CHAPTER II

SURVEY OF LITERATURE AND RESEARCH

METHODOLOGY

This chapter consists of two sections. Section I relates to review of earlier studies and section II relates to the methodology of the present study.

Section I

Review of Earlier Studies

An attempt has been made to review the earlier studies in order to acquire knowledge particularly on automobile industry. This gives an idea to the researcher to form the analysis in such a manner that the person who does the research might not repeat what has been done in the past. Review of literature gives a clear picture of what has to be done and what has to be avoided in the future. The form and methods used by different persons divert the researcher to form a new way for the analysis. Thus, in this section, the researcher has studied the issues related to evolution, trend of growth, productivity, employment, problems and challenges faced by the automobile industry.
Studies on Automobile Industry

Rajaram Dasgupta\textsuperscript{1} attempted to estimate a fairly detailed projection of the demand for different categories of commercial vehicles. His study period was from 1983-84 to 1989-90. For estimating the combined demand projection for the commercial vehicles, the author first estimated the demand for trucks. The estimated demand for trucks was built up in three stages. First the total growth in road freight traffic was estimated. For projecting the freight traffic, the author had gathered the data for the years from 1960-61 to 1976-77 from the Report of the National Transport Policy Committee, Planning Commission. The author had estimated the freight traffic for future years (1977-78 to 1989-90) by using a semi-log function of time. The author had then converted these estimates into the number of trucks required on the basis of observed norms of traffic carried per truck. The change in the required number of trucks gives the additional demand for new trucks which, added to replacement demand, gives the total demand for new trucks. The estimated demand for new trucks was disaggregated into four different

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payload sizes. Of these light-duty commercial vehicles carried payloads of less than 3 tons, and medium-duty vehicles carried payloads of 3 to 7 tons, medium-heavy duty vehicles carried payloads of 7 to 9 tons and heavy duty vehicles carries payloads of more than 9 tons. In the similar way, the demand for new buses and special vehicles by different payload size classes individually estimated and finally the combined demand projection for the commercial vehicles was estimated. As per the author’s combined demand projection for commercial vehicles, it was just likely to cross one lakh units in 1984-85 of which about 72.5 thousand units would be accounted for by trucks, another 27 thousand units by buses and the small balance by special vehicles. By the end of the decade (1989-90) the volume of total demand was likely to cross 1.30 lakh units of which roughly 89 thousand units would be trucks, about 37 thousand buses and around 4 thousand special vehicles. As against the author’s projections, the projection for the Sixth Plan period and beyond indicated 1.3 lakh units by 1984-85 and 2.15 lakh units by 1989-90. The author thus, contended that the official demand forecasts were exaggerated because the assumptions about growth of traffic on which they are based are unrealistic. Finally, the author argued that the current policies of licensing a number of new units were likely to result in underutilization of
capacity and consequent loss of economies of scale. A preferable policy would be to increase capacity in the existing units would achieve greater efficiency in production and bring competition in the industry.

Aggarwal, R. N.\textsuperscript{2} tried to pinpoint the main causes of the sickness of the automobile industry in India. The author had used the data collected from Bombay Stock Exchange Directory of industries, Annual Reports and Profit and Loss Accounts of the Companies, Automotive Industry of India (Facts and Figures), and Government Reports. The author classified the causes of sickness under three heads namely (i) technology and cost structure (ii) government policies, and (iii) economic factors. Regarding the production technology, the author had pointed out that the production technology is highly capital intensive but not a high technology industry in the sense that components are fairly standardized and produced by a large number of sub-contractors. To produce good quality vehicles, the production technology required high quality of inputs, engineering and management skills along with heavy investments in machinery. With regard to cost structure, were the high proportion of bought out raw materials and services

and also the tax incidence on vehicles. Regarding the government policy, the industry had remained regulated and controlled in the sense that no manufacturer was allowed to enter or exit into the industry, no change in the model, and no foreign collaboration (technical and financial) was allowed without the government’s prior approval. Besides, the government policies, there had been many economic factors such as small size of the market and the absence of economies of scale in production, inefficient use of resources, competition with railways, absence of infrastructure credit facilities, foreign exchange, high maintenance cost and poor investment in research and development (R&D). Finally, the author concluded that the cost of vehicles could be reduced through cutting of taxes and excise duty rates; import substitution had not helped the consumers in terms of price and quality of vehicles and; price control and protection policy had lead to a significant fall in the quality of vehicles in terms of efficiency, pollution and safety standards.
Surjeet Singh and Irshad Ahmed Khan\textsuperscript{3} attempted to examine the trends in government policy and the market concentration in automobile industry in India. The author had covered a period from 1965 to 1985. The author had used a theoretical framework to trace the trends in government policy. The author had also used the data collected from Association of Indian Automobile Manufacturers (AIAM) and Automotive Component Manufacturer’s Association (ACMA) and the sales data collected from Herfindahl’s index. The author had pointed out that, there has been only one firm (Mahindra & Mahindra) occupying the entire jeep market. In case of cars, the concentration index has been fluctuating over the years. It has come down from 0.47 to 0.38 due to new entrant Maruti-Udyog Ltd. In case of LCVs segment, there was more or less an equal distribution of the market for the firms. The index had declined from 0.26 in 1972 to 0.19 in 1985. This was also mainly due to the entry of new firms with Japanese collaborations. In the field of M&HCVs segment, two large firms (TELCO and Ashok Leyland) dominated the market. In case of 2-wheeler segment, there exit a large foreign collaboration agreements. Scooter production had

a high degree of concentration because of the presence of only three major producers (Bajaj Auto Ltd., Maharashtra Scooters Ltd., and LML). A declined concentration had occurred since 1972 in the production of mopeds. As far as motorcycles segment is concerned, there had been a declined in concentration with the introduction of new brands in the market by the entry of many new firms with Japanese collaboration particularly with 100cc engine vehicles. Bajaj Auto had remained the leader though its share had come down from 62.3 per cent in 1972 to 60.7 per cent in 1985. Both MSL and LML followed with second and third position respectively in 1985. In 3-wheeler segment, the index had declined from 0.59 in 1965 to 0.57 in 1985. Finally, the author concluded that the automobile industry in India lacks behind mainly due to its inability to go beyond indigenization of imported technology and developing or upgrading it to keep it contemporary. To a large extent, the government policies are responsible.

Surjeet Singh and Irshad Ahmed Kahan⁴ attempted to examine the production and sales performance and also the productive efficiency of the

automobile industry in India. The author had used the data collected from the Automobile Manufacturers Association of India (AMAI) and Annual Survey of Industries (ASI). The period of study spans from 1965 to 1985. The author had pointed out that the Indian automobile industry had an uneventful progress till the eighties but had made substantial and rapid growth after 1980 as the liberalization and broad-banding policies proved to be strong stimulants. The total production of automobiles had grown at an annual compound rate of 12.98 per cent during the period 1965-85, but the maximum growth has occurred during 1980-85 (18.90 per cent) mainly due to liberalization. The period of 1975-80 observed a growth rate of 13.86 per cent. The production of total motor vehicles (grand total excluding tractors) grew annually at 12.92 per cent during 1965-85, with the highest growth during 1980-85 (20.3 per cent). The least growth has been observed during 1970-75 (7.72 per cent). This period witnessed a spurt in oil prices. With regard to total sales of automobiles, it increased from 256,470 in 1972 to 1,409,165 in 1985 showing a growth rate of 14.0 per cent. The maximum growth rate has occurred during 1980-85 (19.29 per cent). In case of factor intensities, the author has pointed out that since 1976-77 the capital intensity in the automobile industry as a whole and motor vehicles and parts had
continuously increased with motorcycles, scooters and parts segment witnessing a fluctuating trend over the period implying thereby that capital deepening had taken place. Similarly, the labour productivity in case of industry as a whole and motor vehicles and parts has an increasing trend with a decline in 1979-80. The motorcycle and scooter segment not only witnessed a fluctuating trend in labour productivity but it had been lower than the industry average except for 1978-79. Moreover, capital productivity in case of industry as a whole declined over the period. The motorcycles and scooters segment observed a declining and fluctuating trend in capital productivity all over the period. Finally, the author concluded that the performance of the Indian automobile industry in terms of production and sales had been reasonable. But the piece-meal government policies and tardy progress on the indigenisation front are not conducive for higher growth of the industry. Moreover, the inability to go beyond indigenisation of import technology and developing or upgrading it to keep it contemporary was not a health sign.
Bhaktavatsala Rao, C. attempted to explore the structural configuration and strategic investments in the Indian automobile industry. The author had developed a theoretical framework. The author had selected 13 four-wheeled manufactures and the period of study was from 1974-90. The author viewed the evolution of the Indian automobile industry in three qualitatively distinct periods namely (i) the period 1928-1955 dominated by virtual total kit import and assembly activity, (ii) the period 1955-1974 characterised by the emergence of indigenous automobile manufacture and industry’s maturity towards self-reliance, and (iii) the period 1974-90 marked by structural adjustments and forces of industrial liberalization and internal competition. The author identified the structural configuration in terms of product and manufacturing dimensions. The author also analysed the strategic investments on research and development, plant expansion and modernization, material and machine tool, import dependence and capital intensity through innovative indexing of data.

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Avinandan Mukherjee and Trilochan Sastry\textsuperscript{6} attempted to do a comparative analysis of the automobile industries among four industrializing countries namely South Korea, Brazil, China and India. The author had divided the article into four sections. The first section of the article deals with evolution of automobile industry in the four countries. The second section deals with government policies. The third section deals with extent of adoption of lean production. The last section deals with implications and conclusions. The South Korean automobile industry started production in the early 1960 and initially gained experience through CKD manufacture and started mass production with a single model - the Pony. Three large diversified South Korean companies emerged in the automobile market – Daewoo, Hyundai and Kia. These companies gained knowledge and experience through joint ventures with MNCs, although they never surrender management control. Later they developed their own models for the world market. Government policies clearly encouraged exports, and by 1993 they were exporting 38 per cent of their production. They gradually adopt lean production and acquire product design capabilities to try and become truly

\textsuperscript{6}Avinandan Mukherjee and Trilochan Sastry, (1996): “Automobile Industry in Emerging Economies: A Comparison of South Korea, Brazil, China and India”, \textit{Economic and Political Weekly}, November 30, pp M75-M78.
international. The Indian automobile industry was governed by regulations since the country became independent in 1947. Import collaborations and equality ventures were severely restricted by the government. Capacity expansion was restricted and required licenses issued by the government and technology transfer from foreign companies was subject to government approval. In 1981, the government decided to set up Maruti Udyog in collaboration with Suzuki Motor Company of Japan, the first MNC to enter the country. Maruti started mass production by introducing a “people’s” car in the economy segment. This led to a boom in demand for automobiles in India. Market liberalization in 1991 and a change in policy allowed free entry to foreign companies. MNCs have not chosen to enter in to their own instead they have entered into joint ventures with Indian partners. Unlike the South Korean industry which grew from CKD manufacture to a significant exporter of cars, Indian automobile industries developed through several large assemblers who entered the Indian market through joint ventures with local supplier firms. Unlike South Korea, managerial control is with international companies. The development of Brazilian industry initially started with the objective of import substitution during 1950s. However, unlike Indian government policy at that time, foreign companies were
allowed to enter with full management control, and Volkswagen, General Motors and Ford were major companies in Brazil for a long time. Much later, in 1990, the government opened up the market to imports. Current growth has been led by the "popular" car in the economy segment. The Brazilian industry has also not invested significantly in product development. Efforts are on to adopt lean manufacturing practices, although the supplier industry continues to a major bottleneck. Government policy on duties and taxes has been vacillating leading to cyclical demand over the years. The Chinese automobile industry had a different evolution. The industry has always been highly fragmented and in 1979 there were 130 assemblers who made 1,86,000 vehicles, with most of them making only hundreds of vehicles. By 1993 there was some consolidation into “combined management companies” and there were 40 assemblers producing about 5,00,000 vehicles. Further, unlike South Korea, Brazil and India, passenger car production has been a very small percentage of total production, and was 15 per cent in 1994. Autonomy provided to provincial governments led to disperse development by foreign collaborations. To obtain foreign capital and technology, they were forced to give managerial control to international partners. Of late the government pushed a “people’s” car in the economy
segment. This is similar to what happened in Brazil and India where the small car led industry growth. Unlike Brazil and Korea, there is no major thrust towards adopting lean production. With regard to government policies, the Indian government followed a taxation and protection policy even after independence. Since the economic liberalization launched in 1991, the government of India announced a new automobile policy in June 1993. Excise duties and import duties varied over the years. When compared with international standards, these duties continue to be high. The Brazilian government’s role has also undergone changes in the recent past. Previously, the focus of government policy was on import substitution. China’s progress from the command to the market economy and the autonomy given to provincial governments has helped in growth. The Chinese government now identifies the auto industry as one of China’s ‘development pillars’ and has been trying to attract foreign investment to improve technology. The role of the South Korean government has perhaps been the most positive among all the four countries. This is because the South Korean government has always supported as well as disciplined South Korean industry through export targets and incentive and through price control. With regard to lean production, it was not been adopted in a significant way except in Brazil.
Finally, the authors concluded that, South Korea, a relatively late entrant to the automobile industry has made the most significant progress. Government support, a clear vision of becoming an export oriented world class industry, retaining management control, investing in R & D, and acquiring product development capabilities have helped it to grow and develop fast. The other three countries have not invested in capability building to the same extent. The industry in Brazil is older than that in South Korea, but indigenous product development capabilities are lacking and manufacturing competitiveness is limited even though the industry is entirely controlled by MNCs. The Indian industry is experiencing a revolution with rapid growth and the entry of the largest number of MNCs. The Chinese industry is also growing very rapidly although it is still highly fragmented.

Narayanan, K⁷ attempted to analyses the effects of de-regulation policy on technology acquisition and competitiveness in the Indian automobile industry. The author had used data from the annual reports and balance-sheets of 12 selected automobile manufacturing companies for the

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period 1980-81 to 1989-90. The data relate to firms assembling or producing cars and other four wheeled vehicles namely light, medium and heavy commercial vehicles. The author had used the evolutionary theoretical framework in the analysis of inter-firm difference in competitiveness. His analysis revealed that de-regulation brings about technology paradigm and trajectory shifts through acquisition from abroad or through in-house technological efforts. New firms who depended on intra-firm transfer of technology and firms with in-house R & D efforts, to accomplish paradigm shifts, appear more successful. After de-regulation and specifically after the introduction of the broad-banding scheme, the number of vehicle producers increased substantially.

Hrushikesh Panda\textsuperscript{8} tried to examined the effect of the determinants of employment and the role of technology in bring about changes in the rate of growth of employment of the automobile firms during the regulated period (1960-79) and the liberalized period (1980-89). The author for his study had selected five firms from each of the three different segments of the

industry—namely, the car segment comprising the firms Hindustan Motors Ltd (HML) and Premier Automobiles Ltd (PAL), the light commercial vehicle (LCV) and utility vehicle (UV) segment comprising the firms Bajaj Tempo Ltd (BTL) and Mahindra & Mahindra Ltd (MML) and the medium and heavy commercial vehicle (M&HCV) segment comprising the firms Ashok Leyland Ltd (ALL) and Tata Engineering Locomotives Company Ltd (TELCO). The author had used the data collected from the Bombay Stock Exchange Directory, Index of Wholesale Prices in India, Annual Survey of Industries (ASI), Reserve Bank of India (RBI) bulletins, Annual Reports of Firms, Indian Automobile Manufactures (IAMA) and Tariff Commission Report, 1968. The author had derived demand function for labour by taking vertical integration adjusted output, wages per hour, rental price of capital and price of materials as ratios of product price, and the Divisia index of Total Factor Productivity (TFP) as the explanatory variables of employment. The author also estimated the Error Correction Mechanism (ECM) model to derive the short-run effects of different explanatory variables on employment and the degree of adjustment in each period to the long-run equilibrium level of employment. He used ‘0’ as the dummy variable for the period from 1960 to 1979 and ‘1’ as the dummy variable for the period from
1980 to 1989. The author had employed the kinked-exponential method to study growth rates of employment for three sub-periods: (i) Regulated Period 1 (RP1) from 1960 to 1968; (ii) Regulated Period 2 (RP2) from 1969 to 1979; and (iii) Liberalised Period (LP) from 1980 to 1989. The main findings of the study were: (i) four of the six firms experienced a decline in the rate of growth of employment after liberalization. Growth of productivity did not bring about changes in the level of employment of firms in any of the three segments of the industry: the car segment, the LCV segment and the MHCV segment. Thus, growth in productivity was neither labour saving nor labour augmenting. (ii) changes in employment were less than proportionate to growth of wage rate than to changes in vertical-integration adjusted output. (iii) there is no change in the growth rate of employment in the car producing segment after liberalization. On the other hand, there is a marginal decline in the growth rate of employment of the LCV producing firm, BTL and there is an increasing growth rate of employment in the MHCV producing firm, TELCO. (iv) the shift in technology after liberalization affected the degree of adjustment to long run equilibrium only in the MHCV segment.
Tapas Piplai\textsuperscript{9} attempted to examine the effects of liberalization on the Indian vehicle industry, particularly in the spheres of production, marketing, export, technology tie-up, product upgradation and profitability. The study period spans from 1995-96 to 1999-2000. The author had used the data collected from Automobile Components Manufacturers Association (ACMA), Centre for Statistical Organisation (CSO), Centre for Monitoring Indian Economy (CMIE) and various other journals. The data analysis indicates that, the production of the four and six-wheeler industry has never been steady during the study period. Expect 1995-96, 1996-97 and 1999-00, it registered minus 5 per cent and minus 6 per cent during 1997-98 and 1998-99 respectively. In case of three-wheeler, expect during the first three years, it registered only negative growth rate of minus 11 per cent and minus 2 per cent in the subsequent two years. In case of two-wheeler, except 1997-98 the industry showed a steady performance. On an average, during the study period, the production of four and six wheeler, three and two wheeler registered at the growth rate of 11 per cent, 9.8 and 11.5 per cent per annum respectively. The overall industry registered at the average growth rate of

11.3 per cent per annum. The author had made a comparison of the average compounded growth rate per annum between 1970s, 1980s and 1990s for each segment as well as for the whole industry. The data analysis reveals that the overall industry growth rate which increased at the rate of 13.9 per cent in 1980s and 11.5 per cent in 1970 had come down substantially after liberalisation to 8.7 per cent. The consumption market for vehicles had also not improved, rather it had continued with the same growth rate after liberalisation. The export of vehicles also had come down drastically on year to year basis almost for all categories. Analysis reveals that except 1995-96 and 1996-97, the entire vehicle industry in the subsequent three years, only showed a negative growth of minus 4 per cent, minus 17 per cent and minus 10 per cent respectively. The value addition which grew at the rate of 36.5 per cent during 1995-96 had come down to minus 5.6 per cent during 1998-99. Similarly the cost of raw materials which grew at the rate of 39 per cent had come down to 1.5 per cent during the same period. Similarly the cost of production had sharply fallen in 1998-99 by minus 9.8 per cent after registering an increase of 32.3 per cent in 1995-96. Selling cost however, grew during the entire period (1995-99) at 22 per cent. Thus the analysis of data clearly indicates that in the post-liberalisation period the rate at which
the vehicle market had been growing in 1970s and 1980s could not be sustained in 1990s and it came down substantially. The reasons are unstable growth of the economy coupled with fall in government investment expenditure in basic core sectors like agriculture, industry and infrastructure; worldwide recession; sudden increase in the production capacity of the Indian firms; entry of many foreign companies with huge installed capacity along with their improved technology which led to quality and price war pushing the investment expenditure and selling expenses to a further high level. This resulted in a fall in profitability of the industry. Finally, the author concluded that in general, except thrusting upon a high degree of unsustainable competition nothing remarkable is achieved in the post-liberalisation period.

Chithra Gopal R.S\textsuperscript{10} tried to traces the genesis of automobile industry, market trends in the global automobile production for the year 2004 and also the initiatives to spearhead less polluting technologies. The author had taken the US automobile industry and Ford Motor Company as classic examples to identify Porter’s Five Forces and to do SWOT analysis,

respectively. The author observed that the automobile industry had evolved continuously with changing times from craft production in 1890s to mass production in 1910s to lean production techniques in the 1970s. The prominent role played by the US till late 1990s had of late been cornered by the Japanese auto-makers. The global output from the automobile industry touched 64.6 million vehicles in 2004, thereby retaining its leadership in manufacturing activity, providing employment to one in seven people, either directly or indirectly. This supply mainly catered to meet the demand from households where the automobiles constituted the second largest expenditure item next only to housing. Thus the global automobile industry dominated by Europe, US, Japan, and of late by China and India, continued to have a significant influence on economic development, international trade, foreign direct investment and environment-friendly practices. By analyzing the response of auto-manufacturers to climate change, the author had observed that the automakers were in the forefront of popularizing environment-friendly initiatives. They were investing on engine modifications and related pollution-reducing technologies aimed at producing more fuel efficient vehicles. Hybrid vehicles and green vehicles running on alternative fuels are proving to be commercially viable options with customers queuing up for
these products, which offered significant savings on gasoline prices. Finally the author concluded that the industry had become highly competitive.

Seema Sharma\textsuperscript{11} attempted to examine the productivity performance of the Indian automobile industry. The author had covered the period from 1990-91 to 2003-04 and used the data taken from the Prowess database developed by Centre for Monitoring Indian Economy (CMIE), Mumbai. The author had employed the Growth Accounting Approach for measuring total factor productivity (TFP). The growth accounting approach is based on the development of indices of output and input. A nonparametric measure of TFP is computed from the ratio of these indices. The author had also employed Divisia-Tornquist approximation to obtain the estimates of TFP index for the study period. As the specific TFP values might fluctuate from year to year, the author considered TFP Growth (TFPG) is best in terms of productivity trends over a period of time. The author obtained TFPG as difference between the rates of growth of real product and real factor input. Apart from the combined estimates of the TFP, in order to evaluate the productivity of individual factors of production (capital, labour, raw material

and energy), the author had computed partial factor productivities. Based on the result of Divisia-Tornquist approximation in the form of an index on TFP, the author indicated that the Indian automobile industry could not experience productivity gain over the study period. The industry witnessed a downfall in the years 1993-94 to 1994-95 which implies that resources have not been utilized efficiently. The downswing in productivity levels was followed by a recovery in 1995-96, which gathered momentum till 1997-98, with a maximum level in 1997-98 and yet another downswing in 1998-99. This phenomenon continued till the end of the study period with negative TFP growth rates which indicates that the industry could not perform well on TFP account. This highlights the inefficient use of the resources in the industry, as the rate of growth of inputs has been higher than that of output. The results on partial factor productivity indices also corroborate the TFP deterioration. Finally, the author concluded that there is tremendous scope to reduce costs by utilizing the factors more efficiently.
Narayanan, K\textsuperscript{12} attempted to analyse the determinants of growth of firms in the Indian automobile industry during three different regimes, namely, licensing (1980-81 to 1984-85), deregulation (1985-86 to 1990-91) and liberalization (1991-92 to 1995-96). The author selected 11 automobile manufacturing firms and the period of study was from 1980-81 to 1995-96. The author had used the balance sheets and annual reports of the individual companies and publications of Automobile Components Manufacturers Association (ACMA) and Association of Indian Automobile Manufacturers (AIAM). The author had employed two-way fixed effect model of the growth function. The result of study reveals that growth rate of firms are, by and large determined by non-price factors like technology, firm size, vertical integration, capital intensity and the age of the firm.

Burange L.G. and Shruti Yamini\textsuperscript{13} tried to study the competitiveness of firms in Indian automobile industry. The author had developed a

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competitiveness index for a sample of 14 firms for the year 2005-06. The author had used PROWESS database of Centre for Monitoring Indian Economy (CMIE), Society of Indian Automobile Manufacturers (SIAM) and Automotive Component Manufacturers Association (ACMA). The author finally concluded that, there was relative competitive position among the sample firms and also the overall picture of the industry.

Mahipat Ranawat and Rajnish Tiwari\textsuperscript{14} tried to traces the evolution of the India automotive industry from its inception to present day and also study the influence of important policies on the development of the industry. The authors had identified that the evolution of India’s automotive industry have occurred in four phases. In the first (1947-1965) and second phase (1966-1979), the important policies were related to protection, indigenisation and regulation of the industry. On the one hand, these policies helped India to build an indigenous automotive industry, while on the other it led to unsatisfactory industry performance. In the third phase (1980-1990),

the single most important policy was the one with regard to relaxation in the means of technology acquisition. The foreign competition inducted into the industry transformed its dynamics. Lastly, in the fourth phase (1991 onwards) the liberalisation with regard to foreign investment had a significant influence on the Indian automotive industry as we see it today. As a result, the production of mere 4,000 vehicles in 1950 has crossed the historic landmark of 10 million vehicles in 2006. Today, the industry produces a wide range of automobiles and auto-components catering to both the domestic as well as foreign markets. Finally the authors concluded that with every major shift in policies made by the Indian government, the automotive industry has come out stronger and better.

Roopesh Kaushik\textsuperscript{15} attempted to examine the performance and prospects of the Indian automobile sector. His period of study was from 2001-02 to 2005-06. The author had used the data collected from Economic Survey, Society of Indian Automobile Manufactures (SIAM) and Centre for Monitoring Indian Economy (CMIE). The author had employed exponential

growth method, F-test and co-efficient of variation. His finding revealed that in some firms there exist higher variations in the production, sales and exports, while in other, there exist lower variations. The firms which have higher variation indicate a huge spurt in the demand of their vehicles.

Raj Kumar Gautam and Sabil Raj\textsuperscript{16} attempted to analysis the growth of Indian automobile sector in the era of globalization. The authors had covered the period from 2001-02 to 2006-07. They used the data collected from Society of Indian Automobile Manufacturers (SIAM). The major findings of their study are (i) the sector had shown a tremendous growth after liberalization. (ii) the globalization process had affected the sector in all the areas of manufacturing, sales, personnel research and development and financing. Globalization had helped to improve the financial position of the automobile sector in India. (iii) the automobile industry had a tremendous scope for growth in passenger cars and commercial vehicles. (iv) to meet the challenges posed by globalization, the Indian automobile manufacturers need to ensure the technological

advancement, appropriate marketing strategies and adequate customer care feedback system in their organizations.

**Research Gap Identified through Review of Earlier Studies**

While scanning through the available literature on the evaluation of automobile industries in India, it was observed that comprehensive and specific automobile related studies were limited, most of the available studies were isolated and did not covered the various dimensions of automobile evaluation, specifically the factors determining the demand for and supply of automobile vehicles. Hence the researcher tried to do an economic evaluation on automobile industries in India. The research on this aspects from time to time would provide useful information for planning market strategies and policy framing in automobile sector.
Section II

Methodology of the Study

The methodology adopted for the present study, “An Economic Analysis of Automobile Industry: A Case Study of India” is a statistical information of growth trend and the demand for and supply of passenger cars and its services by its dealers and authorized service centres. Research methodology refers to the method of conducting research systematically and scientifically. The features related to this chapter are as the following sections, the source of data, sample design, and the statistical tools used in the study.

Source of Data

The present study is based on both the primary and secondary data. Secondary data had been used to evaluate the growth rate of production and domestic sales of automobile industry in India. The main sources of the secondary data are: (i) private organizations namely Society of Indian Automobile Manufacturers (SIAM) and Automotive Compound Manufacturers Association (ACMA); and (ii) annual reports published by the Government of India, journals, newspapers, articles, various books and
websites. The first and second objectives of the present study are based on secondary data.

The **primary data** has been collected from the State of Tamil Nadu through personal interviews with passenger car users and administrative officers as interview schedule I and interview schedule II respectively in order to study the third objective of the study.

**Interview schedule I** covered the particulars of household, education level of the respondents, occupation of the respondents, income level of the respondents, reasons for preferring car and its services, and accessibility of services after sales.

**Interview schedule II** covered the location of car dealers, year of inception, number of marketing area coverage, target of car selling, amount of returns, administrative cost, number of the other branded cars serviced in a month, nature of service done in the service centers, and infrastructure facilities available in the dealer and service centres.

Before finalising the interview schedules, tentative schedules had been prepared for the purpose of pre-testing the credibility of the schedule,
for which a pre-test was conducted in the field itself by asking questions and getting the responses from some of the respondents. Based on the responses of the respondents some of the unnecessary questions were deleted and some necessary relevant questions were added in the respective schedules and finalised interview schedules had been used for collecting the primary data.

**Period of Study**

In the present study to discuss the second objective of the study secondary data were collected for a period of 40 year from 1970-71 to 2009-10. The period of study has been further sub-divided into four periods as Period I (1970-71 to 1979-80); Period II (1980-81 to 1989-90); Period III (1990-91 to 1999-2000); Period IV (2000-01 to 2009-10). Period I and II come under the category as ‘before liberalisation’ and Period III and IV come under the category as ‘after liberalisation’. As for as the primary data was concerned, the field survey was carried over in all the district headquarters of Tamil Nadu for the last 6 months from June to November 2010.
**Area of Study**

In order to study the second and third objective of the present study, the researcher has chosen India and Tamil Nadu as his study area to collect secondary and primary data respectively. India is one of the oldest civilizations in the world with a kaleidoscopic variety and rich cultural heritage. It has achieved all-round socio-economic progress during the last 62 years of its Independence. India has become self-sufficient in agricultural production and is now one of the top industrialized countries in the world and one of the few nations to have gone into outer space to conquer nature for the benefit of the people. It covers an area of 32,87,263 sq. km, extending from the snow-covered Himalayan heights to the tropical rain forests of the south. As the 7th largest country in the world, India stands apart from the rest of Asia, marked off as it is by mountains and the sea, which give the country a distinct geographical entity. Bounded by the Great Himalayas in the north, it stretches southwards and at the Tropic of Cancer, tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west. Lying entirely in the northern hemisphere, the mainland extends between latitudes 8° 4' and 37° 6' north, longitudes 68° 7' and 97° 25' east and measures about 3,214 km from north to south between
the extreme latitudes and about 2,933 km from east to west between the extreme longitudes. It has a land frontier of about 15,200 km. The total length of the coastline of the mainland, Lakshadweep Islands and Andaman & Nicobar Islands is 7,516.6 km.
FIGURE 2.1
STATE-WISE MAP OF INDIA
The State Tamil Nadu is situated at the South Eastern extremity of the Indian Peninsula bounded on the North by Karnataka and Andhra Pradesh on the East by Bay of Bengal, on the South by the Indian Ocean and on the West by Kerala State. It lies between 8 5' and 13 35' of northern latitude and 76 15' and 80 20' of eastern longitude with an area of 1,30,058 square kilometres. It is the 11th State in India in area forming 4.11 percent of the Union areas. Tamil Nadu has a total population of about 62,405,679 which includes 31,400,909 males and 31,004,770 females, as per 2001 census. It constitutes 6.05 per cent of the India’s population. It ranks 6th among the States / UTs. The density of population per square kilometer is 478 and the literacy rate is 73.47 per cent as per 2001 census. In 1991, there were only 21 districts in the State of Tamil Nadu. In 2001, eight new districts were created by reorganising the territorial jurisdiction. As on today, the State has comprised of 32 districts (Figure 2.1). The state capital, Madras was now renamed, as Chennai is the fourth largest city in the Indian Sub-continent and 30th largest city in the world.
FIGURE 2.2

DISTRICT-WISE MAP OF TAMIL NADU
Tamil Nadu is one of the well developed states in terms of industrial development. In the post-liberalisation era, Tamil Nadu has emerged as one of the front-runners by attracting a large number of investment proposals particularly in recent times. Today, Tamil Nadu is the third largest economy in India. With the setting up of major automobile projects namely Ford-Mahindra, Hyundai Motors, Hindustan Motors, Mitsubishi, Ashok Leyland and TAFE, Chennai, has emerged as the Detroit of South East Asia. Tamil Nadu has always been a fore-runner in the industrial process, both in terms of industrial output and in encouraging various new large scale products. Tamil Nadu has the second highest number of petrol pumps at 2,965. As on 1st October 2010, Tamil Nadu has 1.10 crore registered motor vehicles, which stood second among the states in the country with Maharashtra being first where about 1.25 crore vehicles were registered. Table 2.1 shows the district-wise distribution of major automobile manufacturing plants in Tamil Nadu.
TABLE 2.1

DISTRICT-WISE DISTRIBUTION OF MAJOR AUTO PLAYERS’ PLANTS IN TAMILNADU

<table>
<thead>
<tr>
<th>State</th>
<th>District</th>
<th>No. of automobile mfg. plants (SIAM members)</th>
<th>No. of auto-component mfg. plants (ACMA members)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamil Nadu</td>
<td>Kanchipuram</td>
<td>5</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Tiruvallur</td>
<td>3</td>
<td>35</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Krishnagiri</td>
<td>5</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Coimbatore</td>
<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Chennai</td>
<td>2</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15</td>
<td>122</td>
<td>137</td>
</tr>
</tbody>
</table>

Source: Self-construction based on authors’ own study of the location of manufacturing plants of major automobile and auto-component players in India.

India's automobile industry was growing fast, but it remains a 2-wheeler nation. More than 78 per cent of motor vehicles on the road were 2-wheeler, their popularity driven by low price, high fuel mileage, and an ability to maneuver deftly through India's dense traffic. For the last ten years, the 2-wheeler market has grown at a CARG of 11 per cent.

But even as the market grows, motorbikes face a pack of ultra-low-cost four wheel challengers: the "Sub A" segment auto mobile exemplified by Tata motors Ltd's., $2,500 Nano. The recently launched Nano bridge the gap between $1000 motor bikes and $5000 cars. This ventured the
researcher to take only Tamil Nadu as his study area with special reference to passenger car only.

**Sample Size**

As on 9th July 2009, Indian Oil Corporation (IOC) has the largest number of petrol pumps at 18,140 while Hindustan Petroleum Corporation (HPCL) has 8,539 re-fuelling stations and Bharath Petroleum Corporation (BPCL) has 8,389 petrol pumps in India. Of the 35,068 petrol pumps owned by the state-run firms, the maximum 4,262 are in Uttar Pradesh. Tamil Nadu has the second highest number of petrol pumps at 2,962. Due to time constraint, the researcher has covered only one fuel station from each district. In total, the researcher has covered 32 fuel stations and has also chosen 20 respondents at random from each fuel station/district, that is, the researcher has covered 32 districts with 640 respondents (Table 2.2).
TABLE 2.2
DISTRICT-WISE RESPONDENTS DISTRIBUTION IN TAMIL NADU

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the District</th>
<th>Location of the Fuel Station</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ariyalur</td>
<td>Ramu Agencies Ariyalur</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Chennai</td>
<td>Elpasso Enterprises D-125, 1st Main Road Anna Nagar, Chennai - 600 102</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Coimbatore</td>
<td>Ayyappan &amp; Venkateshwara Agencies Sf No. 763 &amp; 814 L&amp;T Bye Pass Road, Madukkarai Coimbatore 641 108</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Cuddalore</td>
<td>Rajan Service Station Chennai Trichy NH Cuddalore – 606304</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td>Dharmapuri</td>
<td>Express Service Station Truck Terminal, Zuzuwadi Sipcot (Po), Hosur – 635126</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Erode</td>
<td>Agathur Ambal Agencies Kangeyam Road, Erode - 638 108</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>Kanchipuram</td>
<td>A Angamuthu Mudaliar 19 GST Road, Acharapakkam Kancheepuram - 603 301</td>
<td>20</td>
</tr>
<tr>
<td>9.</td>
<td>Kanniyakumari</td>
<td>Ramesh Agencies State Highway 90 Near CSI Church, Kulasekharan Kanniyakumari -629 161</td>
<td>20</td>
</tr>
<tr>
<td>10.</td>
<td>Karur</td>
<td>Akc Service Station Coimbatore Road, Karur - 639002</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11.</td>
<td>Krishnagiri</td>
<td>Ram Agencies</td>
<td>NH 7, Hosur Road, Shoolagiri</td>
</tr>
<tr>
<td>12.</td>
<td>Madurai</td>
<td>Chellam Oil Agencies</td>
<td>No 1, West Veli Street Madurai - 625 001</td>
</tr>
<tr>
<td>13.</td>
<td>Nagapattinam</td>
<td>Ramesh Agencies</td>
<td>NH 76, Harimugundan Sivasakthi Nagar, Manjaakollai, Nagapattinam</td>
</tr>
<tr>
<td>14.</td>
<td>Namakkal</td>
<td>Andavar &amp; Company</td>
<td>Trichy Main Road Namakkal – 637002</td>
</tr>
<tr>
<td>15.</td>
<td>Perambalur</td>
<td>Ramini Agencies</td>
<td>State High 142, Perambalur</td>
</tr>
<tr>
<td>16.</td>
<td>Pudukkottai</td>
<td>Jeevan Agencies</td>
<td>9, Housing Colony Rajagopalapuram, Pudukkottai – 622001</td>
</tr>
<tr>
<td>17.</td>
<td>Ramanathapuram</td>
<td>Kumariah Kovil Agencies</td>
<td>Ramanathapuram-623 503</td>
</tr>
<tr>
<td>18.</td>
<td>Salem</td>
<td>Annai Sundharammal Agencies</td>
<td>Omalur Main Road Salem - 636 309</td>
</tr>
<tr>
<td>19.</td>
<td>Sivagangai</td>
<td>Amirtham Agencies</td>
<td>Thondi Road, Sivagangai – 630551</td>
</tr>
<tr>
<td>20.</td>
<td>Thanjavur</td>
<td>PLA Traders</td>
<td>2889 Srinivasa Pillai Road Thanjavur - 613 001</td>
</tr>
<tr>
<td>21.</td>
<td>Nilgiris</td>
<td>Abdul Rahim</td>
<td>Devarshola, Nilgiris</td>
</tr>
<tr>
<td>22.</td>
<td>Theni</td>
<td>Sri Renuga Agencies</td>
<td>620, Periyakulam Road Theni – 625 531</td>
</tr>
<tr>
<td>No.</td>
<td>City/Location</td>
<td>Address</td>
<td>Quantity</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>23</td>
<td>Thoothukkudi</td>
<td>Chitra Agency, 55, Gin Factory Road, Tuticorin – 628 002</td>
<td>20</td>
</tr>
<tr>
<td>24</td>
<td>Tiruchirapalli</td>
<td>Gopaldas Automobiles No. 10, NH 45, New Chennai Byepass Road Trichy 620 010</td>
<td>20</td>
</tr>
<tr>
<td>25</td>
<td>Tirunelveli</td>
<td>Ramani Agencies No 52, Aachimadam Krishnapuram, Tiruchendur Road, Maharaja Nagar Tirunelveli – 627011</td>
<td>20</td>
</tr>
<tr>
<td>26</td>
<td>Tiruppur</td>
<td>Sri Velmurugan Autos No. 231, K.Chettypalayam, Dharapuram Road, Tirupur – 641 608</td>
<td>20</td>
</tr>
<tr>
<td>27</td>
<td>Tiruvallur</td>
<td>Raj Agencies 6, Trunk Road, Poonamallee Tiruvallur - 600056</td>
<td>20</td>
</tr>
<tr>
<td>28</td>
<td>Tiruvannamalai</td>
<td>Sri Balasubramaniyan Agency 50-A 11 Thandarampet Road Tiruvannamalai – 606601</td>
<td>20</td>
</tr>
<tr>
<td>29</td>
<td>Thiruvarur</td>
<td>Sundar Agencies NH 67, Thiruvarur</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>Vellore</td>
<td>Kalaimagal Agency Arcot Road, Rangapuram Vellore – 632 009</td>
<td>20</td>
</tr>
<tr>
<td>31</td>
<td>Villupuram</td>
<td>Coco Gingee Tindivanam Road Gingee – 604 202</td>
<td>20</td>
</tr>
<tr>
<td>32</td>
<td>Virudhunagar</td>
<td>Aruna Agency Virudhunagar</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>640</strong></td>
</tr>
</tbody>
</table>
TOOLS OF ANALYSIS

To study the **first objective**, a descriptive method was used to obtain the genesis of automobiles.

**Computation of Growth Rate**

To study the **second objective**, the growth models were used.

Vaidyananthan in his ‘Growth Rates’ has given a detailed description of computation of various growth rates. Pushpangadan also in his ‘Growth Rate’ gave some measures to calculate the growth rate.

(i) The fundamental and simple form to find out the growth rate is linear specification, \( Y = a + bt \). In this, the annual growth rate is regressed against time. For a significant trend, the curve implies that there is growth if \( b > 0 \) and decay if \( b < 0 \). The growth rate is given by \( G_t = \frac{b}{y} \).

(ii) The semi-log or log linear equation of the form \( \log Y = a + bt \), it is obvious that the growth rate is \( G_t = b \) which gives a constant growth rate over the period \( b > 0 \).
(iii) For the log quadratic form \( \log Y = a + bt + ct^2 \), the growth rate is

\[
G_t = \frac{\sum_{t=1}^{n} (b + 2ct)}{n} \quad t = 1, 2 \ldots n
\]

For the significant \( c \) and \( b \), if \( b > 0 \) and \( c > 0 \) the growth rate is increasing at an increasing rate, that is, accelerating. If \( b < 0 \) and \( c > 0 \) the growth rate is increasing from a negative value rate provided \( t > \frac{-b}{2c} \). If \( b > 0 \) and \( c < 0 \), the growth curve \( Y \) is decreasing as long as \( t > \frac{-b}{2c} \) since \\
\[
\frac{dG_t}{dt} \quad \text{is negative.}
\]

Various functions discussed above are useful when the change in the growth rate is expected to be gradual. On the other hand, if there is supposed to be a sharp break in the period with different growth rates before and after, the log quadratic form \( \log Y = a + bt + ct^2 \) and the log linear function \( \log Y = a + bt \) may be fitted separately for the two sub periods. This was another reason to choose this function. Since this study was to analyses the growth rate of automobile industry for four sub-periods i.e., 1970-1971 to 1979-

To study the **third objective** percentage and averages were used with graphical presentation.

**(a) Percentages and Averages**

The present study has widely made use of the percentages and the averages in the analysis of the growth trend of production, domestic sales and export of various categories of automobile in India.

**(b) Graphical Presentation**

The graphical presentations such as bar graph, line graph and pie-charts were made use in this study.

**(c) Garrett Ranking Technique**

For studying the services provided by various departments like purchasing marketing, financing, research and development to the
customers, by making use of primary data, Garrett ranking Technique was used. The ranking given by the 640 respondents (customer) is converted into present position using the following formula,

\[
\text{Percent Position} = \frac{100 \times (R - 0.5)}{N}
\]

where,

\( R \) = Rank given for the department by the individual

\( N \) = Number of individual ranked.

The percent position of each rank thus obtained is converted into score by referring the table given by Henry E. Garrett and R.S.Woodwort. The score of all respondents was then added to gather and divided by the number of respondents experiencing that particular department. The mean scores of each thus arrived at, were ranged in descending order and corresponding ranks allotted.
Co-efficient of Correlation

To test the first hypothesis of the study, co-efficient correlation was used.

The term correlation indicates the relationship between two variables in which changes in the value of one variable, the value of other variable also change. When an increase in the value of one variable is associated with an increase in the value of other variable correlation is said to be positive. On the other hand, with a decrease in the value of one variable the other variable increase, correlation is said to be negative. The value of coefficient of correlation lies between +1 and -1. If the value of coefficient of correlation is +1, correlation is said to be positive; if it is -1, correlation is said to be negative and if it is 0, there exist no correlation between any two variables.

\[
\text{Correlation Co-efficient } (r) = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{n \sigma_x \sigma_y}
\]
where,

\[ r = \text{co-efficient of correlation} \]
\[ n = \text{number of pair of observation.} \]
\[ \sigma_x \ & \ \sigma_y = \text{standard deviation of variable } x \text{ and } y \]
\[ \bar{X} \ & \ \bar{Y} = \text{mean of variable } x \text{ and } y. \]

**Chi-Square Test \((\chi^2)\)**

To test the second hypothesis of the study chi-square test was used.

The \( \chi^2 \) test (pronounced as chi-square test) is one of the simplest and most widely used non-parametric test in statistical work. The \( \chi^2 \) test was first used by Karl Pearson in the year 1900. The quantity \( \chi^2 \) describes the magnitude of the discrepancy between theory and observation. It is defined as:

\[
\chi^2 = \frac{(O - E)^2}{E}
\]

where, \( O \) refers to the observed frequency and \( E \) refers to the expected frequency.