IMPACT OF GLOBALISATION ON INDIA’S TECHNOLOGICAL REGIME: AN ANALYSIS OF INDIA’S MANUFACTURING SECTOR

SYNOPSIS

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Globalisation, by dint of spectacular success of the information and communication technologies (ICTs) and by the wave of dismantling the barriers of free flow of trade, investment, finance, technology, knowledge and information within the countries fostered phenomenal changes in the structure and nature of manufacturing across the globe. This added a new dimension to the concept of competition amidst which the developing countries found themselves in a position to keep abreast of the developments ushered in the process of technology acquisition, adoption and innovation to challenge the prevailing propriety of the Developed Bloc.

Globalisation has added another dimension to the pattern and structure of manufacturing sector.

The particular process of production is being split up into two or more processes, which are undertaken in different locations but lead to the same final production. The firms are in the process of making decisions such that the upstream boundary set by a single firm consists of purchasing materials or parts from other firms and the downstream boundary is determined by selling its product to other firms.

Technology plays an important role in the manufacturing production. However, in the aftermath of the transformation of manufacturing stated above, technology, viewed simply as the input-output relation postulated by the neoclassicists would not suffice to take care of the switching changes. For survival in the new wave of competition by introducing new techniques and new products to meet variety of and ever changing consumer demand technological innovation, acquisition and adoption were felt necessary. The evolutionary theory of economics observed that production function view considered technological development exogenous to the economic process and thereby could not accommodate the issue of technological innovation, albeit, the innovation appeared as the pivotal theme in the context of changing production and organisation structure across the globe after globalisation.

In order to supplant the traditional view of technology at the behest of changing perspectives the concept of ‘technology regime’ emerged which is an offspring of
the development of the Evolutionary Theory of Economic Change in the hands of Nelson and Winter.

The technology regime comprises of the technological opportunities, appropriability of innovations, cumulativeness of technical advances and properties of knowledge base. Technological opportunity conditions refer to the ambit of possible technical solutions relating to problem-solving activities of firms and the ease with which such solutions can be achieved. Appropriability of innovations summarizes the possibilities of protecting innovations from imitation and of reaping profits from innovative activities. Cumulativeness of technical advances is related to the notion that today’s knowledge and innovation form the base on which innovation of tomorrow would build up and that innovative firms today are more likely to innovate in the future in specific technologies and long specific trajectories than non-innovative firms. The property of the knowledge base relates to the nature of knowledge underpinning firms’ innovative activities. Evolutionary theory defines technologies not in terms of a stylized input-output analysis, rather these are seen as ‘being linked with other technologies, economic activities and production and user practices and a whole range of institutions forming a technology system’.

The present study was undertaken at this backdrop. The principal objective of the present study was to examine the impact of globalisation ushered thorough a phenomenal growth of technology and knowledge on the technological regime of a country like India. In order carry out such investigation the study tried to underpin (a) the rationality behind assessing the traits of India’s technology regime undergoing change in the context of the liberalisation of the economy with reference to India's manufacturing sector.

(b) Secondly, the study also intended to examine the impact of globalisation on India’s technology regime in a macroeconomic perspective. In order to do so, the impact of the import of technology by India on national expenditure on R&D and the impact of R&D activity on technology intensive exports were studied empirically.

(c) The third objective of the study was to evaluate how, after liberalisation, technological innovation and adoption measured by R&D intensity (R&D
expenditure as proportion of sales) was influenced by size of the manufacturing industry (measured by sales turnover), outward orientation measured by earning in foreign exchange (as proportion of sales) and outward orientation measured by exports f.o.b. (as proportion of sales), import intensity of embodied technology (import of capital goods as proportion of sales) and import intensity of disembodied technology (payment of royalties, technical fees etc., by domestic firms abroad as proportion of sales). This was done in the perspective of India’s manufacturing industries in an aggregative framework.

(d) The fourth objective of the study was to examine the impact of liberalisation on India’s technology regime at the disaggregated level. In order to accomplish this, factors influencing the R&D Intensity of India’s manufacturing firms were explored and the relative importance of the factors were assessed empirically.

This dissertation consists of seven chapters and a bibliography. In Chapter 1, in the introductory part, the rationale of the study was discussed. It contained an analysis of how India’s manufacturing sector occupied a pivotal position in the economy. Since with liberalisation of the economy the entry of foreign firms in the economy was made easier and the opportunities before the firms and industries to import technology and knowledge became more easygoing the concept of technology regime loomed important in the context of India’s manufacturing sector. This was discussed drawing upon statistical facts of the Indian economy.

Chapter 2 of the study provided a survey of existing literature encompassing technology regime, technology acquisition, technology spillover, technology adoption, innovation and R&D in the Indian context and also at the theoretical levels. The chapter concluded by discerning the research gap which the study sought to overcome.

In Chapter 3, objectives, data source, research methodology, significance and limitations of the study were discussed.

The expenditure incurred by the government, firms and industries on Research and Development (R&D) is considered in the literature as best procurator of technological opportunity available, technology adoption and absorption of technology also. Therefore, in order to accomplish the second objective the
impact of embodied technology import on public R&D was explored in Chapter 4 based upon secondary data obtained in context of the Indian economy. A comparison was made between pre-and post-reform era by the inclusion of dummy variables in the log-linear regression model.

The exports of technology intensive products is said to be influenced by the R&D carried out and accordingly the trend of these exports in the case of Indian economy was also analysed in Chapter 4 drawing upon classification of exports provided by OECD. Next the impact of India’s public R&D on its exports of High Technology (HT) products was explored in a log-linear model.

In order to accomplish the third objective attempts were made in Chapter 5 to study how, after liberalisation, technological innovation and adoption measured by R&D intensity (R&D expenditure as proportion of sales)(RDI) was influenced by size(SIZE) of the manufacturing industry (measured by sales turnover), outward orientation measured by earning in foreign exchange(as proportion of sales)(OOR-1) and outward orientation measured by exports f.o.b.(as proportion of sales)(OOR-2), import intensity of embodied technology(import of capital goods as proportion of sales)(ETI) and import intensity of disembodied technology(payment of royalties, technical fees etc., by domestic firms abroad as proportion of sales)(DTI). This was done in the perspective of India’s manufacturing industries in an aggregative framework.

Two models were adopted in Chapter 5 to accomplish the third objective. In the first Model, the influence of SIZE and ETI and DTI on RDI of the industries was explored in elasticity terms. While carrying out this exercise log linear regression model was applied as in this situation this model is recognised as the most suitable model. Data at the industry-level were obtained from the Capitaline Corporate Database, Mumbai, in respect of 14 industries, namely, Automobile, Cement, Chemicals, Food Processing, Electric Equipment, Electronics, Engineering, Personal Care, Pharmaceuticals, Refineries, Software, Steel, Telecommunications and Textiles.

In this chapter, in the second Model, in order to capture the influence of outward orientation along with the influence of size of the industry and the import of technology on RDI a multiple regression analysis was done taking RDI as the
dependent variable and ETI, DTI, SIZE, OOR1 and OOR2 as the explanatory variables.

While fulfilling the last objective, in Chapter 6, the Capitaline Corporate Database, Mumbai, was used to obtain data at the levels of the firms on annual sales turnover, R&D expenditure, Profit before tax (PBT), exports of firms (f.o.b) representing Outward Orientation-1, earnings of foreign exchange against sharing knowledge and expertise with foreign firms denoting Outward Orientation-2, import of capital goods representing import of embodied technology (ET) and payment of royalty, technical fee, etc. abroad against acquiring knowledge, technical knowhow, etc. representing import of disembodied technology(DT).

R&D, PBT, Outward Orientation-1, Outward Orientation-2, ET and DT were expressed as percentage of annual sales turnover converting the variables to R&D intensity (RDI), PBTS, OOR-1, OOR-2, ETI and DTI. Market share (MSH) was expressed as the proportion of sales of the respective firms to the sales of the industry.

In Chapter 6 the Capitaline Corporate Database, Mumbai, was used to obtain data. While selecting the firms the objective was to obtain data covering as long a period as possible. A thorough screening of the database helped in consolidating data for the following number of firms in connection with the different industries:

6 in Automobiles, 5 in Cement, 11 in Electric Equipment, 6 in Electronics, 11 in Engineering, 2 in Food Processing, 14 in Chemicals, 5 in personal care product producing industry, 15 in Pharmaceuticals, 5 in Refinery, 4 in Software, 4 in Steel, 3 in Telecommunications and 07 in Textiles industries.

In Chapter 6, at the disaggregated level, this study attempted to identify the factors which played decisive role in garnering the technological opportunities for the Indian manufacturing sector with the data set consisting of 98 observations for the enterprises in the Indian manufacturing sector for the period 1996 to 2009. A multiple regression was run for the full sample in order to discern how far and to what extent the explanatory variables explained the variation in RDI.
Chapter 7 of the study included the summary, conclusions and avenues for further research.

The significance of the study lies in several respects.

The main focus of this study was on India’s manufacturing sector. This should be attributed to the longstanding importance of the sector in India’s economy which was discussed in Chapter 1 of the study. The relatively declining trend of the agricultural sector in accommodating the pressure of population on it and the heightening importance of the service sector in making contribution to the GDP need a careful scrutiny in a country like India where the surplus population from agriculture could hardly be absorbed into the latter owing to lack of proper training and education and this called forth an assessment of the position that could be occupied by the manufacturing sector in relieving the pressures upon the economy. In this study an attempt was made in that direction.

Secondly, at the advent of the globalisation the production structure and organisational pattern of the manufacturing industries had undergone several changes. Firms started to realize that in order to be competitive its nature of indulging in mass production has to be replaced by the multiproduct trait and more emphasis would have to be placed on ensuring quality and quick response to customer demand. It is the situation under which innovation registered an indelible mark. No matter whether it is product or process innovation- the central theme is continuous improvement and up gradation of technology that implicates acquisition, adoption and consolidation of knowledge. Firms should no longer be viewed as optimizing agent, rather, they should endeavour to modify the demand for their products and get themselves accustomed to the development of new technologies. Technology is a powerful factor for the growth of the manufacturing sector but, in the context of the changes in the production structures and organisational pattern of the sector that was ushered through globalisation, the concept of technology defined in terms of the production function approach of the neo-classical type could no longer be appropriate. The concept of ‘technology regime’, introduced by the Evolutionary Theory appeared to be meaningful and contextual since, according to this concept, technologies should not be defined in terms of a stylized input-output analysis, rather these should best be seen as ‘being linked with other technologies, economic activities and
production and user practices and a whole range of institutions forming a technology system'. In this study this point was clarified in detail.

Thirdly, where most studied concentrated on the issues pertaining to the productivity of the Indian manufacturing sector, the present study, unveiled the emerging nature of India’s technological regime after the liberalisation of the economy in 1991. The main components of the regime defined in terms of acquisition and adoption of new technology and technological innovation were discussed in the context of Indian scenario. Moreover, the association of the technological regime of India with the country’s manufacturing sector was studied in analytical framework. After liberalisation of the economy the scope was widened for the import of technology, exports of goods, earnings of foreign exchange through royalties, etc. and a vast market with pronounced competitive elements. Accordingly, in order to gain competitive edge over others the need for technological innovation was aggravated calling forth enhanced R&D expenditure by the government as well as the private sector. All these necessitated a review of the trend of import of technology, R&D expenditure incurred, exports of goods, earnings of foreign exchange by the government, industries and the firms which was accommodated in the study at the macroeconomic perspective.

Fourthly, the study tried to explore the factors influencing the R&D expenditure of the government, industries and the firms since expenditure incurred on R&D was a better proxy for the technology adoption, acquisition and absorption of new technology.

Lastly, the treatment of industry and the firm separately in the study was done in view of the fact that in evolutionary theory decision rules made within the firms are viewed as a legacy from the firms’ past. These rules are appropriate to the circumstances within which the firms find themselves. These are not responsive to the situations which the firms encounter irregularly. Firms expand or contract facing disequilibria no matter whether industries are near equilibrium. Industries, in evolutionary theory, could not be treated as aggregation of firms because ‘firms are a combination, even compromise, of internalizing and externalizing tendencies’.