CHAPTER - III

INDUSTRIAL DIVERSIFICATION FOR THE INDIAN NON-ELECTRICAL MACHINERY AND ELECTRICAL MACHINERY MANUFACTURING INDUSTRIES DURING 1973-74 TO 1988-89
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Industrial Diversification for the Indian Non-Electrical Machinery and Electrical Machinery Manufacturing Industries During 1973-74 To 1988-89

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CHAPTER III

INDUSTRIAL DIVERSIFICATION IN THE INDIAN NON-ELECTRICAL AND ELECTRICAL MACHINERY MANUFACTURING INDUSTRIES: AN EMPIRICAL ESTIMATION DURING 1973-74 TO 1988-89

3.1. INTRODUCTION

In the process of economic development of a nation certain unique patterns are found characterising different stages. The development of any economy involves a structural shift away from agriculture to manufacturing and tertiary sectors. In particular the manufacturing sector plays a vital role in the process of such a shift and functions as an accelerator of the overall development of the economy. Industrialisation paves the way for diversifying the economic activity through a wide range of commodity manufacturing activities. It also creates the condition for the growth of modern service sector industries such as the banking and insurance and a well developed network of transport and communication system in a national economy.

If, we study industrial growth of the countries during the period of industrial revolution and the subsequent era, we observe a definite and discernible pattern. In the first stage of industrial growth, it is the consumer goods industries such as the food and food processing, wood, leather and textiles which are predominant. Hence, it is but natural that consumer goods industries set the pace of industrialisation in the initial stages of industrial growth. Only when certain basic wants are met, a country can divert its investible resources for developing other industries. Another important reason why the consumer goods industries tend to develop in the first phase of industrialisation is the presence of favourable initial factor endowment conditions in the national economy. The factors include the limited extent of
domestic savings for capital formation, primitive mode of production, semi skilled labour and the limited entrepreneurial resources.

In the second stage, capital goods industries gain importance and develop. However, in terms of their share in industrial output and the rate of growth, they tend to lag behind the consumer goods industries. Why is it that capital goods industries tend to replace the consumer goods industries in the second stage of industrialisation? The answer lies in the fact that a country cannot make rapid strides in the industrial front, if, it continuous to concentrate merely on the production of consumer goods. The production of consumption goods of better quality on a massive scale and at cheaper prices organically calls for the specialisation of various production processes, embodiment of better technology in the arts of manufacture and finer division of labour. This creates the conditions necessary for the production process to assume highly round-about methods in the value adding process. In other words, the production system becomes highly capital intensive calling for the growth of capital goods industries.

Thus, the history of economic development reveals a fundamental difference between the early primitive methods of production in which labour and raw materials are the important factors of production and the second stage in which more and more intermediate or capital goods manufacturing enterprises emerge in the industrial system. Thus, the capital and capital goods industries grow at much faster rates than the consumer goods industries and tend to dominate the industrial structure. This in turn defines a close parallel in the structural change that characterises the pattern of economic development and the pattern of industrial development.
The economic growth in many countries of the world has been considerably accelerated by the increasing use of capital goods and improved techniques of production. In each country, one would observe considerable differences in the pattern of growth of the primary, secondary and tertiary sectors and the growth rates of specific industries within these sub-sectors. Nevertheless, economic development is characterised by a process in which the primary sectors develop first and then the secondary and tertiary sectors. Similarly, irrespective of the variations in factor endowments, locational, social, political and cultural traits and the state of technology, the growth of the manufacturing sector in an economy follows a more or less certain unique patterns which bears similarity across nations. Diversification of industrial activity thus becomes the hallmark of economic development. As observed earlier, the capital goods industries such as the metallurgical, automobile, engineering and chemicals develop at faster rates than the traditional industries. Consequently, the industrialisation process enables the system to achieve sustained increase in the share of net output of the diversified capital goods industries in the total industrial production and also of the net national income of a nation.

3.2. MEANING OF DIVERSIFICATION

Diversification, as we see in reality, is a common practice in the manufacturing and other types of business operations. The traditional assumption of a single homogeneous product being produced by firms has lost empirical validity in the present day operational conditions because the firms face compulsions to produce a verity of products to cater to the sophisticated demand conditions in the markets. Sometimes, firms are found producing quite different or unrelated products under one roof for the same reason.

Diversification of industrial activity enables the system to achieve self sufficiency in the process of economic growth. The process of diversification of the
The industrial base has been by and large guided in the West, by the strength of the free market forces. The competitive market conditions have forced the firms to secure optimal allocation of the investible resources to achieve economies of scale. This process in the long run has resulted in the development of diverse industrial activities with a strong science and technology base embodied in the hard core of the value adding process.

Careful economic planning, also has proved its success as an alternative mechanism for achieving diversified industrial growth. The erstwhile Soviet Union, has demonstrated to the world that through deliberate economic planning, by adopting a strategy of imbalanced industrial structure at the beginning, can, over a period of time succeed in establishing much strong and diversified industrial activity. Like Soviet Union, India too through a process of planning, has strived to achieve diversified industrial manufacturing system. This, to a large extent has strengthened India's industrial base over the years. Further, it was instrumental in achieving self-reliance and self-sufficiency in a number of vital manufacturing sectors of the economy.

Growth of monopolistic tendencies in the industrial system has been a common phenomenon in most of the free market economies. The presence of monopoly elements in the industrial manufactures act as constraints in maximising the net welfare of the general public. The governments have tried to curb this tendency through several economic policies and regulations and have setup antimonopoly bodies and enacted anti-monopoly legislations. In India also, the Monopolies and Restrictive Trade Practices (MRTP) Act in 1969[1] sought to control such development of monopoly institutions in the industrial scenario.
3.3. TYPES OF DIVERSIFICATION

In the following section we present a brief discussion about various types of industrial diversification and the motives for diversification. Motives for diversification depend on its types. The types of diversification as observed in practice and motives for them are as follows:

3.3.1. LATERAL DIVERSIFICATION

When a firm produces different goods from a given stock of plant and machinery to meet the market demand, then the firm is said to practice lateral diversification. For example a leather tanning firm can be described to practice lateral diversification when it starts making shoes, leather garments, suitcases etc., because all such production activities originate using the tanned leather as the primary input.

3.3.2. CONGLOMERATE DIVERSIFICATION

In this type of diversification the products need not originate from the same product or source or converge at the same process or market as is the situation in the case of lateral diversification. The marketing of the new products will not have the same characteristic as that of the original product. The new product, will be quite unrelated in terms of its value adding process and the demand it will satisfy in the market. Conglomerate diversification helps a firm in augmenting market power by stabilising its earnings through cross-subsidisation, i.e. by making up the loss incurred in one product from the gains made from the other. This process, may lead to the emergence of entry barriers to new firms into the market. It, also will provide more options to undertake risk for the sake of maximising profits. It, thus becomes possible for the firm engaged in the conglomerate diversification to sustain stability in the
process of growth, better utilisation of resources and achieve profitable scale of operation.

3.3.3. VERTICAL DIVERSIFICATION

We can also call vertical diversification as vertical integration. It involves diversification in the process of manufacturing or distribution which precedes or succeeds those in which the firm has already been engaged. We can classify this diversification into two categories, viz. backward integration and forward integration.

Backward integration is seen where a firm starts manufacturing products previously purchased from others in order to use them in making its original product. For example a chocolate manufacturing firm may have its own cock plantation farm.

The second category is called as 'forward integration'. It occurs when the firm moves nearer to the final market for its product and carries out a function which was previously under-taken by its customers. For example flour mill may start making its own bakery products.

3.3.4. DIAGONAL DIVERSIFICATION

If, a firm produces auxiliary goods and services required for the several main process or lines of production, then, the firm is said to practice diagonal diversification. For example a firm may have its own power house to generate electricity or a machine tool making unit required to meet every processing activity. The main motive for the diagonal diversification or integration will be more or less the same as the lateral and vertical diversification. Viz., (i) mopping up of excess capacity and (ii) reduction of risks.
Motives for diversification depend on its type. The motives of all types of diversification can be summarised below:

- Profitability or earnings maximisation of the firms motivate them to operate at full utilisation of resources and the plant capacities available at their disposal.

- Stability motive enables firms to reduce risks and uncertainties by ensuring adequate supply of resources for the manufacturing activity and the markets with assured supply of the products produced.

- Growth motive of the firms are centered around the expansion of productive capacities. The firms which do not achieve a satisfactory rate of earnings, will embark on growth acceleration process. In order to attract fresh capital from the stock market, the firms tend to produce a wide range of industrial products. If the firms have diversified industrial activities, it is easy for them to attract the capital from the stock market to meet the financial resources required to match the diversification. If, adequate rate of growth cannot be met by operating within the existing sphere of a firm's activities then the only option available for the firms will be to diversify the output towards meeting the fast growing market demand.

- Market power motive of the firms are directed towards increasing the barriers for the entry of new firms by suitably developing diversification strategies and consolidating their market share.

In general, a new industry will have higher degree of diagonal and vertical integration. But an old industry for obvious reasons will be compelled to adopt lateral diversification. This is because, in the case of a new industry, auxiliary services may not be available, which will force the firms to make their own provisions within the organisation. For an old industry like the textiles the demand for such services will be large enough and so, independent units may come into existence for their supplies in an efficient way.
3.4 THEORIES OF DIVERSIFICATION

What a consumer is to the theory of demand, a firm is to the theory of price and production functions. Jovan[2], almost 100 years after Adam Smith, has developed a theory of demand which in its embryo contained the seeds of the present utility centered neo-classical theory. Towards giving his approach a general theoretical content, he has refined the concepts relating to costs of production associated with the factors used up in the production process viz., value adding. He and his follower Edgeworth[3] have developed an elaborate discussion aimed at establishing the conditions under which price of the products produced and the average cost incurred in producing the product could be matched by to operate under optimum output level. In this approach, they visualised that the firms in a competitive market, in the long-run can only earn normal profit. Later Clark[4] and Knight[5] have carried further the analysis and refined the perfectly competitive market model so as to examine the cost-price-output relationship. This approach has become the standard in the present day economic literature.

However, around the 1930's the theory of firms started taking a significantly different approach. The assumption of perfect competition was found to be inappropriate to describe the true behaviour of the firms in the real market conditions. Sraffa's[6] description of the laws of returns under competitive conditions was perhaps the vital turning point in the theory of pricing and value determination. Thereafter, Joan's[7] theory of Imperfect Competition and Chamberlin's[8] analysis of Monopolistic Competition came into existence as theoretical structures in providing satisfactory empirical models to capture the behaviour of firms. Of the two, Chamberlin's theory has opened an altogether new avenue for analysing the behavioural objectives of firms and industries in a market. Duopoly, Oligopoly, Product Diversification, Advertisement or Selling Costs, Research and Development, Pricing Policy etc., became important elements in developing a comprehensive
approach in the study of firms. More realism i.e. empiricism was fused into the traditional theory of the firm.

Besides price, non-price competition also emerged as a new premise in evaluating the aims, objectives and behaviour of firms and industry in the market. Generally, the firm is taken as the production unit that arrives at price, output and profit decisions considering the market condition in which it functions. In the process, the firm is said to produce outputs at the least cost of production. When we speak of the firm, we mean an abstract income producing unit having specific characteristics common to firms operating in an industry.

Conventional price theory predicts that industries in which output is produced by a few dominant firms, in the long-run, may earn higher rates of return on the investment when the opportunity cost of the capital is minimised, so that the normal or competitive rate of return is maximised. The emphasis on the long-run recognises that the actual profit rates to differ from the normal in the short-run, independent of the number of sellers. The changes in demand may raise or lower the profits until the reallocation of resources pushes the industry towards long-run equilibrium[9].

The word 'may' indicates that seller concentration is a necessary, but not a sufficient condition. For instance, if, in an industry few sellers fail to cooperate with others, as regards the price and output decisions, as a consequence the profits may turn out to be normal. Alternatively, if entry of new firms into the industry is relatively easy in an oligopolistic market, then set price in the market may be close to the level of competitive price and may discourage potential entrants. Because of such a price situation in the long-run the profits may tend to equal the normal equilibrium level of a competitive market. A price policy so designed is called limit pricing. The 'limit' here refers to that price at which entry of new firms would be discouraged while price above the limit may attract the new entrants in the market[10].
Bain[11] has examined in detail the possibility of entry barriers of firms by classifying the entry levels as very high, substantial, and moderate-to-low, on the profit rates of the leading firms in a sample of oligopolistic industries for the periods 1936-1940 and 1947-1951. He expected that the limit price and the monopoly price would probably coincide if there exists very high barriers for the entry of new firms. In an oligopoly market characterised by substantial or moderate levels of entry barriers, he felt it would be profitable for the leading firms to set an entry-forestalling price below the monopoly level, i.e., a price which will be very near to competitive price if in the market entry barriers tend to decrease. Therefore, profit rates he argued will decline as the barriers to entry decreases. He further found that the seller concentration alone was not an adequate indicator of the probable incidence of extremes of excess profits and monopolistic output restriction. Hence, the concurrent influence of the entry conditions should clearly be taken into account in order to understand the 'limit price'.

Concentration is an important aspect of the market structure. We can also call it as sellers concentration. It plays a highly significant role in determining the structure, conduct and the behavioural characteristics of the firms in a market. The term market concentration, has been used to refer to a situation prevalent in the market when an industry or market is controlled by a small number of leading or dominant producers or firms. They may exclusively or at least very largely tend to define the characteristic of the industry. Normally, in this context two variables become quite relevant in understanding the concept of seller concentration. They include, i) the number of firms in the industry, and ii) the relative size of the firms. In a way, these aspects are implicitly taken into account as a standard material in the traditional theory of market and value.
However, in the context of the modern theory of firms, the implications of market concentration have more wider connotations vis-à-vis the standard traditional approach to the theory of price/value. Hence, the modern approach considers Structure, Conduct and Performance of firms in an industry more elaborately by examining empirically the hidden elements and their causal influence on market concentration. Thus, in the process of evaluating the behaviour of markets and firms, modern approach differs from the traditional ones. Moreover, besides profit maximisation/cost minimisation for any given level of output of the firms, many new indicators or variables becomes a necessity in appraising the role of firms in a market situation. These include profitability, price-cost margin, growth, technological progress, market share of output, rates of capacity utilisation, etc. Thus, the approach to evaluate the behaviour of firms had to be more comprehensive and logical in nature. Further, such an approach also throws significant insight for the State while making decisions aimed at regulating the role of firms in a market. Such regulations, sets the stage for the firms and the industries to form part of the aggregate production system of the national economy.

Concentration of firms thus are important and integral element of a market in which competition tends to be imperfect, giving scope for a few firms to augment significant portion of industry's market. To understand the mechanism by which market concentration determines the economic behaviour of few firms vis-à-vis that of others in the industry, we are compelled to use newer theoretical models and approaches in meaningfully understanding oligopolistic and monopolistic market models.

As like market concentration we can also examine industrial concentration and diversification. Amey[12] defined, diversification as "the spreading of firms operations in a business over dissimilar economic activities". The term diversification can be explained in both micro and macro perspectives. In a micro sense,
diversification refers to the shift in the production from a single product base to a
verity of products (multiple products) by a single firm or an industry. This is often
referred to as product diversification. Penrose[13] observed that a firm is said to
diversify, whenever, without entirely abandoning its old lines of product, it embarks
upon the production of new products, including intermediate products, which are
sufficiently different from the other products it produces to imply some significant
difference in the firm's production and distribution programmes.

3.5. MEASUREMENT OF INDUSTRIAL DIVERSIFICATION

The estimation of industrial diversification at a micro level assumes
importance because it has a direct implication on the antitrust policies formulated by
the State. The empirical measurement of market concentration should reflect two
structural dimensions viz., the number of firms and the inequalities in the market
share between the firms. For example:

\[ I = \sum_{i=1}^{n} w_i p_i \]

Where,

- \( I \) = measures the index of diversification
- \( p_i \) = refers to the share of ith product or firm in the market/industry
- \( w_i \) = weight attached
- \( i = 1, \ldots, n \), the number of firms in the industry

Some of the indices used for measuring the extent of diversification are discussed
below:

3.5.1. COUNTING OF NUMBER OF INDUSTRIES IN WHICH THE FIRM OPERATES

This method is the simplest and the crudest way of measuring diversification.
In this method we just count the number of industries in which the firm operates.
Even though, this method is very simple and empirically more useful, economists have pointed out certain demerits, viz. it gives undue weight to many activities which account for only a small proportion of the firms' total business. The method is rarely used in actual practice. Nevertheless, it gives a feel for the extent of diversification by the firms.

3.5.2. GORTS INDEX

This method measures diversification as the ratio of firm's sales within the firm's primary industry to the firm's total sales. A high ratio reflects less diversification and vice versa. This is in fact 'one-product concentration ratio' used to measure product diversification by the firm which is based on similar logic as used for market concentration ratios. A better approach would be to take the ratio of non-primary product sales to the firm's total sales. This gives the variations in the range of diversification between 0 and 1. The higher the index value the higher will be the degree of diversification. One of the limitation of this index is that it fails to give any idea about the number of industries in which the firm operates. The value may be same when the firm operates in one non-primary industry or 100 non-primary industries[14].

3.5.3. BERRY'S INDEX

Berry[14] proposed and applied the Herfindahl index of concentration to measure product diversification by a firm symbolically the index is expressed as:

$$D_H = 1 - \sum_{i=1}^{n} (P_i)^2$$

Where,

- $D_H = $ the degree of diversification and
- $P_i = $ the ratio of the firms' output (or sales) in the 'i'th industry to the firms total output (or sales) in 'n' industries.
For a single product firm this index will have zero value. It increases when the diversification level increases. Both, number of industries (i.e., products) and their shares are taken into account by this index. For a situation of equal diversification in ‘n’ industries this index will equal to \((1-1/n)\). It approaches to unity when 'n' is very large or approaches infinity.

3.5.4. THE ENTROPY INDEX

The Entropy index\[16\] is used for measuring concentration as a straightforward application in measuring diversification symbolically,

\[
D_E = \sum_{i=1}^{n} P_i \log \frac{1}{P_i} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots [1]
\]

Where,

\(P_i\) = the ratio of the firms' sales (or any other size variable) in the ‘i’th industry
to the firms' total sales in ‘n’ industries.

The Entropy index \(D_E\) takes zero value when a firm is active only in one industry, and \(\log_n\) when it is equally active in each of the 'n' industries.

The Entropy index is a useful one, in the sense that it can be decomposed into components showing inter-industry and intra-industry diversification. Let us say that a firm is active in ‘n’ four-digit industries which can be aggregated into ‘s’ two-digit sectors. The Entropy coefficient \(D_E\) in disaggregate form for such arrangement of groups can be written as:

\[
D_E = \sum_{s=1}^{S} P_s \log \frac{1}{P_s} + \sum_{s=1}^{S} P_s D_s \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots [2]
\]
Where,

\[ D_s = \sum_{1 \in S} \frac{P_i}{P_s} \log \frac{P_s}{P_i} \quad [3] \]

The first term in this expression is inter-sectoral diversification, the second term is intra-sectoral diversification, viz. a weighted average of diversification within the sectors, the weight \( P_s \) being the share of each sector in the total sales.

3.5.5. UTTON'S MEASURE

Utton's[17] index is based on the cumulative diversification curve for the firm. This curve is obtained by plotting the cumulative employment share of the firm in different industries against rank order of the industry in decreasing importance starting with the primary industry in which the firm operates. This can be explained in the following figure.
If $P_i$ be the proportion of the firm's employment in the $i$'th industry and $n$ the number of industries in which the firm operates, then the area under the diversification curve ‘OO’ can be computed using the expression developed by Utton as,

$$V = \frac{1}{2} + n - \sum_{i=1}^{n} P_i$$

The above expression is not a satisfactory measure of diversification as it varies directly with the number of industries ignoring their relative importance. Utton, therefore, suggests double of the area above the diversification curve as a satisfactory index for diversification. We can simplify the expression as follows:

$$W = 2Y = 2 \sum_{i=1}^{n} P_i - 1$$

Where,

$Y$ = the area above the diversification curve

Utton's index takes the value 1 when the firm is completely specialised i.e., the firm operates in one industry only and the value 'n' when the firm has its activities equally spread among 'n' industries. Thus, the index can be interpreted as a number equivalent. If $W=4$, this implies that the firm is diversified to the extent equivalent to one operating equally in four industries. In place of employment, one may use sales or assets or any other economic variable indicating its size of operation to measure the index of diversification.

It is very difficult to say, of the different measures of diversification, which one is the most appropriate measure. However, looking at the empirical studies, the index suggested by Berry is found being widely used. Utton's index is potentially useful but being a new one it has not yet been popular in empirical research. The Entropy index has gained equal popularity as that of Berry's index because it has its unique advantage of being decomposed to take care of intra and inter-sectoral diversification of the firm.
In the present study, we have used Herfindhal index (which is just the same as Berry's index) to measure the extent of industrial diversification. Accordingly, the Herfindhal index can be expressed symbolically,

\[ \text{Herfindhal Index (H)} = \sum_{i=1}^{n} (pi)^2 \]

where,

- \( pi = qi/Q \)
- \( qi = \text{output of 'i'th industry} \)
- \( Q = \text{is total output of all the industries} \)
- \( n = \text{is the total number of industries} \)

The Herfindhal index value ranges from 0 to 1. The implication is, if Herfindhal index takes value 1, no diversification and when it is equal to 0, then completely diversified or of uniform growth.

For the purpose of appreciating finer variations in the magnitude of the Herfindhal index from 0 to 1, we have classified them into four classes indicating the following implications:

- **If the actual index value were to be low from the period's mean**
  - 5 to 10 per cent or more = Significantly High Degree of Diversification
  - Up to 5 per cent = Moderately High Degree of Diversification

- **If the actual index value were to be high from the period's mean**
  - 5 to 10 per cent or more = Significantly Low Degree of Diversification
  - Up to 5 per cent = Moderately Low Degree of Diversification
3.6. A REVIEW OF SELECT STUDIES

Economic theory and the existing empirical research studies provide only limited insight into the effects of industrial diversification on the overall performance of the economic system. This is partially due to the fact that most of the empirical studies on diversification have been specifically aimed at estimating the extent of, or the motives for diversification, limiting the scope at a firm or industry specific level. In order to devise development strategies and to lay foundation for economic institutions to gear towards achieving faster and sustainable rates of growth, managing the effects of industrial conglomerates, mergers, and takeover of firms controlling and regulating the behaviour of industrial manufactures has assumed importance.

The phenomenon of diversification has traditionally been associated with a firm and therefore the earlier studies were concerned with the effects of product diversification using the firm level data. However, from this micro level studies it became evident that product diversification that happens at a firm level also has important implications on the overall industrial structure of the economy and will influence the pace and pattern of the development process.

Rhodes[18] in his study has examined the phenomenon of diversification using an industry structure and performance framework. Results of his analysis provided tentative evidence for the relationship prevailing between diversification and industry's price-cost margin. In general, diversification, he concluded has to be viewed as a process of structural adjustment in a competitive market economy. But, his study has not reflected diversification being hindered by the entry barriers for the firms into an industry. However, empirical evidence has supported the theoretical proposition that barriers to entry might be a more general phenomenon that could be
useful in specific cases of firms entering the market. The study has provided an useful alternative for analysing industry structure vis-à-vis the traditional theory of firms.

Mac Donald[19] has examined the patterns of diversification in the U.S manufacturing industries for the period between 1963 and 1977. From the results, he observed that diversification as a phenomenon was not a random factor. Entry of firms are likely to be rapid in a growing industry, especially while the industries relate their primary activities through supply relationships or due to marketing similarities. Research and Development (R&D) expenditure was taken as a major factor in analysing the observed patterns of diversification. The R&D intensive industries generate outbound diversification and eventually lead to attracting inbound diversification. However, firms device their diversification strategies based on their R&D intensity in a given industrial structure. Much of the diversification that has taken place was found reflecting the transfer of sharable organisation, capital and other related activities.

Stephen[20] made an attempt to measure industrial concentration, by using an alternative approach in order to examine the use of existing concentration indices. He suggested 'the U index' as an alternative approach for the measurement of concentration. He argued that this index was less ambiguous while examining the relationship prevailing across the number of firms and their size inequalities as compared to other indices. Moreover, he pointed out that the 'U' index embodied more flexibility in the weights attached to the constituent firms for measuring concentration. This flexibility has provided the 'U' index to be acceptable as a more generalised approach vis-à-vis the well-known Herfindhal index.

Goudie and Meeks[21] have examined the diversification of firms in U.K under conditions when merger possibilities was present for quoted/listed companies during 1949 -1973. The companies engaged principally in the distribution activities
of the manufactured products and certain other industrial services. The study found that, when the firms adopt merger strategies with other firms, it also leads to the diversification of industrial activities in a competitive market environment. In the study they have classified the firms into 22 industry groups. They defined diversified merger to refer to a situation in which merger takes place, between firms classified at different industry groups. The study also found, that during the reference period, about 33 per cent of the mergers having taken place based on the market value of the firms wealth and nearly 39 per cent of mergers being based on the number of firms operating in an industry while diversification has taken place. The result also has pointed out certain specific time pattern in the process of diversified merger in the case of U.K.

Weiss[22] found a positive relation between changes in the concentration of firms and changes in the plant size of firms. The plant size was defined by him to refer to the economies in the scale of operation. The changes in the measure of plant economies, according to him was due to changes in concentration levels. However, scale was traced to be exogenous and hence will have no effect on the level of concentration. The conclusions of the study have to be carefully understood, since, his alternative approach suffers due to specification bias in defining and measuring the change in concentration levels. The operational condition of the industries with small degree of concentration was found to be similar in nature. Therefore, the estimated levels of concentration and the association of residuals due to the definitional variation employed have to be carefully interfaced so as to understand the results of the study.

Muller and Hamm[23] in their study have analysed trends in industrial concentration during 1947 to 1970. Product differentiation was found to be correlated with rising levels of concentration. However, a high level of initial concentration was observed with falling levels of concentration. They have used
Weiss's [24] specification for evaluation of the factors causing firm level concentration. The results have shown that the initial level of concentration being significantly negative. The negative result implied that a high degree of concentration cannot substantially increase the level of concentration in industries because of the higher levels of concentration already prevalent in the market.

Frederick et al. [25] have attempted a study on "Concentration, Price and Critical Concentration Ratios". Estimation of a critical concentration ratio, was found to be potentially of great importance since it outlined specific behavioural pattern of the firms in terms of anti-trust policies pursued by the government. If, the critical concentration ratio was found to be high and if, the concentration levels had no effect, then it would signify that the level below it would be suggestive of a horizontal merger in the markets to exist. Where concentration was below the critical level and when the merger could not increase the levels of concentration to the critical level, then significant impact can be expected of the critical level of concentration. The most important conclusion of this study was that a single critical concentration ratio for all manufacturing is likely to be incorrect to assess the specific cases of concentration. The ability to collude depends upon many variables in addition to concentration. These variables are certain to differ, from industry to industry. The results suggest that reliable estimates of critical concentration ratios or of critical number of leading firms are unlikely to drop, because the other variables are likely to affect the ability to collude. In general, the study has yielded a clear critical concentration ratio close to those found by previous ones.

Clarke and Devies [26] have analysed aggregate concentration, market concentration and diversification. They examined the extent to which changes in the aggregate concentration in the economy can be attributed to changes in firm level diversification in the U.K for the period 1963-68 and 1971-77. They have employed Hirshchman-Herfindhal indices of concentration and diversification. The analysis has
pointed out that only 10 per cent level of the aggregate concentration having prevailed during the period 1963-68. The other 90 per cent of the increase was found attributable to increase in market concentration, implying that increasing diversification was not a major factor at work, during the study period. A more limited analysis between 1963-68 and 1971-77 has shown a six per cent fall in the diversification. This exactly has matched the six per cent fall in the aggregate level of concentration. This study reveals that a few spectacular mergers could be seriously misleading as an indicator of the over all trends in diversification.

Kirupashankar[27] has examined the characteristics of diversification in Indian industry for the period 1975-76 to 1980-81. He had analysed product diversification in 1694 companies belonging to corporate private sector enterprises. The magnitude of diversification in these companies was found to be low in 1975-76. Nevertheless, the small proportion of diversified companies contributed a major share in the sales of all companies. As for the trends characterising the level and the magnitude and the spread and depth of diversification, the study has found an increasing tendency but only marginally or at the most, moderately during 1975-76 to 1980-81. Companies were found diversifying the activities only related to their main activity.

Frederic[28] in his study on "An International Comparison of Concentration Ratios" has observed that the research on industrial monopoly using comparative data for several countries, being focused primarily on relative concentration levels in certain specified industries. He supplemented, the analysis by investigating the international data about the overall concentration as well as concentration for individual industries. He has found the total market size being highly correlated with concentration levels. This he has pointed, was due to the fact that the establishment size and the degree by which the industries were characterised by multi-establishment enterprises were highly correlated with the GNP.
Gupta[29] made a study of the factors affecting the concentration in Indian industries. He, in this context investigated the monopoly power of the manufacturing industries in India. For this purpose his analysis used the data relating to concentration variable for a fairly long period of time. He found a substantial proportion of monopoly power in various industries being crucially dependent upon the economies of large scale production. He observed the largest firms in various industries have significantly increased their monopoly power through multi-product operations by capitalising the special advantages uniquely accruing to them.

Wright[30] in his study examined the role of product differentiation, scale economies and initial concentration in determining changes in market concentration over time. He found, the product differentiation and the initial level of concentration to be quite significant empirical variables to study the behaviour of firms and their conduct. The proposition that product differentiation affect the changes in relative concentration levels, was found to be primarily due to the prevention of erosion in the market shares of the larger firms in such industries in which the market concentration already exist.

Beng[31] made an attempt to test the hypothesis that an association exists between market concentration and industry profitability in the context of Malaysian manufacturing sector. Market concentration was measured as the ratio of output of the ‘n’ establishments in the industry's aggregate output. The sample of the study consisted of twenty two four digit level manufacturing industries. (As per the Malaysian Industrial Classification Codes).

From the forgoing review of the empirical studies in the area industrial concentration and diversification it is evident that a positive relationship has been empirically established between market concentration and the profitability of the firm
or industry. An important debate surfaced on the question of the underlying causal mechanism for this relationship to manifest in the market. The traditional structure, contact and performance hypothesis suggests that these results provide the explanation that the typical setting of the market to be less favorable to the interest of the consumers in markets where concentration exists as a result of collusion or other forms of non-competitive avenues available for the firms in the specific industries to compete with rival firms.

Another significant point that is evident from the existing empirical studies is that, most of the studies have focused the issues relating to concentration and diversification having reference to specific industries and the constituent firms. However, the question of concentration and diversification also needs to be examined at the level of manufacturing industries classified at three and four digit industrial disaggregation in order to get deeper insights as to the extent by which comparative change in the industrial structure has taken place during a given period of time. This aspect of enquiry assumes empirical significance because, the pace and pattern of the industrialisation process in the developing nations brings forth dynamic restructuring in the relative significance of the industries at three and four digit disaggregation that constitute or define internal structure of industries at two/three digit level classification. This can be termed as trends in industrial diversification/concentration at a macro structure of the industrial systems of a nation. The hallmark of reaching industrial maturity has been empirically well established in that the relative significance of industries involving higher technological base, capital and expanding market will emerge more prominently than the others. It is towards this purpose the present analysis is undertaken in the study to examine the nature and extent of industrial diversification in the Indian Non-Electrical(35) and Electrical Machinery (36) manufactures at three digit disaggregation during 1973-74 to 1988-89.
3.7. RESULTS AND DISCUSSIONS

In the following section, we present an analysis of diversification indices estimated using data at three digit level industrial classification pertaining to the Number of factory establishments, Gross fixed capital, Number of employees and Gross value added for the Indian Non-Electrical(35) and Electrical Machinery(36) manufacturing industries for the period 1973-74 to 1988-89.

To estimate the index of diversification we have used Herfindhal Index of concentration. Though, Herfindhal Index is typically used in empirical studies to calculate the extent of industrial concentration. We, in the present study have made an attempt to interpret this index in order to infer the extent of industrial diversification. In Herfindhal Index the ratio of concentration will range between the extreme values of 0 and 1, respectively measuring absolute lack of concentration and the prevalence of total concentration. This logic from the point of view of diversification is treated in the present analysis to represent total diversification and absolute lack of diversification respectively, when the estimated Herfindhal Index values assume 0 and 1.

For the purpose of appreciating finer variations in the estimated indices and to infer about the nature and extent of diversification, we have defined the mean value to capture the general characteristic of the period in reference. Further, inorder to understand the specific years in which the actual index has implied a different characteristic feature other than the period's mean, we have adopted the following procedure in the present study. The actual index, if, were to be low in value from the mean, below five and from five to ten per cent or more, then the extent of diversification is implied to represent moderately high and significantly high levels respectively. Similarly, if the actual index has tended to be high in value from the period's mean magnitude below five and from five to ten per cent or more, then we
have interpreted the extent of diversification to denote moderately low and signifi-
cantly low levels respectively with reference to the period's general characteristic.

3.7.1. NUMBER OF FACTORY ESTABLISHMENTS

The estimated indices of concentration or alternatively diversification in respect of the number of factory establishments of the Non-Electrical Machinery (35) manufacturing industries in India at three digit level disaggregation are presented in table 3.1 for the period 1973-74 to 1988-89. The trends are portrayed graphically in figure 3.1. It can be inferred from the table that the industries engaged in the manufacture of Non-Electrical Machinery(35) products in India for the period as a whole, with a mean value at around 0.1316, bordering close to a value around zero has empirically implied a fairly high degree of diversification characterising the structural dispersal of factory establishments. The dispersal range of the indices from the mean value has implied moderately low level of diversification, with the index values being greater than up to five per cent limit from the mean of the period in the following years viz., 1973-74, 1975-76, 1976-77, 1978-79, 1979-80, 1980-81, 1981-82 and 1983-84. With the actual index value being less between five to ten per cent or more in magnitude from the mean, we observe the years 1974-75, 1982-83, and 1984-85 to 1988-89 characterising moderately high degree of structural diversi-
fication as regards the number of factory establishments in the Non-Electrical Machinery(35) manufacturing industries in India. From the foregoing analysis we find industrial diversification being hindered during crisis years of the 70's.

The estimated diversification index of the number of factory establishments in the Electrical Machinery(36) manufacturing industries of India at three digit level disaggregation are presented in table 3.2 for the period 1973-74 to 1988-89. The annual trends of the same are portrayed in figure 3.1.
We can observe from the table that the Herfindhal index of the Indian factory establishments engaged in the manufacture of the Electrical Machinery(36) products for the reference period as a whole, has assumed a mean value at around 0.2155. This value though not very much close to zero magnitude, it is not quite high (say about 0.5 and above). Hence, we may consider relatively better degree of structural diversification having taken place as regards the number of factory establishments engaged in the Electrical Machinery(36) manufacturing in India. The dispersal of the estimated yearly magnitude of the Herfindhal index has implied significantly low levels of diversification, with the index values greater up to five per cent level above the mean magnitude during the years 1973-74 and 1974-75. Moderately low degree of diversification is implied by the estimated Herfindhal index as we observe the magnitude tending to assume magnitudes in the range of about five to ten per cent or more above the mean value of the period in the years viz., 1975-76, 1977-78 and 1978-79. Further during the years 1976-77 and, 1979-80 to 1984-85 the estimated Herfindhal index by assuming magnitudes below five per cent from the period's mean value was indicative of a moderately high degree of structural diversification in regard to number of factory establishments in the Electrical Machinery(36) manufacturing industries at three digit disaggregation in India. Significantly high degree of diversification is implied by the estimated Herfindhal index, since, the values have assumed less than five to ten percent or more from the mean the magnitude during 1985-86 to 1988-89.

3.7.2. GROSS FIXED CAPITAL

The calculated Herfindhal indices in terms of the Gross fixed capital stocks of the Indian Non-Electrical Machinery(35) industries at three digit level disaggregation are presented in table 3.3. and the trends are graphically portrayed in figure 3.2.
FIGURE 3.1

DIVERSIFICATION OF FACTORY

FIGURE 3.2

DIVERSIFICATION OF GROSS FIXED CAPITAL
From the table it is evident that during the study period the Herfindhal index in regard to gross fixed capital employed by the Indian Non-Electrical Machinery(35) industries has assumed the mean value around 0.1356. Since this mean value is closer to zero, it empirically indicates a fair degree of structural diversification characterising the deployment of the gross fixed capital across the three digit industries belonging to the Non-Electrical Machinery(35) industries. Moderately low level of structural diversification in the deployment of gross fixed capital became evident from the estimated index as the values were greater by around five to ten per cent or more than the period's mean during the years viz., 1975-76, 1981-82 and 1983-84 to 1988-89. The estimated value of the Herfindhal indices by assuming values less by about five to ten per cent and more from the period's mean value has implied moderately high degree of diversification characterising the stock of gross fixed capital among the ten three digit industrial categories in the Non-Electrical Machinery(35) during the years viz., 1973-74, 1974-75, 1976-77 to 1980-81 and 1982-83.

The diversification Index estimated for the gross fixed capital employed by the constituent three digit industries of the Indian the Electrical Machinery(36) manufacturers are presented in table 3.4 and the yearly trends of the same has been portrayed in figure 3.2 for better visual comprehension.

It can be seen from the table that the diversification index of gross fixed capital for the Electrical Machinery(36) industry at three digit disaggregation has defined a mean value for the period around 0.2557. This magnitude implies a relatively better structural dispersal in India through not very close to zero. The estimates of Herfindhal index was found assuming magnitudes upto five per cent greater than the mean of the period during 1982-83 and thereby implied moderately a low degree of diversification prevalent in this year. Fairly high level of industrial diversification was observed characterising the gross fixed capital deployed by the
constituent three digit industries of the Electrical Machinery(36) with the Herfindhal index assuming a value less than up to five per cent of the mean during the year 1981-82. With the Herfindhal index values ranging between five to ten per cent and more than the mean value was found characterising fairly a low degree of diversification in the following years viz., 1973-74 to 1980-81. The period 1983-84 to 1988-89 had witnessed significantly high degree of diversification in gross fixed capital employed among the three digit industries, since the Herfindhal index values were observed to assume values less between five to ten per cent and more vis-à-vis the period's mean magnitude.

3.7.3. NUMBER OF EMPLOYEES

The estimated indices of diversification with regard to the number of persons employed in the Indian Non-Electrical Machinery(35) industries at three digit level disaggregation are presented in table 3.5 for the period 1973-74 to 1988-89. The trends are portrayed graphically in figure 3.3 in order to gain better visual comprehension.

For the reference period as a whole the estimated Herfindhal Index by yielding a mean value at around 0.1249 was indicative of fairly a better degree of structural diversification characterising the dispersal of number of employees across the three digit industries engaged in the manufacture of Non-Electrical Machinery(35) products. An analysis of the yearly magnitudes of the Herfindhal index for the study period has revealed the following years being associated with magnitudes up to around five per cent greater than the mean magnitude. The years include 1973-74 to 1977-78, 1983-84 and 1985-86 to 1988-89. Hence, we infer these years being associated with moderately low degree of employment diversification in the Non-Electrical Machinery (35) industry. In contrast, our estimates were found assuming lower magnitudes upto around five per cent from the mean index value in
the years 1978-79 to 1982-83 and 1984-85. Hence, we consider these years being characterised by moderately high degree of diversification in employment emerging as the characteristic feature the Non-Electrical Machinery(35) industry at three digit disaggregation.

Table 3.6 presents the estimated magnitudes of Herfindhal index for the Electrical Machinery(36) manufacturing industries in India at three digit level disaggregation in regard to number of persons employed for the period 1973-74 to 1988-89. Figure 3.3 portrays the yearly trends in Herfindhal index graphically.

From the estimates of the Herfindhal index, it becomes clear that the period in reference as a whole was characterised by a relatively moderate degree of employment diversification in the Electrical Machinery(36) manufacturing industries at three digit disaggregation since the estimated mean took a value around 0.2334. Significantly low degree of diversification in employment became evident between 1973-74 and 1976-77, because the Herfindhal index associated with these years have assumed magnitudes greater in the range of five to ten per cent and more from the mean value. Moderately low degree was observed to be the feature of employment diversification across the constituent three digit industries during 1977-78 to 1982-83. During these years the Herfindhal index took values upto five per cent above the mean. The actual values of the Herfindhal index being less than upto five per cent from the mean, we observe the years viz., 1984-85 and 1987-88 being characterised with a moderately high degree of employment diversification in the Electrical Machinery(36) manufacturers in India. Significantly high degree of employment diversification across the three digit industries of the Electrical Machinery(36) (Actual Herfindhal Index being around five to ten per cent or more in value than the mean) became apparent during the years 1983-84, 1985-86, 1986-87 and 1988-89.
3.7.4. GROSS VALUE ADDED

The estimated degree of structural diversification characterising the gross value added by the industrial manufactures producing Non-Electrical Machinery(35) products in India at three digit disaggregation during 1973-74 to 1988-89 are presented in table 3.7. The trends are graphically portrayed in the figure 3.4.

For the reference period of the study, the estimated value of Herfindhal index in regard to gross value added has yielded a mean value at around 0.1340. This magnitude reveals a fairly better degree of diversification in terms of gross value added across industries at three digit level disaggregation in the Non-Electrical Machinery(35) category. An analysis of the Herfindhal index during the study period in reference characterises the following years being associated with moderately low degree of diversification in terms of gross value added as the magnitudes were greater than up to around five per cent from the mean value. These years include 1973-74, 1977-78, 1984-85, 1985-86, 1986-87, and 1988-89. The actual value of the Herfindhal index being less in value, up to around five per cent from the mean during 1974-75 to 1976-77, 1978-79 to 1983-84 and 1987-88 has implied the years being characterised by moderately high degree of dispersal in the gross value added across the constituent three digit industries in the Non-Electrical Machinery(35) manufacturers in India.

The estimated Herfindhal index of diversification in terms of the gross value added by the Electrical Machinery(36) industries in India at three digit disaggregation are presented in table 3.8. for the period of 1973-74 to 1988-89. The graphical illustration in figure 3.4. presents the yearly trends for visual comprehension.

From table 3.8. it can be seen that the mean of the Herfindhal index for the period has assumed a magnitude around 0.2675. Being about 25 per cent greater
HERFINDHAL INDEX OF INDUSTRIAL DIVERSIFICATION: INDIAN NON-ELECTRICAL AND ELECTRICAL MACHINERY MANUFACTURING INDUSTRIES DURING 1973-74 TO 1988-89

FIGURE 3.3

FIGURE 3.4
than zero magnitude, this average value tends to indicate only a moderate degree of
diversification characterising gross value added across the three digit industries in the
Indian Electrical Machinery(36) manufacturers. During 1973-74, 1975-76, 1976-77,
1977-78 and 1984-85 the actual Herfindhal index with values greater in the range
of five to ten per cent and more, from the mean magnitude has implied a significantly
low level of diversification characterising in the gross value added. Moderately low
degree of diversification was observed in the years viz., 1974-75 and 1978-79 to
1980-81, as the calculated Herfindhal index took values upto around five per cent
above the mean value. Significant diversification was found characterising the gross
value added by the industries at three digit disaggregation in the Electrical
Machinery(36) during the years 1981-82 and 1982-83 since the Herfindhal index of
these two years assumed values upto five per cent, less than the mean magnitude.
Significantly high degree of diversification was observed in the gross value added as
the characteristic feature of the years 1983-84 and, 1985-86 to 1988-89 as the
calculated Herfindhal index associated with these years has assumed values less in
the range of about five to ten per cent and more, from the mean of the period as
regards the gross value added by three digit industrial manufactures belonging to the
Electrical Machinery(36) in India.

It is evident from the above analysis that in all the chosen variables to study
the extent of diversification viz., the number of factory units, gross fixed capital, total
number of employees and gross value added, the 16 year period in reference is
marked by a fair degree of structural spread among the three digit manufacturing
industries in the Indian Non-Electrical Machinery Manufacturing (35) enterprises.
The aggregate mean value of the Herfindhal index, is found hovering around 0.1249
to 0.1356 respectively with regard to the number of employees and the gross fixed
capital. A further analysis of the individual year's Herfindhal index from the
aggregate mean was confirming either the diversification was mostly centered just
less than around 5.0 per cent above or below, respectively implying the structural
diversity to be i) moderately low or ii) moderately high during the reference period of the study. If, we look at the two decades involved in the present investigation, the estimates of Herfindhal index has empirically confirmed the 80's being characterised by a comparatively even structural spread in the variables than the 70's.

It is interesting to note from the above discussions that the industries engaged in the Electrical Machinery(36) in terms of all the four variables used in the present study viz., number of factories, gross fixed capital, total number of employees and gross value added, the extent of diversification has implied only a moderate level of structural spread compared to the Electrical Machinery(36) manufacturing industries during the reference period. The aggregate mean value of the Herfindhal Index, is found assuming a range between 0.2155 and 0.2675 respectively in the number of factory establishments and the gross value added. The analysis of the individual year's Herfindhal Index from the aggregate mean, we observe being mostly centered around the extreme ends of diversification viz., i) significantly high or ii) significantly low degree of diversification during the reference period. We also find that the industries engaged in the Electrical Machinery(36) manufacturing experiencing a high degree of diversification in terms of all the four variables in our analysis, mostly during the 80's rather than 70's in our analysis.

The liberal economic regime, with fairly stable GNP growth that was witnessed in India during the 80's, than the 70's which was afflicted with early oil price hike induced inflation, mid 70's economic crisis, offers the background conditions that has favoured more stable and uniform structural spread in the Non-Electrical Machinery (35) and the Electrical Machinery(36) manufacturing industries during 1973-74 to 1988-89.
NOTES AND REFERENCES


### TABLE 3.1


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**Herfindhal Index (HI)**

| HI | 0.1365 | 0.1304 | 0.1336 | 0.1356 | 0.1317 | 0.1325 | 0.1327 | 0.1324 | 0.1317 | 0.1311 | 0.1341 | 0.1313 | 0.1287 | 0.1300 | 0.1268 | 0.1269 |

**Summary Statistics**

- **Mean (MEAN)**: 0.131620
- **Standard Deviation (SD)**: 2.10595
- **Coefficient of Variation (CV)**: 15.9999
- **5% of the Mean**: 0.013162
- **10% of the Mean**: 0.000658

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
### TABLE 3.2

**Herfindhal Index of Industrial Diversification: Number Of Factory Establishments in the Indian Electrical Machinery(36) Manufacturing Industry During 1973-74 to 1988-89**

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**Mean** = 0.124929  
**SD** = 1.998864  
**CV** = 16

5% OF THE MEAN = 0.0107755  
10% OF THE MEAN = 0.021551

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
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**HI**

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| CV = 16 |

5% OF THE MEAN = 0.0067797

10% OF THE MEAN = 0.135595

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
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**MEAN** = 0.255710875  
**SD** = 0.0127855  
**CV** = 16

5% OF THE MEAN = 0.0127855  
10% OF THE MEAN = 0.025571

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
### Herfindhal Index of Industrial Diversification: Number Of Employees in the Indian Non-Electrical Machinery(35) Manufacturing Industry During 1973-74 to 1988-89

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- **MEAN** = 0.124929
- **SD** = 1.998864
- **CV** = 16

- **5% OF THE MEAN** = 0.006246
- **10% OF THE MEAN** = 0.012492

*Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.*
### TABLE 3.6

Herfindhal Index of Industrial Diversification: Number Of Employees in the Indian Electrical Machinery(36) Manufacturing Industry During 1973-74 to 1988-89

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**MEAN = 0.2334255**  
**SD = 3.734808**  
**CV = 16**  

| 5% OF THE MEAN = 0.0116712 | 10% OF THE MEAN = 0.0233425 |

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
### TABLE 3.7

Herfindhal Index of Industrial Diversification: Gross Value Added In the Indian Non-Electrical Machinery(35) Manufacturing Industry During 1973-74 to 1988-89

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**MEAN = 0.133947**  
**SD = 2.143143**  
**CV = 16**

5% OF THE MEAN = 0.0066973  
10% OF THE MEAN = 0.0133947

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.
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- **MEAN** = 0.267454125
- **SD** = 0.279266
- **CV** = 16

5% OF THE MEAN = 0.0133727
10% OF THE MEAN = 0.0267454

Source: Computed from ASI Factory Sector, Summary Results, Various Reports, C.S.O., Government of India, New Delhi.