product to local usage conditions can also be an effective technology strategy. Customers' perceptions, preferences, and tastes, play important role in adapting a product to the liking of local users.
Indigenization	Government guidelines or no guidelines, indigenization has to be planned effectively otherwise it will be forced by market forces. Import component should reduce overtime.
Economies of scale and scope	Economies of scale not only bring the cost down but also help in developing a strong and innovative supplier base.
Corporate image and value of the firm	Better corporate image keeps the value of the firm high. Short-term technology problems do have an impact on the market price of equity shares. High value of the firm does contribute to corporate image.
Competitiveness	With the loss of competitiveness, the first few casualties go in volumes and innovation culture. Low volumes create other problems like supplier development, technology absorption, and innovation capability.

Suggested actions

- Indigenization process is to be speeded up.
- VE projects to be identified for cost reduction.
- Technology upgrading for improved engine performance and better fuel efficiency.
- Improving sales and thereby increasing volumes. KHML has been allowed to enter the foreign market by Honda.
- Stringent emission control norms to be met with technological improvements.

Expected performance

- Increased volumes.
- Effective indigenization schedule.
- Development of technology management function.
- Evolving technology strategy for the firm.
- Beat the competition through customer oriented product technology innovations.

33 Syntheses

Technology strategy: In the absence of a clear statement of strategy the firm keeps striking in the dark. Short-term success in the market does not guarantee ruggedness of a technology strategy. Senior management commitment to building a strategic attitude needs to be visible in its decision-making process in general and in technology in particular. Quick and effective adoption of product technology to local conditions, developing capabilities to adopt manufacturing technology, promoting innovation culture, degree of vertical integration, and formation of core technology group are a few determinants of a technology strategy. A technological strategy needs to be derived from long-term corporate goals and should take into account each and every component of the technology management function in an organization. Short-term strategies may emphasize product and process technology absorption and make incremental innovations on a continuous basis but a long-term strategy must clearly indicate the firm's intention of cultivating core competencies. Firms need to evolve effective technology strategies which can serve their long-term corporate objectives.

Technology transfer: The objective of technology acquisition has an important bearing on the model of technology transfer. If technology borrowers have a sound financial base and want to develop a strong technology base then long-term collaboration with restricted management control has proved to be effective in the cases of Telco, Bajaj, ALL, and BTL. Firms with a sound technology base and having developed capabilities to absorb technology, go in for one-time technology transfer. Firms which are looking for strong technological, management, and financial support and are desirous of becoming technology leaders in the home country are going in for active transfer of technology.

Technology leadership: The capability to develop technology independently able to provide technologically superior products, being able to compete at the global level, to be able to afford state-of-the-art technology in the core and allied industries, competence to make breakthroughs and radical innovations, and ability to retain competitive advantage in terms of technology are the characteristics of technology leaders. No one example of active transfer of technology in the Indian automobile industry is exhibiting any of these characteristics.

Effectiveness of technology alliance: The success of joint venture partnerships lies in the faith which the partners have in each others' technological capabilities. Efforts should be directed towards reducing the dependence on technology providers. Generally the problem arises when the firm grows strong in the local market and starts planning for market expansion. A healthy alliance is one which develops its own strengths and exploits the opportunities it is exposed to without affecting the interests of technology providers in the global market. Management control should be used to strengthen the firm technologically and financially and not for serving only the corporate interests of the technology providers. Joint ventures which work on mutual faith and trust deliver better results than those operated under the tight control of technology providers.

Competitiveness: The vision to develop core competencies can only keep a firm as the front runner in the race of competitiveness which is only based on competitive advantage. A firm essentially relies on technological strength to achieve sustainable competitive advantage while it seldom depends on market forces which are highly dynamic in nature and beyond its control. MUL could flourish in a protected market and HHML had no competition in fuel efficient 100cc motorbike segments, while the market in both cases was continuously growing. The competitiveness of these firms is not yet established.

Economies of scale and scope: Market leadership, cost effectiveness, and supplier development suffer if advantage is not taken of the economies of integration. Economies of scale and scope have long-term repercussions on technology leadership and erodes the technology base of a firm. Along with technology, substantial marketing efforts go into reaching a stage at which economies of integration can be made best use of. This is an important interface where the technology management function interacts actively with the marketing function. Restricting the entrance of new competitors could also be considered as another advantage of being able to exploit economies of integration. MUL to a great extent and HHML to some extent has been able to exploit economies of scale, but no joint venture in the automobile industry in India has been able to exploit economies of scope.

Supplier development: Effective supplier development brings down the total investment in the automobile manufacturing project and obviously reduces the risk. It also provides flexibility to introduce new models in minimum time. The effects of foreign exchange rate fluctuations can also be minimized to a great extent with local supplier development. Volume plays an important role in supplier development activity. MUL and HHML have done a reasonably good job as far as supplier development is concerned. KHML and recent entrants to the Indian automobile market suffer in the absence of volumes.

Indigenization: Government regulations should not be the guiding force behind the indigenization agenda of the firm. The indigenization process may be looked upon as a measure of technology absorption capability. Low volumes, poor capacity utilization, and

higher investment will always disprove economics of indigenization initially only, but efforts on the global marketing and quality fronts will restore the balance. MUL and HHML have tried this strategy initially and when the market grew with time the firms had no difficulty in stretching their production capacities. KHML could not take advantage of the situation and a slow indigenization process was seen as a major constraint.

Technology waste: Improved capability to adopt, adapt, and implement new technologies refines technology absorption skills and helps in building technology development potential. This also helps in improving research productivity and minimizes technology waste.

Equity participation by technology provider: this makes the commitment to commercial and technological success distinctly visible for technology providers in the joint venture. A clash of interest in the global market can be avoided by exercising management control effectively. The active transfer of technology calls for organizational changes at the macro level and work culture change at the micro level. All the three firms whose cases are presented in the article have undergone major organizational changes from time to time. The Japanese work culture has also been injected into these organizations which has helped the firms in developing an innovation culture.

Customers' technology awareness: Customers technology awareness improves with availability of technology and increase in competition. A strong marketing set-up not only helps communicate the products' technological features to customers but can also contribute to developing solutions for market niches which can subsequently grow into market segments.

34 Conclusions

The active transfer of technology in the Indian automobile industry has shown mixed experiences. Joint ventures which have come into existence as a result of technology transfer arrangements have had tough times initially, but recently, most of them are showing impressive financial results. An attempt to assess their technological health has revealed that they have a long way to go. Active transfer of technology has reduced the dependence on technology providers but only in a limited domain.

The brightest spot which came across during the course of study was enthusiasm shown by people working in these organizations to absorb the state-of-the-art technology and innovating these borrowed technologies. The absence of a technology strategy, technological mission and vision, and lack of faith and support from top management are slowing down the process of technology adoption in the Indian automobile industry at large. The emphasis has been on developing core products and does not seem to be on cultivating core competencies. A strategic shift in the attitude of Indian automobile giants is now called for if they have to emerge as global players in world's most competitive industry.

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