There is an increasing realization of the manifold ways in which electronics technology could enhance productivity and efficiency in the process of production and exchange in an economy. The unprecedented break-through in microelectronics technology in the recent years has led to the emergence of a series of "new products" and "new processes" characterized by miniaturization, cost-effectiveness, reliability, and versatility. Also, the convergence of electronics, computing and telecommunications, often referred to as the "second industrial revolution", has been causing fundamental changes in the organizational structure of industrial activities. These technological developments with their structural impacts in relation to changes in product-types, market-organization and factor use, have transformed electronics industry a "major growth pole" in the industrially advanced economies. Given the imperativeness of electronics industry in the structural change associated with the growth dynamics of the modern economy, most of the developing countries have also been attempting to develop an electronics base through different strategies and with varying levels of success (Kapilinski 1987)

In this world wide trend India is not left behind. Attempts have been made since seventies towards developing a broad-based and technologically dynamic electronics industry. Initially, the Indian electronics strategy, in tune with the then general
industrial strategy, aimed at an import-substituting, self-reliant and public sector-led growth under the umbrella of government protection and regulations. Towards the close of the seventies, and in particular, during the early eighties, there has been a shift towards a more open and market-oriented strategy with a view to make the electronics industry competitive in structure and vibrant in growth. As a sequel to these institutional changes, some far reaching changes are taking place in the internal structure of electronics industry. That is to say, an ongoing process of restructuring in terms of sustained changes in the structure of demand, product, market, technology etc. is taking place within the electronics sector itself. The present study is an attempt to capture the nature of such a structural change, which for brevity is called here as "market induced" structural change, and its implications on different facets of output growth in Indian electronics industry.

Instructively, the change in the electronics strategy has taken place in tune with the general shift in the Indian industrial strategy wherein the macro planning process is considerably diluted, if not totally reversed, and increasing emphasis is placed on market forces in resource allocation for industrial investment during the eighties. The analysis of structural changes in the electronics industry can, therefore, be taken as a case study to illustrate the impact of the market-induced industrial restructuring that is currently undergoing in the Indian economy.

Obviously, the research questions in the study have been
identified in the light of an overview of the literature on structural change and growth. The development of an economy is characterized by changes in its structure. The replacement of the old structure with the new one is often referred to as restructuring. In the literature the question of structural change has been empirically dealt with by Fisher (1935), Clark (1940), Taylor (1969), Kuznets (1971, 1972), Chenery et al (1975, 1979, 1986, 1989) and others. In general, they viewed structural change as an integral part of the dynamic process of economic growth in any modern economy. By dividing an economy broadly into primary, secondary and tertiary sectors Fisher (1930) and Clark (1940) hypothesized that as economic growth takes place the shares of secondary and tertiary sectors in the national income and employment would increase and that of primary sector would decline.

While Fisher-Clark thesis was concerned with the three different sectors of an economy at an aggregate level, some others focussed on the changes within the secondary sector. The patterns of movement in the sub-sectoral shares are diverse with the manufacturing giving momentum to the secondary sector. That is to say, along with changes in the composition of national product there occurs shifts in the income devoted to investment, in the composition of different types of industrial goods (product structure), in the relative importance of plants and firms (size structure and market structure) etc. These changes are attributed to such economic factors as structure of demand, technological improvements and input-output relations with a host of non-economic factors.
The notion of intra-sectoral changes (changes in the relative shares of different types of industries) associated with the emergence of new products, new processes and new market was implicit in the Schumpeterian analysis of innovation. (Schumpeter 1961) While Schumpeter's approach towards the process of innovation has been subjected to detailed analysis, the dynamics of structural change implied in his analysis was hardly inquired into. In this context, it may be noted that the dynamics of structural change implied in Schumpeter's analysis was taken to further theoretical articulation by Passinetti (1981).

Passinetti has attempted a model of structural change taking into account, on the one hand, technical change in line with Schumpeter's analysis, and changes in consumer demand with change in income on the other. His thesis is based on two theoretical premises; the first one relates to the long run relationship between consumption and income. Drawing from Engels (1857), Passinetti assumes that demand for consumer goods over time is primarily a function of real income of consumers rather than the price of goods and hence, he attributes a logistic shape to the demand curve in the long run. The second one relates to the impact of technical change. He holds the view that the net effect of technical change is to increase productivity over time, and that it also leads to the addition of new products and processes into the economy. Nevertheless, there are intersectoral variations in such changes which Passinetti explains in terms of differential profit rates and demand conditions.
In his presentation Passinetti conceptualizes each sector as a vertically integrated one, wherein inputs required for the production of a final good are produced within that sector. In this framework, the usual interdependence of an input-output system is transformed into input requirements of a series of self-contained sectors. With the dynamics of technological change, new commodities appear into this system and are demanded in a series of spurts and then are gradually pushed aside by newer ones. The development of new products and process resulting from technical change and the accompanying dynamics of differential profit rates result in the restructuring of the economy. Passinetti's construct, as Bagchi (1987 p 8) states, "is best seen as a composite model of the advanced capitalist economy, where there is hierarchy of natural rates of profit as between the different sectors in response to perceived rates of profit and where dynamic equilibrium conditions are continually disturbed by unanticipated technical change, demand shifts and unemployment caused by both macro economic demand failures and unanticipated problems of disproportionality as between different sectors".

On the whole, it is evident from the brief review of the relevant literature that the process of structural change is inherently associated with the growth dynamics of a modern economy. The structural change can be conceived of taking place at various levels: in terms of changes in the primary, secondary and tertiary sectors; in terms of sub-sectors within the secondary sector; and in terms of changes within a given industry. These changes, in the main, relate to changes in the
relative shares of different product groups in the aggregate output and thereby the inter-sectoral linkages, and also changes in the size-distribution of firms and hence, the market-structure. In other words, the process of a structural change i.e., restructuring, has two major dimensions: (1) the change in the product structure and (2) the change in the market structure.

A change in the structure is effected through endogenous or exogenous factors and is brought about through changes in demand (growth in income) and technical changes directly or indirectly caused by institutional changes. In the Indian context, what has been happening in the eighties is a replacement of the old structures evolved under the aegis of the planning process by new structures induced by the changes in the government policy biased in favor of market forces rather than the planning criteria. To understand the nature of the "market-induced" structural changes, it is useful to keep in view the milestones in policy changes.

The policy Framework

In the post-independence period the process of restructuring was sought to be achieved through the planning process in India. With regard to industrial restructuring, the Indian plans were influenced by the Mahalanobis strategy, which deviated from the 'textile first' strategy of industrial development followed by the successful "late-comers" like Japan in industrialization. [Chakravarthy (1987)]. The underlying task implied in the Mahalanobis strategy was the development of a capital goods
sector as rapidly as possible which would reduce imports and make production less dependent on foreign market. In this restructuring process, the Indian plans envisaged a greater role to the public sector. While the private sector was assigned the due role, the investment decisions were not carried out by the market test of profitability but in accordance with the overall plan requirements. Above all, the restructuring was sought for along with technological self-reliance, and hence, the strategy envisaged a limited role to foreign investment. To bring out the desired changes, the government used a variety of control instruments like Industrial Licensing, Monopolies and Restrictive Trade Practice Act, Foreign Exchange Regulation Act etc. The period since the late seventies however witnessed a marked deviation from the earlier regime of planning and controls to one of liberalization and greater role to market forces. These changes were initiated across the board encompassing almost all the industries.

It is timely to remember that Klein (1977) has warned us, though in a different context, against the fallacy of "composition error". i.e., of assuming what is true or seem to be true of the whole (macro performance) to be 'true of the parts' (micro behavior). Besides, the systematic structural changes at the macro level is effected by the changes in the constituent parts. Therefore, a closer understanding of the macro changes pre-supposes an examination of the micro-foundations. To put it differently, a realistic assessment of the impact of the different policy regimes on restructuring and growth calls for a detailed analysis at the industry/sector
As stated earlier, the growth and structural changes in Indian electronics industry was shaped largely by government's general industrial policies and more significantly by the policies explicitly designed for electronics industry. During the early years of the development, the thrust was on self-reliant growth in tune with the then general industrial/technology policy framework. The resolution, which set up the Electronics Commission in 1971, asserted that "the government attached the highest importance to the development of an integrated and self-reliant electronics industry in the country. ....an intensive promotional effort relating to both production and research & development was, therefore essential to ensure a rapid growth of self reliance"7. The strategy was to build up on a deliberately derivative basis an integrated structure so as to meet the requirements on the local manufacturing basis (DoE 1979).

In pursuit of the above strategy, priorities were worked out, production capacities and investment were licenced and imports progressively controlled by a wide array of policy measures, which were predominantly regulatory and protectionist in character. The industry was planned to be developed mainly within the confines of the public sector and the small scale sector. The entry and operation of foreign capital and technology were regulated in accordance with the priorities of industrialization and objectives of self-reliance.

The strategy remained more or less same in essence for a
decade or so but was changed towards a more open and market oriented one in the eighties through a series of policy changes as is evident from table 1. The series of policy changes initiated in the early eighties were in sharp contrast with the earlier regime of planning. These policy changes sought a liberal climate, both internally and externally through dilution of the industrial licensing, relaxations of MRTPA and FERA provisions, liberalization of imports and greater access to the import of foreign capital and technology. Moreover, considerable relaxations were effected in the fiscal regime including reduction in direct taxes and reduction in import duties to provide a more propitious economic climate for private sector in the Indian industrial economy.

Clearly, two phases in policy initiatives could thus be identified: The main anchor of the first phase covering the seventies was around the development of the industry under protection with minimal recourse to foreign capital and foreign technology on the one hand and large companies and business houses (MRTP companies) on the other. The eighties marked the second phase when the government took a number of initiatives in the direction of a more liberal and open electronics policy. Broadly speaking, the shift was from the earlier controls towards a more liberal policy with the emphasis laid on minimum viable capacity, scale economies, easier access to foreign technology and capital and relatively free entry to private sector capital, including companies covered under Monopolies and Restrictive
<table>
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<tr>
<th>Milestones</th>
<th>Year</th>
<th>Remarks</th>
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<tr>
<td>1. Bhabha Committee</td>
<td>1966</td>
<td>Recommended development of an integrated electronics sector to achieve self reliance with minimal recourse to foreign capital and dominant role to public sector and small scale.</td>
</tr>
<tr>
<td>2. Sondhi Committee</td>
<td>1979</td>
<td>Recommended dismantling of controls in general and MRTP and FERA companies in particular.</td>
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<tr>
<td>3. Menon Committee</td>
<td>1979</td>
<td>Recommended liberalization of import of foreign capital and technology and duty free import of capital equipment.</td>
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<tr>
<td>4. Components Policy</td>
<td>1981</td>
<td>De-licensing of component manufacture except for MRTP and FERA companies. Provision of 40 per cent equity to FERA companies in high tech. areas. No MRTP clearance required under section 21 and 22 of MRTP Act except for VSI and VLSI. General reduction in duty on components and liberal import of capital goods for component manufacture.</td>
</tr>
<tr>
<td>5. Color TV Policy</td>
<td>1983</td>
<td>Ceiling on capacity was removed. All sectors of industry excluding foreign companies were allowed to participate.</td>
</tr>
<tr>
<td>6. Telecommunication Policy</td>
<td>1984</td>
<td>Telecommunication</td>
</tr>
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7. Computer Policy 1984

All Indian companies (excluding FERA) were allowed to enter the computer industry with no restriction on capacity. Most of the components needed were put under OGL to facilitate import.

8. Integrated Policy 1985

De-reserved certain components of small scale sector. Introduced broad-banding and liberal approach towards foreign companies even with more than 40 per cent equity in high tech areas.

9. Computer Software Policy 1987

Reduction in the import duty on all imports meant for software exports and no duty for hundred per cent export. Provision of special financing schemes and permission for foreign companies (with more than 40 per cent equity) in the hundred percent export projects.

Trade Practice Act (MRTPA) and Foreign Exchange Regulation Act (FERA) with a view to make the industry technologically modern, cost effective and price-competitive.

It is against the backdrop of these policy changes that the present study seeks to examine the different dimensions of the structural change in the Indian electronics. In the study we
conceptualize electronics as a broad sector with sub-sectors and final or intermediate products. From this conceptual framework it follows that an important dimension of the ongoing restructuring process is the changes in the product structure. Here, the focus of our analysis is on the shift in the relative shares of different products (product groups) and its implications on different facets of the growth like output, value added, foreign exchange outflows etc., of electronics industry.

The other dimension of the restructuring process under examination pertains to the market structure. Here, the focus of analysis is on the changes in the market structure as a result of the entry of new firms facilitated by the release of institutional barriers and its implications on the firms' competitive strategies and the performance. The analysis then moves on to technological change, as manifested in the emergence of new products, new processes and the shorter life cycle which in turn acted as a catalyst in the process of restructuring. The focus of analysis is on the technological behavior of firms and the level and direction of technological change in electronics industry.

The Issues and the Scheme of Presentation

The Indian electronics industry is currently undergoing a stage of transition resulting from a shift in the strategy from "controlled" growth to a "liberalized" growth through changes in the policy stance of the government. The present study, dealing with different dimensions of the ongoing structural change and
its implications on different facets of output growth, is presented in seven chapters including this introductory chapter.

The policy liberalization of the eighties marked a considerable dilution of the earlier regime of planning and implied greater emphasis on market forces. How does the product structure of the industry change when the investment decisions are left to the atomistic behavior of the private entrepreneurs guided by profit motive? Given the inter-sectoral linkages, what will be the impact of such changes in product structure on the industry's capacity to generate value added (income), employment and a positive external balance? By conceptualizing electronics as a broad sector with different sub-sectors, the second chapter seeks answers to these types of questions relating to the product structure and the accompanying linkage patterns. The analysis is carried out in the input-output framework.

The impact of the policy liberalization, which aimed at making the industry more competitive, is not confined to the product structure alone. A change in the market structure as a result of the release of institutionally set entry and exit barriers is another important dimension of structural change. How competitive is the market structure of Indian electronics industry now? How has it responded to the government policy changes during different phases of its evolution? What are the competitive strategies of the firms? How conducive are the competitive strategies to the long term growth of the industry? How do these strategies influence their performance? The third chapter examines the above issues in the framework of Structure
conduct performance (S-C-P) paradigm by illustrating the case of computer industry.

Studies in the S-C-P paradigm considers market structure in terms of the size distribution and the relative shares of firms in the national market. However, viewed in terms of the arguments developed by Sraffa (1926) and Hotelling (1929), it is plausible to conceive of a situation wherein the firms, despite their small shares in the national market, enjoy some "monopoly" power if the national market is divided into regional markets. Chapter four attempts to enquire if there is regional market segmentation and if so what is its impact on firms' performance? The analysis is carried out by taking the case of television receivers.

In a technologically dynamic industry like electronics one of the prime objectives of policy liberalization is to make the industry technologically dynamic. In fact, technological change itself is a key factor in the structural change. How does policy liberalization influence the technology behavior of firms? Chapter five analyses the technological behavior of firms in, and the progress of, the Indian electronics industry. It inquires as to how does the firms' technological behavior shape the overall level and the direction, of technological progress in a third world industry when it is left to grow its output more in tune with market forces than planning criteria.

How do the observed structural changes and the consequent change in the behavioral pattern of firms influence the output growth and other macro objectives of industrial growth? These
are also equally important issues and are examined in chapter six. It traces the overall trends in the output growth and its implications on the industry's capacity to generate value added (income), employment and foreign exchange.

The last chapter gives a summary of the major findings of the study on Indian electronics industry and on that basis draws some general inferences on the impact of the "market-induced" structural change on industrial growth in the Indian economy.
End Notes

1. This refers to the technological change in the semiconductor (chip) technology and particularly to the emergence of Metal Oxide Semiconductors (MOS) which are characterised by lower power consumption, greater density in the packaging of elements, higher yields in production and therefore lower unit cost. The density of circuitry on a chip, generally described as the level of integration has increased dramatically in the recent years. Based on the scale of integration, the integrated circuits (ICs) are divided into Small Scale Integration (SSI) - with less than 100 active elements, Medium Scale Integration (MSI) - between 100 and 999 active elements, Large scale Integration (LSI) - between 1000 and 99,999 active elements, Very Large Scale Integration (VLSI) - between 100,000 and 999,999 active elements. ICs with more than one million active elements which are now in the market are called Ultra-Large Scale Integration (ULSI). See for details, Langlois et.al (1988) and Forester (1980).

2. The versatility of these systems is facilitated by their programmability. Hence, a system could be used for more than one operations without changing their hardware features. What is required is the change in the software or the instructions used in running the system.

3. This is also referred to as the "information technology revolution" See for details Forester (1985)

4. The review of literature that follows in not a comprehensive one. Here, our purpose is only to bring out the relationship between different dimensions of structural change and growth. The relevant literature on different dimensions of structural change will be cited when the issue is taken up for further analysis.

5. Policy changes in electronics is well documented. See in this context BICP (1987) and Pillai and Subrahmanian (1989).

6. It was recognised that the industrial growth in India began to decelerate in the post 1965 period. For details see Raj (1976), Nayyar (1978) Patnaik (1981). Given the lower rate of industrial growth, government appointed a series of committees to enquire into the impact of the existing policy regime on industrial growth. These committees held the view that the series of controls existed in the industrial sector acted as a hindrance to growth. See in this context reports by Alexander (1975), Dagli (1979), Narasimham (1985) Abid Hussain (1985). Also see Ahluwalia (1985).

7. As quoted in DoE (1982 p 14)