CHAPTER-VIII
CONCLUSIONS AND IMPLICATIONS

8.1 OVERVIEW

Historical evidences coupled with theoretical justification backed the notion that industrialization has been an outcome and accompaniment of economic development. It was found that no major country has yet became rich without becoming industrialized and thus it was also regarded as an engine of growth in the literature. But the source of industrial growth has remained a concern for growth theorists since centuries.

Britain was the first country to industrialize way back in 1800 followed by some other countries from western Europe, United States, Japan, East Asia etc. But the process of industrialization is unique for each country concerned and each followed a different path towards attaining industrialization given the resources and constraints facing them.

Process of industrialization in India started during the period of colonial rule, but the industries were largely developed to provide raw material for the industrial revolution in Britain. But, the major stance towards industrialization in India was laid after independence, especially during the Second Five Year Plan. Based on the genesis of Harrod-Domar model, Mahalanobis model of growth accentuate the accumulation of capital stock through planned investment for industrialization. For attaining self reliance, the Plan emphasized the development of capital goods industries like iron and steel, coal, machine tools, non-ferrous metals, fertilizers, refined petroleum products along with the industries like pharmaceuticals for enhancing mass welfare.

Secondly, for providing a good breeding ground for infant industries, the government resorted to protectionism against the theoretical justifications of free trade.

However while decomposing the source of growth for the United States (US) during 1909 to 1949, Solow has found that around 87 percent of growth in US output
per worker was due to ‘technological change’. Thus, technological change replaced
growth of capital accumulation as the primary source of growth. But the source of
technology generation was regarded as exogenous in nature. Thus, the government in
India also made various selective technical collaborations to import this exogenous
factor to begin with.

These policies of initial planning accelerated growth in the industrial output as
it grew at around 10 percent per annum during 1956 to 1966. But thereafter, the rate
of industrial output growth fell to around 3 percent per annum during 1966 to 1974.
The stagnation in industrial growth initiated a debate for the probable cause for the
downward trend in the sector and the ‘protectionist’ policies of the government were
largely blamed for the reverse trend.

But during the late 1980s, the source of ‘technology’ generation was found in
the theoretical models of endogenous growth. The models emphasized that long-run
growth is driven primarily by the accumulation of technology which is generated
through investment in research and development (R&D). Technology, in turn
prohibits diminishing returns that accrue during capital accumulation. In addition,
investment in R&D also leads to externalities due to its non-rival and partial
excludable properties. These peculiar properties of ‘technology’ lead to emphasize
that technology flow is an automatic process and is facilitated by free trade amongst
those in the frontier of technology to the periphery.

Coupled with the theoretical justification, the empirical evidence from open
economies of East Asia also lead the neo-liberalizers to propagate that greater
integration with the developed countries lead to economic growth in the laggard
countries. Thus, several countries from Latin America and Asia followed the
globalization policies, sometimes forcibly with the implicit assumption that these
policies will lead to sustainable development.

But it was found that the literature stands divided regarding the issue of
greater integration and development. These ramifications generated debate on the
relationship among technology, trade and growth in open economies. These
revelations lead to address issues that were long been central to the international economics, that is, ‘to what extent international trade serves as an engine of growth’. Precisely, there are studies that empirically found that trade lead to technology spillover to the host countries that spur growth and dynamism leading to sustainable development. On the other hand, the literature also exists that found that integrating the economies did not lead to technology spillover automatically.

The sceptics emphasized that accumulation of technology is rather a cumulative, evolutionary and path-dependent process that requires consistent effort, resources and persistent policy for technology absorption, accumulation and diffusion. Moreover, since the generation of technology is a costly and risky affair, the industries in the frontier of technology resort to various means to avoid the technology to spillover freely. It was also found that the latest technology is not always available for sale so as to maintain the technological edge.

Thus, the issue of source of industrial growth and sustainability remained inconclusive. So the present study is an attempt in this direction while taking the case of Indian organized manufacturing industries.

The choice for the case study was made on the ground that after following the protectionist policies for about three decades after independence there was an intensification of reforms in India’s trade, technology and industry policy in 1991. To make a comparative analysis regarding the impact of change in policies, the period from 1980-81 to 2005-06 was chosen for the study. A decade before the initiation of economic reforms seemed plausible to make comparison with the decade that follows. Thus, the period was divided in to pre-reform period till 1991-92 and post-reform period from 1992-93 onwards.

It was assumed in compliance with the neo-classical endogenous growth models that the increase in imports following the economic reforms of 1991 lead to greater embodied technology spillovers in the manufacturing industries in India which in turn have lead to greater total factor productivity growth in the sector coupled with enhanced its efficiency in resource use. It was further hypothesized that there have
been a structural shift towards relatively high income elastic industries leading to industrial sustainability.

The central themes of the thesis is summarize into three sections. The following section 8.2 sums up the key features of growth and structural change in the manufacturing industries, followed by the impact of economic reforms on total factor productivity growth. An overview about the estimation issues and the major results are presented in the section. The section also presents the results of the core issue of the thesis regarding the role of technology spillover in productivity growth. Section 8.3 presents the way forward for accumulation of technology for long-run growth prospectus of manufacturing industries.

8.2 MAIN FINDINGS

To begin with, the empirical analysis first undertook the issue of determining the patterns of industrialization in India since 1980. It was assumed that adoption of economic reforms lead to structural transformation within the manufacturing industries towards relatively high technology industries leading to industrial sustainability. Several descriptive statistics were undertaken to understand the underlying phenomenon of structural transformation within the manufacturing industries in India.

It was found that for the period of analysis (1980-81 to 2005-06), the share of industrial sector averaged to about 26.3 percent of GDP and the share of manufacturing industries averaged to about 16.2 percent of GDP during the period. Regarding the overall trend growth rate of the value added in the organized manufacturing industries, it was found that it decelerated to 5.33 percent in the post-reform period as compared to 7.25 percent in the pre-reform period.

Further, it was found that during the 1990’s, there is minor diversification within the manufacturing sector as the share of few MHT industries (notably chemicals, machinery, motor vehicles) and HT industries (particularly pharmaceuticals) grew as compared to the early 1980s. But, there was a shift more towards MLT industries as its share in total manufacturing value added increases from
27 percent during the early 1980s to 38 percent during the mid 2000s. Thus, the pattern of industrial development is not as if of moving up the technological ladder while increasing the share of the relatively high technology industries. Rather, the pattern of industrialization in India was that of a more diversification within the manufacturing industries.

Secondly, regarding the share of employment in manufacturing industries, it was found that during the early 1980s, the average of 26.5 percent was the paid employment in manufacturing sector out of the total paid employment in India, which fell to an average of 23.8 percent during the early 1990s while during the mid 2000s (2003-04 to 2005-06) its share fell further to 21.6 percent.

Moreover, the process of industrialization is associated with structural changes apart from the simple increase in share of manufacturing output and employment in the total output and employment generated, respectively during the period. Changes in structure of demand, international trade and the pattern of partial productivities and capital-labour ratios, etc determines the evolutionary path towards sustainable industrialization. For the purpose, the study too focussed towards these factors.

The proportionate share of four technology intensive industries in exports and imports, the respective export and import intensity and the relationship between the import and export intensities were undertaken to understand the structure of trade from the manufacturing industries in India. It was found that the major exports were mostly comprised of relatively low technology industries. Although, the period of liberalization has witnessed an increase in the volume of trade but the relationship between import and export intensities does not show any direct and positive relationship. It was, however envisaged that the increased imports following the adoption of economic reforms would lead to technological flows which in turn would enhance their respective exports leading to the positive relationship between import and export intensities. But, the analysis shows that in the post-reform period the import intensity of several industries have risen as envisaged while adopting the reforms but the assumption of enhancing the corresponding export intensity of the
industries has failed to produce the claimed results. Thus, the pattern of the trade followed in the Indian manufacturing sector does not depicts any massive shift towards the relative high technology intensive industries. It was found that the pattern of diversification was found for both the import and exports from the manufacturing industries. Further, it was found that the trend growth rate of exports for about 60 percent of industries decelerated in the post-reform period as compared to the pre-reform period whereas that of the imports the trend growth rate for about 50 percent of industries accelerated in the latter period as compared to the former.

Further, panel regression analysis was done to find out the factors that determine the structure of industrialization in the country. It was found from the analysis that irrespective of technological complexity and the policy adopted, employment and domestic demand are the important factors of determining the pattern of industrialization in India.

Thus, the analysis refutes the claims of neo-classical theories in which structural transformation is regarded essentially a by-product of growth produced by greater liberalization and less intervention. Rather, structural transformation towards relatively high technology intensive industries is a process of moving purposefully often with considerable effort and cost with greater planning and conscious policy interventions.

Further, the total factor productivity growth (TFPG) is an important component that catches the factors other than the tangible factors of production that determines growth. It is the composition of technical progress and the efficiency with which the resources are used. It reflects the advances in technology and organization of production. It was assumed that there is an increase in TFPG in the post-reform period as compared to the pre-reform period in manufacturing industries. A huge literature exists that studies the impact of reforms on the TFPG of Indian manufacturing sector. Some studies have found that the total factor productivity has increased in the post-reform period as compared to the pre-reform period while others have found the opposite. Thus, a clear consensus about the total factor productivity
performance in the post-reform as compared to the pre reform period does not exist. Thus, the estimation and comparison of technological factor productivity growth (TFPG) in the pre-reform period and the post-reform period was done. The results, using the growth accounting approach (translog index) show that the TFPG decelerated in the post-reform period as compared to the pre-reform period for all the industrial sub-groups except the LT industries wherein its rate remained intact.

Again, the results using stochastic frontier production approach shows that there exist inefficiencies in most of the industries, which rejects the hypotheses that the sector has become efficient following the economic reforms. Further the results also show that the relative high technology industries are coupled with greater inefficiencies as compared to the low technology industries which put in jeopardy the issue of sustainability of the industrial sector.

Next, the study tests the hypothesis regarding the relationship amongst technology, trade and growth in open economics. It was assumed that import weighted technology spillover will be greater in the post-reform period, moreso in relatively high technology industries in manufacturing industries. Thus, panel regression analysis was done to find whether TFPG in the manufacturing industries were due to indigenous R&D investment or it was the result of import weighted technology spillover from the major OECD countries. The results show that investment in indigenous R&D remained an important factor in determining productivity for the pre-reform, post- reform and also for the whole period under study while the magnitude of technology spillover stock remained insignificant. The analysis also shows that during the period 1980-81 to 2005-06, technology spillover remains low irrespective of the ‘technology gaps’. Further, the analysis also showed insignificant amount of spillovers irrespective of ‘productivity gaps’.

So, the overall results refutes that greater integration would lead to automatic technology spillovers. Thus, for understanding the factors determining the accumulation of technology, the regression analysis was done to determine whether the impact of indigenous investment in R&D or/and the quantum of capital intensity
plays an important role in generating technological spillovers. It was found from the analysis that the investment in indigenous R&D is an important factor for technological spillovers, but it was found that for the relatively high technology industries, the quantum of indigenous R&D investment done in the Indian manufacturing industries were not sufficient to attract spillovers in these industries.

Thus, the results points to the fact that generating productivity growth is a continuous and path dependent phenomenon in which the investment in indigenous R&D is an important factor. The investment in R&D not only generates new technologies but it also enhances the absorptive capacity of the country to reap the benefits from greater trade relations with major R&D investment countries that are in the frontier of technology generation. Thus, conclusively the neoclassical paradigm of technology being a public good character and its spillover being an automatic process is refuted by the present analysis.

8.3 THE WAY FORWARD

Investment in indigenous R&D not only led to new innovations, it also enhances the absorptive capacity of the sector. But the mechanism of technology accumulation is a continuous and path dependent process that is complex in nature and requires consistent effort and resources for which the role of the government becomes important. Thus, the analysis of various policies that has been undertaken since Independence to enhance the technological capability of the sector was done.

It was found that after Independence, the policy makers with an aim to build the technological base relied more on importing technology from abroad through various foreign collaborations and selectively inviting FDI. Apart from this, various initiatives were undertaken for building indigenous science and technology structure. By the mid 1960s, a number of research institutes came up. But due to the deteriorating fiscal position, foreign collaborations were made restrictive in nature and emphasis was given for indigenous R&D investment and for building technological structure. By the end of 1970s, in wake of second oil crisis and deteriorated foreign exchange position, government adopted a strategy for the
promotion of exports through encouraging FDI, especially in high technology areas. Various measures were undertaken to attract foreign investment. But a phase of greater globalization was marked with the adoption of comprehensive macro-economic and structural adjustment policies in 1991. This phase is marked with greater flexibility in importing technology from abroad through embodied and disembodied means.

These policies were framed with the aim to enhance the technological capability in the sector, but it was found that only 0.8 percent of GDP is spend on R&D in the country and only 0.2 percent of GDP on R&D in industry from 1980 onwards. In the education sector too, it is seen that around 3.8 percent on an average is being spend on this sector during early 2000s.

Thus, first there is a need to increase the quantum of resources and finance towards research and development (R&D) and education sector. Second, greater emphasis should be given to need based research and; third, government should encourage more research in relatively high technology industries. Further, greater incentives should be given to researchers to attract and retain the best talents in the field.

Thus, the study concludes that the claims of neo-liberalizers to regard ‘market’ as the panacea of all ills failed to produced the much acclaimed results. The sustainable development following the structural transformation from relatively low technology intensive industries to high technology industries requires consistent effort and resources towards generating and accumulating technology. This process is complex in nature and requires considerable time, efforts and consistent policy framework. This process was also regarded as ‘path dependent’ in nature in the literature of ‘evolutionary economics’, for which the role of the government plays an important part.