CHAPTER 2

REVIEW OF LITERATURE

2.1 INTRODUCTION

An extensive review of literature has been undertaken to gain an in depth understanding of various issues related to the subject of study. A brief of literature studied and reviewed is presented in this chapter. This review has facilitated finalizing objectives and methodology of the study. The literature reviewed has been classified in five broad areas of study and presented in sections here below. Section 2.1 presents an overview of literature reviewed on cotton. This part reviews studies on production and marketing of cotton, impact of various measures on cotton industry /trade in the world trade organization (WTO) environment, foreign trade and impact of foreign direct investment (FDI) on cotton. The Section 2.2 covers literature reviewed related to Bt cotton. This literature sorted by studies on environmental, health and socio-economic benefits from growing Bt cotton including studies related to Gujarat, national level studies and international studies on Bt cotton. The section 2.3 presents evidence in past studies on the yarn and fabric related research. The section 2.4 describes research studies on textiles industry. This literature review is done for studies on textile industry at domestic level and at international level. Finally, research publications on Indian import- export of textile products have been presented in section 2.5 here below. An extensive review of studies on various subjects related to present study at Gujarat level as well as national and international level has been done for the purpose of deciding objectives and methodology for present study. The same has been presented below.

2.2 REVIEW OF LITERATURE ON COTTON

Review of literature relating to cotton is further categorized in (a) Studies on Foreign trade, (b) Studies on Production and Marketing of Cotton, (c) Studies on Impact of various measures on Cotton Industry/Trade in the World Trade Organisation (WTO) Environment, and (d) Studies on Impact of Foreign Direct Investment (FDI) on Cotton industry.

2.2.1 STUDIES ON FOREIGN TRADE

This part covers various reviews of literature relating to India's foreign trade.

Lajapathi Rai (1985) covering "Indo-Soviet Trade Relations" has examined trends in India's foreign trade with a brief history of Indo-Soviet relations, role of institutions and organisations in the promotion of Indo-Soviet trade and Indo-Soviet Trade in perspective. He made a critical appraisal in all these areas.

Vijay Singh and Madanlal (1985) expressed that south Asian economic cooperation can enable the countries of the region to achieve the economies of scale, better specialization opportunities, improved efficiency through increased competition, less instability of external earnings and improvement in the bargaining position of the countries involved. There is considerable scope for expansion of mutual trade among the countries of the region. These countries are, however, competitive rather than complementary. The economies of South Asian countries are unequal from the viewpoint of industrialisation and technology. Hence production strategy is to be so devised as to match the demand for and supply of export products among themselves and in international markets. If these countries cooperate in promoting industrialisation of their partner countries in the region, their intra-trade is bound to increase.

Uma Rani (1993) investigates the impact of exchange rate volatility on trade flows in India during the period January 1975 to December 1988. The study concludes that India's bilateral imports and exports have, in most of the cases, been adversely affected by the volatile nature of exchange rate.

Konings and Vandenbussche (2004) provided empirical evidence that temporary anti-dumping protection on an average raises the productivity growth of domestic import-competing firms, and that trade policy under certain conditions can induce technological catching-up.

Vijaya Katti (2005) points out that for India to become a major player in world trade, an all-encompassing and comprehensive view needs to be taken for the overall development of the country's foreign trade. The EXIM policy was renamed as the new Foreign Trade Policy. The Foreign Trade Policy was built around two major objectives. These are to double our percentage share of global merchandise trade within the next five years, and to act as an effective instrument

of economic growth by giving a thrust to employment generation. She was of the opinion that the new trade policy was of immense use to India's foreign trade.

Vijaya Katti et. al. (2007) in their paper make an attempt to study some of the major sectors of the Indian economy. They have identified four major sectors, including cotton and textiles and analysed how export promotion councils have helped to shape the Indian economy, its export growth, and the challenges they face in an increasingly globalized world. They also focus on the employment and export intensity of the Indian economy, and highlight the industries that are in particular having low and high export and employment intensity.

Neena Malhotra (2008), says that the ratio of exports to imports, has improved over time, and the fear that liberalisation will adversely affect agriculture, doesn't seem to be valid. Rather immense export opportunities are opened by export market, and our farmers are also taking advantage of these opportunities. There is need for change in the cropping pattern, and domestic oil seeds production should be promoted in a big way to reduce import dependence. Government should provide appropriate facilities in the form of transportation and storage, infrastructure, better varieties of seeds, packaging and branding, and also quality testing Centre’s for matching our products with international quality standards. Thus, domestic marketing reforms must be there with liberalisation of external trade of agriculture commodities.

Jeevan Kumar Khundrakpam (2009) in his paper investigated the exchange rate pass-through to domestic prices in India during the post-economic reform period, and found fairly robust evidence of a rise in pass-through until recent years. This is in contrast to a decline in pass-through observed in several countries since the 1990s. When a large domestic economy liberalises, and gets increasingly integrated with the global economy, the influence of the external sector, including the exchange rate movement, could become substantial during the transition. Dismantling various types of controls within the economy itself could also affect the way the external sector influences the inflationary process in the economy. In consonance with the literature, the plausible factors are reduction in tariff and removal of quantitative restrictions on trade; rise in the proportion of imports and exports in the income and consumption basket;

changing composition of imports; increased inflation persistence due to dismantling of price controls; and lack of control on government deficit under limited monetary independence.

2.2.2 STUDIES ON PRODUCTION AND MARKETING OF COTTON

This part includes literature review regarding the studies on production and marketing of cotton:

Khandelwal (1970) studied the problem of cotton and cotton-seed forward markets in Madhya Pradesh to visualise the problems connected with future markets of cotton and cotton-seed, and to suggest effective measures to overcome these problems. He found that the forward markets were not functioning effectively in Madhya Pradesh. The strength of the membership of the Association had declined. The study suggested the need for reforms in cotton marketing practices and changes in the government policy.

A study by the National Council of Applied Economic Research (1971) into the marketing problems of cotton in Andhra Pradesh revealed that cotton yield was very low since it was cultivated on poor soils and in regions of uncertain rainfall. The yield is further affected by a high incidence of pests and diseases. The study brought to light the prevalence of malpractices like unauthorised deduction and the existence of a few buyers in some regulated markets, thus giving scope for concentration, and the use of more inputs like fertilisers and cultivation under assured irrigation facilities.

Mandalia and Kukadia (1975) studied the economics of cotton cultivation in Baroda district, Gujarat. They made a cost-benefit analysis for a desi variety, Digvijay, and a new high-yielding variety, MCU-5, and compared the two. The study pointed out that MCU-5 cotton fetched a net return higher by Rs 53/ per quintal over Digvijay.

Gangwar and Singh (1975) examined the economic feasibility of financing cotton growers in Hissar district of Haryana. The study relates to two types of cotton varieties. As the American cotton requires more pesticides, fertilisers, and irrigation, farmers were facing severe constraints of these inputs. They should prefer desi variety. The net income derived from both the varieties is the same. It was brought to light that even under adverse weather conditions, the financial institutions may consider advancing credit since these varieties assure minimum recovery of the amount invested.

2.2.3 STUDIES ON IMPACT OF VARIOUS MEASURES ON COTTON INDUSTRY /TRADE IN THE WORLD TRADE ORGANIZATION (WTO) ENVIRONMENT

This part includes literature review regarding studies on impact of various measures on cotton industry /trade in the World Trade Organization (WTO) environment:

Jebamalai Vinanchiarachi (2007) says that in the textile industry, the elimination of the Multi-Fiber Agreement (MFA) quotas has led to intensified competition in domestic and international markets. Pressures for efficiency gains are constant. While tariffs on textile products have been gradually reduced, thereby eroding the benefits of preferential schemes (particularly for least developed countries), a number of non-tariff barriers to trade remain. The challenge for textile clusters in India is to convert comparative advantages into competitiveness. It stems from enhanced adaptive capabilities to use modern technology and devices and to commercialize new knowledge. "Cooption ", i.e., cooperate to compete, is the new industrial theology, and a collective response to competitive pressure is key to enhance competitiveness. This theology must, of course, play its due role in sustaining poverty reduction through the effective empowerment of the poor in the development process.

The NCAER study (2009) on “Assessing the Prospects for India’s Textile and Clothing Sector” is a comprehensive empirical study covering the entire supply chain of textiles and clothing sector for an assessment of the prospects for the industry in the light of global competition from developed and developing countries. The textile industry is presently in a state of flux due to the severe contraction in export and domestic demand in the wake of global economic and financial crisis. Major business restructuring is taking place across the industry. The government has been considering measures to support the industry on which livelihood of millions of people is dependent. The industry is affected by slow and uneven modernization across various segments. Insufficient modernization is especially the case with dyeing and processing, weaving, garments, non-woven and technical textiles segments. Existing policies for modernization such as Technology Upgradation Fund Scheme (TUFS), and policy to attract foreign direct investment need to be properly designed to allow investments where they are most essential. This requires an understanding of the state of the textile and clothing industry so that relevant policy decisions are taken on the basis of facts and figures.

The Exim Bank study (2008) on "Indian Textile and Clothing Industry in Global Context: Salient Features and Issues", is a comprehensive empirical study covering the entire supply chain of Indian textile and clothing sector for an assessment of prospects for the industry in the light of global competition. The study focuses on market analysis of leading countries in exports and imports of textiles in the world, to draw lessons for improving the market share of India in major destinations for its exports, namely, European Union (27 countries), USA, and Japan. Other players whose export-import of textiles data have been examined are China, Bangladesh, Pakistan, Indonesia, and Turkey. Period for which data have been examined is the Post-quota period from 2005 till 2008. Analysis in respect of India is from a number of angles: multi-fibre based, textiles (including carpets), and clothing (readymade garments) segment-wise - mill sector, power looms, handlooms, hosiery, and processing enterprises. Export picture has been examined product group-wise, and destination-wise. The study highlights the competitive advantage India enjoys in the global environment with abundance of raw materials, strong production base, low cost and skilled labour, strong design capabilities, and pro-active government policies. The growth drivers for the industry are well established with growth in the domestic market driven by a large young population, rising household incomes, and increasing consumerism. The growth drivers for the industry in external markets include large fibre-base, presence in entire value chain – including niche segments, and cost competitiveness. The study suggests that India should concentrate more on improving its technology, and integration of industry. Apart from these, it needs to strengthen and develop its supply chain, soft skills, and infrastructure. The long term outlook for the industry is bright; and it would depend on proper implementation of appropriate strategies and the strategic response of the industry in different segments. Segments with high potential for exports in which sizeable foreign direct investment is to be attracted are: retailing of garments and fabrics, apparel manufacturing, manufacture of textile machinery, synthetic fibres, technical textiles, etc.

V. Padmanand and D.P. Jadeja's publication (2007), "Strengthening Industry Value Chains in Textile Clusters in India" deals with interventions in industrial and artisan clusters, largely in the micro, small and medium enterprise sector, consisting of conglomeration of the same or similar type of industry in a geographical area. The institutions pioneering interventions include the Textiles Committee of the Union Ministry of Textiles other such bodies. The authors have developed a thorough strategy framework to identify the value chains and related clusters;

conducting an environmental study of the selected value chains to capture dimensions such as policy, factor conditions, stakeholders, and firms' internal health; evolving and validating a vision, and preparing an action plan to bridge the perceived gaps; spelling out the implementation and its phasing and; monitoring and evaluating the performance.

Balaji (2008) in his article "Textiles: A Roadmap for Competitiveness in the Post-Quota Regime" presents the prominence of the textile and clothing sector to the Indian economy in view of its labour intensiveness, apart from its contribution to industrial output, and exports, highlights the challenges, and presents strategies for the post-quota regime. The phasing out of the textile quotas by developed countries have created free access to Indian textiles to enter the $150 billion US market, and the $120 billion EU market. In actuality, however, India has not been able to utilize the golden opportunity to the extent the potential favoured. China's share in global textile trade which was only 4% in 1980 has more than trebled to over 13% now; but India which had a share of 2% in 1980 is still tottering in the range of 2.5% to 3.0%. Consolidation to reap scale economies, investment in modern technology, revolutionary and non-incremental improvement in productivity levels, continuous innovations, focus on branding, building up marketing muscle, collaborative approach including vertical integration in the entire value chain, are a sine-qua-non for the success of the textile trade. Government has to play a key role in providing quality infrastructure, easing the flow of institutional finance, and creating an enabling environment for flow of foreign direct investment. Industry associations, along with the government need to constantly monitor the environment, and efficiently combat the protectionist tendencies of the developed world. These will go a long way in building the competitiveness of the sector.

2.2.4 STUDIES ON IMPACT OF FOREIGN DIRECT INVESTMENT (FDI) ON COTTON INDUSTRY

This part includes literature review regarding studies on impact of foreign direct investment (FDI) on cotton industry as below:

Grossman and Helpman (1991) examined economic growth from the viewpoint of 'creative destruction'. They point out that introduction of new technology (through foreign transfers, for example) renders an old technology obsolete, and firms can climb up in the 'quality ladders' of

technology by investment on research. Such investment would yield innovation in technology, which in turn would lead to faster growth. Implicit in this theory is the assumption that new technology is necessarily more efficient than the one it replaces.

Rajan and Zingales (1998) concluded that in countries with well-developed financial systems, industries that are naturally heavy users of external finance grow faster. They argue that this result has implications for trade patterns because well-developed financial sector is a source of comparative advantage for a country in industries that rely more on external finance.

Howitt (2000) builds a model, in which countries depend on each other only through technology transfers. He uses this model to show that in the presence of technology transfer, there is a permanent rise in the country's per capita income vis-a-vis other countries. In addition, there is a rise in the growth rate of world income. Theoretically, there is ample reason to explain the 'spillover' effects of FDI in a developing country. Empirical studies examining the 'spillover' effect of FDI on the host country do so by examining the effect of FDI on productivity and competitiveness in the domestic industry, as they are most amenable to measurement. The findings of empirical studies have been mixed, in the case of Canada.

Beck (2002) explores a link between level of financial development and the level and structure of international trade. He analyses theoretically a channel through which economy-wide level of external finance determines the commodity structure of trade balance. The Beck model focuses on the role of finance in mobilizing savings and facilitating large-scale and high return projects. He also finds empirical evidence supporting his model that a well-developed financial sector translates into a comparative advantage in the production of manufactured goods.

Sandhya Ananthanaryanan, Chandrasekhar Krishnamurthi and Nilajan Sen (2003) found in their study a strong evidence consistent with the base broadening hypothesis. The study did not find compelling confirmation regarding momentum or contrary strategies being employed by Foreign Institutional Investors (FIIs). It supported price pressure hypothesis. It did not find any substantiation to the claim that foreigners de-stabilise the market.

Tanushree Mazumdar and Vijay (2006) - The authors believe that the benefits (in terms of cost efficiencies, productivity and profitability) that a developing country reaps from FDI flows

depend on the motives behind the FDI flows. They hypothesise that a country is likely to gain more from efficiency seeking FDI flows than from market-seeking or resource-seeking FDI flows. The authors test this hypothesis with respect to India, using annual data and a distributed log model. Five sectors have been selected for the purpose of testing the hypothesis. Findings reveal that in India, FDI flows have not contributed significantly to the three parameters - cost reduction, improvement in productivity and profitability - in most of the sectors.

Debashis Chakraborty and Arup Guha (2007) felt that the usefulness of easing controls on capital flows in a country is a long-debated question. It is felt that the liberal capital control regime boosts the confidence of the international community on the domestic economy and becomes instrumental for ensuring higher capital inflows. On the contrary, it is widely held that controls on capital flows ensure a developing country against experiencing a sudden potential currency crisis. In the light of the current debate in India on the appropriateness of adoption of Capital Account Convertibility (CAC), the author examined the interrelation between current and capital account balance in the country. He also examined the macroeconomic scenario in order to explore whether the country has reached a stage to opt for full-fledged CAC. The empirical findings suggest that India should move cautiously in this regard.

Guangling Liu (2007), in his paper investigates the impact of the real effective exchange rate volatility on South Africa's exports for the period from 1978 to 2005. A General Autoregressive Conditional Heteroskedasticity (GARCH) model is used to measure exchange rate volatility, and the Johansen co-integration tests and Error Correction Model (ECM) are employed to analyses the long run equilibrium and the dynamic short run relationship between exports and the real effective exchange rate volatility. The empirical evidence indicates that exports is positively related to foreign income, and negatively related to the real effective exchange rate in the long run. However, in the short run, the real effective exchange rate volatility is insignificantly related to exports volume.

2.3 REVIEW OF LITERATURE ON BT COTTON

This review of literature includes the literature review on the BT Cotton study at development stage, domestic level as well as on international level.

2.3.1 ENVIRONMENTAL, HEALTH AND SOCIO-ECONOMIC BENEFITS FROM GROWING BT-COTTON

A broad review of literature related to the subject area of research has been made and presented. Literature review focusing the Environmental, health and socio-economic benefits from growing BT-cotton in various countries in the world as well as in various states in India. The research output on environmental, health and socio economic benefits of BT technology was reported in peer-reviewed scientific literature, conference proceedings, government and institutional reports market research, and company literature.

i. Conventional cotton farming in India

India is one of the major cotton producing countries, ranking 3rd after U.S.A. and China. Cotton accounts for 30 percentage of agricultural Gross Domestic Product in India and has the largest cotton area of 20 million acres (Sadasivappa and Quim, 2009). It provides livelihood to more than 60 million people in India by way of support in agriculture and activities such as processing agriculture cotton textiles etc. The productivity of cotton is substantially low compared to the area of cultivation in the other cotton producing countries. The main reason for low productivity is damage caused by insect pest *viz. Helicoverpa armigera*, commonly referred to as American Bollworm. About Rs. 12 billion worth of pesticides were used in India to control just the bollworm complex of cotton (Barwale *et.al.* 2004*).* Indian farmers often lose up to half of their entire cotton crop or sometimes the whole crop to the cotton bollworm (Huesing and English 2004).

Traditionally, the major obstacles for expansion of cotton yields have been the inadequacy of water and attack by insects. To overcome the damage caused by the insect pests, chemical fertilizers, pesticides, insecticides etc. were usually applied to the cotton crops. The excessive use of chemicals to control pest incidence, though increased yield levels within a short span, it has been the major contributor to environmental degradation as measured in terms of adverse effects on human health, soil and water quality, local biodiversity and ecological balance (Anon, 2010).

Pesticides being used in agricultural tracts are released into the environment and come into human contact directly and indirectly. Human beings are exposed to pesticides found in environmental media (soil, water, air and food) by different routes of exposure such as inhalation, ingestion and dermal contact. Exposure to pesticides results in acute and chronic health problems. These range from temporary acute effects like irritation of eyes, excessive salivation to chronic diseases like cancer, reproductive and developmental disorders etc. (Kong-Ming 2007). The number of sprays per crop season might vary from 5 to 20 or more. It is estimated that insecticides worth about Rs. 30 billion (US $ 660 million) are used annually in Indian agriculture of which about Rs.16 billion are spent for the control of cotton pests and of this `12 billion against bollworm alone. In terms of volume, about 54 percentage of the total insecticides used in Indian agriculture are sprayed on cotton crop. This indicates the economic importance of bollworms in general and *H. armigera* in particular. Despite such huge efforts, bollworm control was not successful because a pest like *H.armigera* had developed resistance to most of the currently recommended insecticides (Shanmugham et.al. 2007). This bewildering critical situation had led the farmers to a series of social and economic risks especially the small-scale farmers in developing countries like India.

BT-cotton came as a boon at a time when they were in deep dungeon of crisis and desperately looking for an alternative and dependable control measure. Keeping in a view of the economic importance of cotton bollworms and the benefits that BT-cotton can offer to the growers, MAHYCO (Maharashtra Hybrid Seed Company), a leading Indian seed company, took the initiative in introducing this technology into India in collaboration with Monsanto Company (Shanmugham *et.al*., 2007).

ii. Importance of genetically modified crops

Phipps and Park (2002), opined that the green revolution in India, which brought together improved varieties, increased use of fertilizers, irrigation and synthetic pesticides, is credited with helping to feed the current global population of 6 billion. In their paper, the authors explained the effect of pesticides to reduce crop losses and their potential negative effects on public health, with special emphasis on developing countries, and the environment. The response of the agricultural industry in bringing forward new technology such as reduced application rates

of targeted pesticides with lower toxicity and persistency was noted. It was also reviewed that, with increasing world population, a slowing of the rate of crop improvement through conventional breeding and a declining area of land available for food production there is a need for new technologies to produce more food of improved nutritional value in an environmentally acceptable and sustainable manner.

Joseph Huesing and Leigh English (2004) reported that the benefits of the GM crops are increased yield, reduced pesticide use, less environmental damage, less fungal contamination and reduced labor cost.

iii. Toxicity Studies on BT Cotton

Feed-safety studies with BT-cotton seed meal were carried out with goats, buffalos, cows, rabbits, birds and fish. The results revealed that the animals fed with *BT*-cotton seed meal were comparable to the control animals in various tests and showed no ill-effects. These studies were carried out by the Industrial Toxicological Research Centre (ITRC), Lucknow, National Dairy Research Institute (NDRI), Karnal, Central Institute of Fisheries Education (CIFE), Mumbai, Central Avian Research Institute (CARI), Bareily, National Institute of Nutrition (NIN), Hyderabad, and Govind Vallabh Pant University for Agriculture and Technology, Pantnagar. These institutions conducted research to assess the effect of leachate from BT-cotton plant on soil rhizosphere and non-rhizosphere micro flora, soil collembolan and earthworms. There is no difference between the soils where BT and non-BT plants had been grown. The information generated on pollen dispersal had established that airborne pollen transmission is limited to only a couple of meters and the risk of undesirable unprogressive hybridization with related species is minimal.

Further, BT-cotton hybrids are tetraploid in genetic composition where as their nearest relatives, the native cotton 'Desi' varieties, are diploid and hence genetically incompatible for hybridization. Studies on adverse impact of BT-cotton revealed that biological control agents like ladybird beetles, green lacewings and parasitic hymenoptera were not negatively affected.

Research studies were carried out to determine the levels of BT protein expressed in different tissues (terminal leaves, squares and bolls) at different ages of the crop and at different locations,

showed that although the expression varied between the tissues and also with the age of the plant, the amount of protein present in various tissues at any given time was adequate to bring about mortality of the early instars bollworms. Baseline susceptibility data was also generated for a number of geographic populations of *Helicoverpa armigera* so that it can serve as a benchmark for monitoring resistance, if any, in future. These studies were carried out, prior to commercial cultivation of BT cotton, by Project Directorate of Biological Control, (PDBC) ICAR, Bangalore. Field trials conducted from 1998 to 2001, indicated that BT-cotton hybrids provided effective control of the bollworm complex in all the locations and seasons.

iv. Development of BT cotton farming

The *Bacillus thuringiensis* (BT) transgenic cotton is rapidly leading in world agriculture (Ismael *et.al.* 2002). The introduction of commercial cotton varieties producing the insecticidal proteins is expected to improve grower profitability, reduce environmental pollution from synthetic insecticides, and increase worker safety (Gould, 1998; Gaser and Fraley, 1989). More than one million acres of insect tolerant cotton were used since commercial planting in China in 1997. The GM technology reduced both the cost of pesticide applications and exposure to pesticides (Guo *et.al.,* 1999, Zhao *et.al.,* 1999, Pray et.al., 2002). However, poor performance of the transgenic traits during boll period, variable performance between different regions was reported in China and the other cotton production regions of the world (Fitt *et.al.,* 1994, Matzke and Matzke, 1995, Zhao *et.al.,* 1999, Olsen and Daly, 2000). The loss of the efficacy was associated with a reduction of the insecticidal proteins (Finnegan and Mcelory, 1994, Benedict *et.al.,* 1996) attributed these differences to somaclonal variation and/or positional effects on Cry1 A gene expression, some have deduced the introduced genes were silenced or switched off (Stam and Kooter, 1997). Several researchers attributed that production of the toxin was influenced by plant age or reproductive stage, and a variety of environmental factors (Benedict *et.al.,* 1993, and Wu *et.al*., 1997). High temperature is one of the environmental factors to affect cotton development process (Reddy *et.al.,* 1992). The maximum temperature is usually at 36-40° C, the period of high temperature occurs for 6-10 days during cotton growing season in China (Miao *et.al.,* 1998, and Zhou, 1999), and resulted in senescence of leaves, abscission of bolls and reduced lint yield (Zhou *et.al.,* 1996).

The field investigation revealed that the reduction of the insect resistant efficacy for BT cotton was due to high temperature climate. Therefore the changed efficacy might be related with the high temperature. To ensure that resistance management strategies designed for use with transgenic cotton successful, the assessment of the insecticidal proteins expression by high temperature is necessary. The synthesis of the BT protein and its cycle in plant are also the physiological process of nitrogen metabolism which were controlled by several key enzymes such as NR, GPT, GOT, protease and peptidase and peptidase (Steward, 1965). The leaf insecticidal proteins content of BT cotton had close correlation with NR, GPT and protease activity (Chen *et.al.* 2003) indicated that the nitrogen metabolism of the BT cotton affected the BT protein content. The relationships between the toxin levels and the nitrogen metabolism under high temperature condition are important to illustrate the cause of the efficacy reduction.

Choudhary and Laroia (2001), stated that *Bacillus thuringiensis* (BT) is a naturally-occurring soil bacterium that produces a protein that is toxic to Lepidopteron insect pests. BT has been used widely by small scale and organic farmers in conventional sprays and is an environmentally benign pesticide. Using the tools of molecular biology, scientists had been able to introduce the gene for BT protein into cotton. These varieties are referred to as transgenic BT cotton varieties and are resistant to attack by lepidopteron insect pests (Barwale, 2005).

2.4 DEVELOPMENT OF TRANSGENIC COTTON IN INDIA

The Department of Biotechnology (DBT) of Government of India the primary agency funding research on transgenic plants in India. During the period 1989–1997, approximately Rs. 27 crores, *i.e.* nearly 4 percent of the total DBT budget was spent on projects for developing transgenic plants. In addition, other agencies such as Council of Scientific and Industrial Research (CSIR), Department of Science and Technology (DST), and Indian Council of Agricultural Research (ICAR) together provided support to the order of Rs. 7 corers towards (Ghosh, 2000) research on BT cotton in India that began since 1994.

According to Reddy *et.al. (*1999), the transgenic cotton variety had been developed at Central Institute of Cotton Research (CICR), Nagpur. The scientists at CICR developed two BT genes *viz.* Cry1Ab and Cry1Ac, directly into local Indian cotton varieties such as LRA 5166 and LRK 516 (Anjali).

i. Pesticides usage in BT Cotton farming

Perlak *et al.* (1990) stated that the Monsanto developed Bollgard cotton, commonly known as BT-cotton, a novel approach for the control of insect-pest injury in production agriculture. According to Gould (1998), if the area under BT transgenic increases, it will exert high selection pressure on target pest species and accelerate the buildup of resistance. Mann and Mullins (1999), observed that the BT-cotton varieties decrease overall levels of insecticide application for *Lepidopteron* pests. When supplemental insecticide sprays were applied, they have greater efficacy on BT than on non-BT varieties, showed that 54 percent higher insecticide efficacy was related to reduced bollworm feeding injury on BT cotton than on non-BT-cotton crops.

Gianessi *et.al.* (2001), estimated that from 1995, the year before *BT* varieties were introduced in 1999, the amount of insecticide used decreased by 1.2 million kg of formulated product, which represents 14 percent of al1 insecticides. In addition the number of spray applications per hectare was reduced by 15 million which represented 22 percent reduction. The Arizona Cotton Research and Protection Council (2000), had stated that BT cotton had helped to reduce insecticide use in Arizona State in USA BT-cotton farming to the lowest levels in the past 20 years. Julie *et al.,* (2001) observed that BT-cotton provides an effective method for Lepidopteran control that is safer to humans and the environment than conventional broad-spectrum insecticides, making BT cotton a valuable new tool in Integrated Pest Management (IPM).

According to Perlak *et al.* (2001) *Bacillus thuringiensis* (BT) cotton is increasing yields and reducing the use of insecticides and thus farmer's product costs in the USA. Jikun Huang et al. (2002) observed that the BT cotton continues to have positive environmental impacts by reducing pesticide use.

Additionally, it was observed that farmers had decreased health problems because of reduced pesticide use. Phipps and Park (2002), estimated that on a global basis GM technology had reduced pesticide use, with the size of the reduction varying between crops and the introduced trait. It was estimated that the use of GM soybean, oil seed rape, and cotton and maize varieties modified for herbicide tolerance and insect protected GM varieties of cotton reduced pesticide use by a total of 22.3 million kg of formulated product in the year 2000.

Barwale *et. al*., (2004) reviewed that the cotton is a very important crop in India and farmers were facing set back due to the challenge of losses due to various insect pests. The first genetically modified crop in India, BT cotton, was introduced to address bollworm infestation. The process of introduction of BT cotton took six years of experimentation, during which time agronomic, environmental, and bio safety data was generated and reported. The trials conducted prior to commercialization clearly established the superior performance of BT cotton, as demonstrated by increased yields and reduction in application of pesticides. Purcell and Perlak (2004) analysed that the BT-cotton substantially reduces the number of pesticide sprayings, which reduces worker and environmental exposure to chemical insecticides and reduces energy use. The quality of life for farmers and their families could be improved by the increased income and time savings due to farming of BT-cotton. These economic, environmental, and social benefits are being realized by large and small scale farmers alike in eight countries around the world.

Bennett *et.al.* (2005) suggested that official BT varieties (Mech 12 and Mech 162) significantly outperform the unofficial varieties. However, unofficial, locally produced BT hybrids can also perform significantly better than non-BT hybrids, although second generation (F2) BT seed appears to have no yield advantage compared to non-BT hybrids but can save on insecticide use.

Qaim and Janvry (2005), analysed that the effects of insect-resistant BT cotton on pesticide use increased the agriculture productivity in Argentina. Based on farm survey data, it was shown that the BT technology reduced the application rates of toxic chemicals by 50 percent, while significantly increasing yields.

Shankar and Thirtle (2005) found that the adoption of new BT technology greatly reduced pesticide applications but only mildly affected yields, when used by large-scale farmers in China.

Shanmugam et.al., (2006) revealed that the Integrated Pest Management (IPM) approach is essential for gaining higher advantage from BT cotton farming as it takes care of varying pest situation.

Torres *et.al*., (2009) reported that the transgenic cotton had significantly altered pest control in BT-cotton crop during the last decade. Cotton was one of the first widely cultivated *Bacillus*

thuringiensis (BT) insect-resistant and Herbicide-tolerant (Ht) transgenic plants. Over 300 transgenic cotton varieties expressing single or dual BT proteins targeting *Lepidopteron* larvae, as well as pyramided varieties with herbicide tolerance, were available to growers.

Sadashivappa and Qaim (2009) found that the BT adopting farmers realized pesticide reductions of roughly 40 percent, and yield advantages of 30-40 percent. Profit gains were at a magnitude of US $ 60 per acre. These benefits had been sustainable over time. Farmer's satisfaction was reflected in a high willingness to pay for BT seeds.

ii. Benefits of genetically modified (g.m) technology

Edge *et.al.,(*2001) emphasized that the direct benefits of BT-cotton farming to control insect pests include reduced use of broad-spectrum insecticide, lower farming risks and production costs, better yields and profitability, expanded opportunities to grow cotton and a brighter economic outlook for the cotton industry. The indirect benefits that arose from the use of the crop primarily stem from the reduction in broad-spectrum insecticide use where BT cotton is used for pest control. Reducing the use of broad-spectrum insecticides in cotton produces benefits that include increased effectiveness of beneficial arthropods as pest control agents, improved control of non-target pests, reduced risk for farm land wildlife species, reduced runoff of broad-spectrum insecticides, reduced fuel usage, lower levels of air pollution and related waste production, and improved safety of farm workers and neighbours.

iii. Prevention of Pesticide Usage

Phipps and Park (2002), reviewed on pesticide use in GM technology crops and concluded that GM technology had reduced pesticide use, with the size of the reduction varying between crops and the introduced trait. They estimated that on a global basis the use of GM soybean, canola, cotton and maize varieties reduced pesticide use by 22 million kg of formulated product in the year 2000. The consultants of Kline and Company had predicted that by 2009, herbicide tolerant and insect protected crops would contribute to an annual reduction of 20 million and 6 million kg of active ingredient respectively. In addition, transgenic crops would be sprayed less frequently. In reducing field operations in Canada with transgenic canola, farmers reduced diesel use by 31 million litres per annum (Canola Council, 2001). This reduced input costs by Canadian $13

million, and the decrease in diesel contributed to a reduction in emissions of carbon dioxide of 110,000 t. To obtain a complete picture of the potential of GM crops and decrease energy inputs, more complex calculations would be needed. These would include not only the different energy costs of pesticide production but also the fact that the use of less pesticide would require less raw ingredients and inserts less diesel fuel in the manufacturing process, less fuel for shipment and storage, less water and fuel used in spraying, of less packaging for their consignment and distribution to and within the agricultural sector.

iv. Environmental Benefits of Bt-Cotton Farming

BT cotton can substantially reduce the number of pesticide sprays, which can provide significant environmental benefits. A number of studies had demonstrated that insecticide sprays were reduced by using BT-cotton (Carpenter *et.al.,* 2002; Edge *et.al.,* 2001 and James, 2002). The farming of BT cotton in place of conventional systems could positively impact non target organisms (NTOs) and beneficial organisms by preserving populations (Head *et.al,* 2001, Smith 1997, Xia 1999). It is compatible with integrated pest management initiatives (Benedict and Altman, 2001). In addition, BT cotton adoption could provide secondary positive environmental impacts such as a) saving on raw materials needed to manufacture chemical insecticides b) conserving fuel oil required to manufacture, distribute, and apply such insecticides and c) eliminating the need to use and dispose of insecticide containers (Leonard and Smith 2001).

Huang *et.al.,* (2002) analyzed that the BT cotton would continue to have positive environmental impact by reducing pesticide usage. Brookes and Barfoot (2005), estimated that there were substantial net economic benefits at the farm level amounting to a cumulative total of $ 27 billion. The technology had reduced pesticide sprayings by 172 million kg and reduced the environmental foot print associated with pesticide use by 14 percentage. The technology was also significantly reduced the release of greenhouse gas emissions from agriculture, which was equivalent to removing five million cars from the roads.

According to Brookes and Barfoot (2006), the adoption of BT technology over the last decade resulted in 24.3 percent and 4.6 percent respectively reduction in the environmental impact associated with insecticide use on the cotton area using the technology. Mancini *et.al.,* (2007)

observed that the Integrated Pest Management (IPM) had been introduced in India to reduce the serious impacts of the use of highly toxic pesticides on people's health and the environment.

Wang *et.al.,* (2008), stated that the combination of BT cotton seed and other forms of biological pest control would help farmers reign the economic and environmental benefits by reducing the use of broad-spectrum insecticides in the BT-cotton farmers, reduced fuel usage and the number of trips across the field to spray for insect pests, positively impacting air pollution and related waste (Kern and Johnson, 1993).

v. Human Health Benefits of Bt-Cotton Farming

Huang *et.al.,* (2001) and (Qiao *et.al.,* 2001) stated the reduction in pesticide use can be linked to improved farmer health. In the past, a large number of farmers became sick due to pesticide applications each year. Pray *et al. (*2001) reported that the adoption of BT-cotton led to positive and significant economic and health benefits for poor and small scale farmers. Huang *et.al.,* (2003) demonstrated that the reductions in pesticide usage was likely lead to labour savings, more efficient overall production, as well as positive health and environmental impacts.

According to Caroline Cox (2001), Imidacloprid a systemic chloronicotinly insecticide, used for the control of sucking insects including rice hoppers, aphids, thripps, white flies, termites, turf insects, soil insects and some beetles. It is most commonly used on cotton, rice cereal, maize, potatoes, vegetables, fruit and cotton. This chemical works by interfering with the transmission of stimuli in the insect nervous system. It causes a blockage in a type of neuronal pathway. This blockage leads to the accumulation of acetylcholine, an important neurotransmitter resulting in the insects, paralysis, and eventually to death. Lovei *et.al.* (2005) found that BT toxins can affect non-target organisms also but not always and affected organisms are closely related to the intended targets.

Hofs *et.al.* (2006) observed that the adoption of BT-cotton led to a decrease in hyper thyroid but the level of insect resistance of this type of cultivation was not sufficient to drop this pesticide completely from the spraying programme. On the other hand, organophosphates were still being applied in substantial amounts, thus raising questions as to the impact of BT cotton adoption on farmer's health.

Jennifer (2007) reported that overall, BT-modified crops appear to be safe for Farmers and consumers. The proteins produced by BT had been used in sprays in farming techniques for many years with no ill effects on environment or human health.

The results of study by Wang et.al. (2008) show that the farming of BT-cotton increased the cotton growing area as well as farmer's income. The cotton net margin in one cropping cycle came out to be higher than the combined net margins of wheat and corn, in two cropping cycles. The income from the BT Cotton farming played a significant role in the investment on education, leisure and health care.

Shelton et.al, (2002) reported that BT crops had reduced the use of other insecticides. The potential ecological and human health consequences of BT plants, including effects on non-target organisms, food safety and the development of resistant insect populations, are being compared for and alternative insect management strategies.

vi. Socio-Economic Benefits of Bt-Cotton Farming

BT-cotton farming prevents the requirement of labour to apply the insecticide and potential benefits in terms of health given that the insecticides are poisonous (Kurunganti, 2004). James (2002), predicted that BT-cotton seeds are more expensive and therefore might increase farmer's costs. The countries where BT-cotton research had taken place includes South Africa (Ismael et. al., 2002a; Bennett et.al., 2003), Argentina (Qaim and De Janvry., 2002), Mexico (Traxler et.al., 2001), Indonesia (Manwan and Subagyo 2001), China (Yang et.al., 2005) and India (Naik 2001, Qaim and Zilberman, 2003; Qaim, 2003, Pemsl *et.al.*, 2004). All of these studies revealed that growing BT-cotton could reduce costs and hence improve the gross margin of cotton production. Some of these studies, in South Africa, had been based on farmers' practice while others were based on trial data on model predictions (Elbehri and MacDonald, 2004).

According to a study conducted in USA, more than 84 percent of growers who planted BT cotton in 1999 were satisfied with the crop, and more than 73 percent of BT cotton users also indicated that they were more satisfied with BT cotton than with a conventional cotton and insecticide program. BT cotton users considered the new technology a "good value" because it offered "cost

effective/efficient insect control" (40 percent of respondents) and "lower insecticide costs/input cost/cheaper insect control" (25 percent of respondents). In 1999, BT cotton users planted a majority of their field space (69 percentage) was with BT-cotton.

Edge *et.al.,* (2001) reported that studies in the USA, Australia, China, Mexico and Spain all demonstrated an overall reduction in insecticide sprays. Ismael **(**2002), analysed that BT cotton had higher yields than non-BT varieties and generated greater revenue. Seed costs for BT cotton were double those of non-BT, although pesticide costs were lower. On balance, the gross margins (revenue costs) of BT growers were higher than those of non-BT growers. (Huang et.al., 2002) analyzed the effect of BT cotton adoption in 1999 with two follow-up surveys conducted in the years 2000 and 2001. Their survey data on yields and econometric analyses indicated that the adoption of BT cotton continued to increase output per hectare in 2000 and 2001 and that the yield gains extended to all provinces in USA. More importantly, BT cotton farmers also increased their incomes by reducing their use of pesticides and labor inputs.

Gouse *et.al.,* (2004) reported that technology adoption would create income benefits for large and small-scale producers, input suppliers and consumers in developing countries. Liborio *et.al.*, (2004) analysed the significant farm-level benefits in various countries. They found that aggregate benefits depend on adoption rate and yield advantage of BT-cotton. These range from a low of US $ 7 million to a high of US $ 67 million in Mali; US $ 4 million to US $ 41 million in Burkina Faso; US $5 million to US $ 52 million in Benin; US $ 4 million to US $ 38 million in Cote d'Ivoire; and, US $ 1 million to US $ 7 million in Senegal.

Bennett *et.al.,* (2004) compared the performance of more than 9,000 BT and non-BT cotton farm plots in Maharashtra state in India during 2002 and 2003 growing seasons. They found that BT cotton varieties have had a significant positive impact on average yields and on the economic performance of cotton growers. Stephen *et.al*. (2006) evaluated that the BT cotton provided benefits in terms of higher yield and gross margin relative to farmers growing conventional (non-BT) cotton, and the benefits were particularly apparent for the smallest producers. BT cotton growers were also used significantly less insecticide than the growers of non-BT cotton.

Brookes and Barfoot (2006), analyzed that there had been substantial net economic benefits at the farm level amounting to $ 5 billion in 2005 and $ 27 billion for the last ten year period. The

technology had reduced pesticide spraying by 224 million kg (equivalent to about 40 percent of the annual volume of pesticide active ingredient applied to available crops in the European Union).

Qaim *et.al.* (2006) emphasized the main factors influencing the agronomic and economic outcomes of the BT cotton growers. They found that BT cotton adopted farmers got much yield and income. Apart from differences in pest pressure and patterns of pesticide use germplasm effects could play a pivotal role. Theoretical arguments were substantiated by empirical evidences generated from India.

Smale *et.al.* (2006) estimated that the economic returns were highly variable over years, farm type, and geographical location. Institutional and marketing arrangements for supplying the technology and marketing the product was the most important determination of BT impact at the farm-level even when the trait was shown to be effective.

Bennett *et.al.* (2006) reported that BT-cotton varieties have had a significant positive impact on average yields and on the economic performance of the cotton growers.

Gandhi and Namboodiri (2006) observed that the incidence of the pests was reported to be considerably lower in BT cotton as compared to non- BT cotton. The yields of BT cotton were found to be higher and the yield increase difference statically significant in all the states under both irrigated and rain-fed conditions. As a result, given the good market acceptance of the product, the value of output per hectare was higher in all the states and conditions.

Manda *et.al.* (2006) reported that the higher yields and reduced pesticide impacts were due to the effects of agricultural intensification. A two years farm scale evaluation of 81 commercial fields in Arizona of USA showed that use of transgenic *Bacillus thuringiensis* (BT) cotton reduced insecticide use, whereas transgenic cotton with BT protein and herbicide resistance (BTHr) did not affect herbicide use. Transgenic cotton had higher yield than non-transgenic cotton for any given number of insecticide applications.

Morese *et.al.* (2007) suggested that BT-cotton adoption households had generated significantly more income from BT Cotton farming than do not-adoption households.

Vitale and Boyer (2007) reported that an economic model was developed to predict the economic impacts to consumers and producers from the introduction of BT crops in the small holder cotton. The analysis concluded that the introduction of BT cotton increase the income levels of the BT cotton growers.

Rajinder *et.al.,* (2007) explained that the adoption of BT cotton, as a solution to curb losses caused by bollworms and to reduce the use of pesticide, successfully brought about a decline in pesticide consumption and expenditure, increase in productivity along with higher output-input ratio.

Vitale et al., (2008) reported that the insecticide sprays were reduced by two-thirds in the BT cotton plots. According to the economic model, *Bollgard II* remained profitable to the grower throughout the range of theoretical technology premiums evaluated ($ 0-75 per hectare) and was represented by economic gains of $ 79- 154 per hectare. The researchers also found that the results to the national scale of using an economic model which predict the economic impacts of introducing BT cotton in the Burkina Faso cotton sector. The results of the model shown that BT cotton would generate benefits of $ 106 per year under typical pest density conditions.

Bennett *et.al.,* (2008) reported that the economic benefits of GM crops at the farm level, possible effects on national economies and consumable considerations, the influence of instructions and policies and implications for biodiversity in developed and developing countries.

Morse and Bennett (2008) reported that little research has been undertaken to date on the impacts of GM adoption on household livelihoods. The results reported here aimed to analysed the livelihood impacts of the adoption of BT cotton in South Africa. The researchers studied 100 interviews of resource-poor farmers growing BT cotton in Makhathini Flats, South Africa. About 88 percent of respondents reported a higher income from BT compared to non-BT varieties and this higher income was utilized primarily for greater education of their children (76%), more investment in growing cotton (46%), repaying credits (28%), investment in other crops (20%) and spending money on themselves. Some 89 percent had increased their asset base as they gained higher income from BT cotton, primarily by increasing their cultivable land.

Brookes and Barfoot (2009) examined specific global economic impacts on farm income, indirect (non-pecuniary) farm-level income effects and impacts on the production base of the four main crops *viz,* soybeans, corn, cotton, and canola. The analysis showed that there had been substantial net economic benefits at the farm level, amounting to $10.1 billion in 2007 and $ 44.1 billion for the 12 year period (in nominal terms). The non-pecuniary benefits associated with the use of the technology have also had a positive impact on adoption (in the US accounting for the equivalent of 25 percent of the total direct farm income benefit).

Subramanian and Qaim (2009) stated that the impact of genetically modified (GM) crops on the

Poor people in developing countries is still the subject of controversy. While earlier studies have examined direct productivity effects of *Bacillus thuringiensis* (BT) cotton and other GM crops, but little was done to assess the wider socio-economic outcomes. BT cotton adoption increases aggregate employment with interesting gender implication. Likewise, aggregate household income rise, including for poor and vulnerable farmers, highlighting that BT cotton contributes to poverty reduction and rural development.

Pitorol *et.al.,* (2009) reported that the adoption of BT cotton technology by Mozambican cotton growers improved their economic status and resulted in a sizeable reduction in poverty. Reddy et.al., (2008) found that the cost of production of BT-cotton farmer's was reduced through adoption of new pest management technologies, such as Integrated Pest Management (IPM) that in the State of Andhra Pradesh in India. They estimated that the adopters of IPM could get higher yield as compared to non-adopters. These technologies have been found to generate more income as the adopters could earn ` 4072 per hectare when compared to the non-adopters and reduces the cost of plant protection by 27 per cent.

2.5 SPREAD OF BT COTTON: - INSIDER VIEW

The biotech industry and its supporters like to present it as a science-based industry whose reputation has suffered only because its scientifically validated claims have been undermined by emotional appeals and disinformation campaigns. In fact, the reverse is the case. And now here can that be seen more clearly than in India, where Monsanto has been using every trick in the book to promote its GM cotton seeds. The biotech industry and proponents of transgenic in

general and BT Cotton companies in particular are very often heard to argue that the rapid spread of BT Cotton in India is an indication of its success on the ground.

In punjab

Mr. Sakattar Singh Barar, Sarpanch of Gumti Khurd village in Kotkapura block of Faridkot district has a story to narrate. On 12th March 2005, soon after the GEAC cleared some BT Cotton varieties for the north zone, a Monsanto Mahyco van came into his village to publicise about BT Cotton. They said that they wanted to give information about the new seeds to farmers. They chose to do this by bringing along some dancer girls with them, who danced to the tunes played on the public address system

In Andhra Pradesh….

The company launched its product in 2002 by giving a big daawat to farmers in many villages. Chinnapu Reddy of Fatimapur village in Kothur mandal in Mahbubnagar had this story to narrate:

“The company guys and the dealers came right up to our doorstep to deliver the seeds. We should have known right then that something was wrong. One day, I came back to the village from the town to find a large gathering and much activity. There were also reporters from the local papers present. When I went closer, I discovered that this was about Bollgard seed. In this ‘function’, the discussions on the seed were held for one and half hours and more time was spent on a big feast. There was 95 kilos of non-vegetarian food cooked that day and there was biryani and chicken fry. On that very day, ‘bookings’ for the season’s seed supply were made by the dealers and the company representatives. When parties like that are thrown, farmers like me tend to think that there must be something to what they are saying and agreed to buy the seed. The seeds have now brought farmers nearer to the gates of suicide deaths again”.

Other farmers like Akki Ramulu of Mallapuram village in Kothur mandal also endorse these views. One farmer in Mallapuram said that after having eaten the food of the company, a farmer cannot refuse the seed (“vallu pettina buvva thinnaaka, vaari vithanam vaddantaama” – after having eaten from their hand, can we refuse their seed).

In states like Andhra Pradesh, Karnataka and Tamil Nadu, Monsanto-Mahyco Biotech is also known to have distributed free pesticides with BT Cotton seed! Advertisements of this “Scheme” had a title screaming. In addition to two kinds of benefits, two kinds of savings also the advertisement promises the following: "Now, in addition to the heavy savings you are making on the sprays that you would use for bollworm prevention, you can also save on expenses on pesticides used for sucking pests. The advantage of the booking: Please pay only Rs 200/- for booking two boxes of Bollgard MECH 12 and MECH 162 varieties. At the time of purchase of seeds, get one TATA MIDA (100 ml) completely Free. Get your booking done with your nearest seed dealer today. Make good use of the offer of 'two kinds of savings'".

“Marketing of BT Cotton in India – Aggressive, Unscrupulous and False”. In the 2005 sales season, free bags were distributed to people who had participated in village level publicity meetings in Khammam district of Andhra Pradesh.

The companies are also known to put out advertisements in local newspapers which have an uncanny resemblance to regular media reports (probably to lend them as much credibility as a regular news story). Interestingly enough, in many of these advertisements, relatives of seed dealers are showcased as successful farmers who have benefited greatly by the use of BT Cotton

Further, there are also many instances of farmers from one district being portrayed in advertisements that appear in other districts. Is this a way to prevent farmers from verifying the veracity of the advertisement since they cannot be bothered to travel long distances to check out the information put out by the company, we wonder. For instance, farmers of Warangal are lured by stories of successful BT Cotton farmers in Guntur and Medak district.

There is also a wide network of Agents placed at the village level, who are entitled to a small commission on the sales that they ensure by promoting the seed with fellow farmers. These are usually well-known influential farmers at the village level. We met a couple of such farmer-agents in Chintanekkonda village in Warangal district, who are well-recognized by other farmers in the village.

There is also a system of “advance bookings” of seed practiced in the state by the companies and seed dealer network. Here, farmers are warned of possible shortage of seed during sowing time

given the ‘high demand’ for BT Cotton seed all around – farmers, afraid of being left behind in the race, opt to pay a certain advance to the dealers in return for an assured supply of seed during sowing period.

In Maharashtra….

Many of the above practices are used to sell BT Cotton in Maharashtra too. Nana Patekar, a popular actor, has been used by the company in its television advertisements and posters in several states. Further, these advertisements were put out during prime time and before news bulletins. In addition, in Maharashtra, the company engaged him to address farmers’ meetings in several places, urging them to use BT Cotton.

Maharashtra also has other kinds of opinion leaders promoting BT Cotton. For instance, a religious leader called Sant Satyapal Maharaj is known to urge his followers to adopt BT Cotton in places

like Akola. It is not clear how the Sent, who is not a farmer, is vouching for the product.

In this state, dealers have been showing small video clippings of some cotton plots as BT Cotton plots to farmers who throng their shops. They tell the farmers who are watching that the video clippings are of BT Cotton and that Mr. XYZ has obtained very good yields from growing BT Cotton. Marketing of BT Cotton in India – Aggressive, Unscrupulous and False.

In Madhya Pradesh….

Posters appeared in many places in Madhya Pradesh before sowing time, featuring a person who claimed to have used BT Cotton seed the previous years with great benefits accruing from his BT Cotton crop. These advertisements urged “other farmers” to benefit similarly from the use of BT Cotton. Investigations revealed that this “farmer” was incidentally a “paan dabbahwala” (a petty shop owner selling betel leaves and cigarettes) who is not even a farmer, leave alone a BT Cotton farmer (Source: Charkha, July 2005)

In the same state, other posters had farmers claiming very good yields from growing BT Cotton. For instance, Ravinder Narain Patidaar of Sarangi village, Jhabua is shown in the poster as having obtained 20 quintals of yield per acre of BT Cotton. In reality, Ravinder Narain, who had

sown 3 packets of MECH 184 BT and 2 packets of MECH 12 BT has oBTained only 25 quintals for all the five acres of BT Cotton he had sown. He is aghast that the company is misusing the photos that were taken from him in this manner.

A third farmer called Pyarelal Patidaar (from Jamli village) also regrets the fact that his photo appears on posters which extol the virtues of BT Cotton – "I said do not put my photo because I do not think that BT Cotton is better than other varieties – however, they did not listen to me", he explains.

In Tamil Nadu….

A variety of marketing strategies are being adopted by the BT Cotton companies in Tamil Nadu also, our investigations revealed. And once again, suggestive false claims by Bollgard farmers seem to be the way to reach out to other farmers

A farmer called S Palanisamy s/o Chellapa Gounder Agarathodai of Vellaiyur of Salem district appeared on a poster proudly displaying a tractor that suggests that he had bought it after using BT Cotton. We went to investigate. At the beginning of this season, Mr. Palanisamy was approached by a company representative who urged the farmer to register for a contest that could take him to Mumbai. That is when the company took a picture of Mr. Palanisamy in front of a tractor. However, what the poster does not reveal is that the farmer was not informed that this photo was for an advertisement of Bollgard and that this tractor was in fact taken by the farmer on a private loan! The farmer says that "with the yields that I get from BT Cotton, I would not be able to buy

even two tractor tyres"

This episode, not surprisingly, appears on a poster called "TRUE STORIES OF FARMERS WHO HAVE SOWN BT COTTON" Marketing of BT Cotton in India – Aggressive, Unscrupulous and False. In Tamil Nadu, another method for popularizing and spreading the market for BT Cotton seems to be through "Bollgard Mandram" or Bollgard Clubs. Signboards of member farmers spreading the message of Bollgard appear all over many villages here.

Some of the other methods adopted here include: Booklet on Success Stories: Seed companies are using booklets of success stories that include last year's BT Cotton farmer photos and stories about their high yields and profits. The Companies are distributing these booklets to the farmers through seed dealers.

Village Meetings and Feasts: The companies conduct meetings in select villages and bring farmers from neighboring villages by arranging vehicles etc. Here, they provide food for the farmers and in some cases, a small per diem is also distributed. To gain credibility, the village head and influential farmers are also brought into the meetings where they put out their messages on the benefits of BT Cotton.

Advertisements: The companies are putting out advertisements in local newspapers, through cable television, in videos in private buses and even videos in haats (rural weekly markets). They also use vinyl (digital) hoardings and cloth banners. Four wheelers with advertisements and film songs go around the villages, publicizing BT Cotton amongst farmers.

Prizes: The BT Cotton companies gave gold and silver prizes to the top retail seed seller and top wholesale merchant for their sales in 2004.

Discount Schemes for Advance Bookings: The companies sell the seeds with a discount of around hundred rupees, for farmers who have booked seeds in advance. They also conduct some lottery draws for the pre-booked farmers - the prizes distributed are two-wheelers and school bags.

Free Gifts: The companies distributed a school bag each for 5 packets of BT Cotton as a free gift.

Handbills: The companies distribute handbills in temple festivals and village bazaars.

To sum up…

Unabashed by what science has been disclosing about the ineffectiveness of the BT technology, Monsanto's Indian subsidiary Monsanto-Mahyco and its sub-licensee BT Cotton seed companies have been busy hyping GM seeds to India's poor farmers as magical, as celebrity-endorsed and even as sexy Marketing of BT Cotton in India – Aggressive, Unscrupulous and False.

There's a striking contrast between the lavish nature of Monsanto's brash promotional campaigns in India and its flat refusal to pay any compensation to the farmers who have suffered often terrible

losses as a result of cultivating its seeds. Such aggressive marketing also means fewer and fewer choices in front of farmers.

In this context…

The Monitoring and Evaluation Committee [MEC] to monitor BT Cotton across the country was set up by Adivasi Ekta Sangathan, AKRSP, CEAD, Centre for Sustainable Agriculture, Grameen Vikas Trust, Greenpeace India, Jan Saahas, Kheti Virasat Mission, Krishnadevaraya Rythu Sankshema Sangam, Krushi, MARI, Navajyothi, Pasumai Tayagam, Prasun, Rashtriya Satyagrah Dal, Sampark, Sarvodaya Youth Organization, SECURE, VASPS and YUVA to monitor BT Cotton in the states of Andhra Pradesh, Madhya Pradesh, Maharashtra, Punjab and Tamil Nadu.

The MEC demands the following in this context:

a) That the aggressive and even false marketing of BT Cotton be stopped immediately
b) That the BT Cotton companies reveal the total amount spent on marketing the seed so far
c) That liability be fixed on the companies in all those cases where they resorted to unscrupulous and false marketing
d) That the governments pro-actively put out information to farmers about how to protect themselves from such companies

2.6 VOICES IN FAVOUR AND AGAINST:

The performance of BT cotton has been considered as satisfactory by government, farmers associations and a majority of BT cotton growers. After introduction of BT cotton in 2002 in India, a few studies were taken up by NGOs, independent researchers, anti-GM activists etc. which looked into the impact of BT cotton crop on different parameters. Of these, some studies found BT Cotton providing substantial positive benefits, whereas some studies reported concerns over impact on environment, bio-safely and health implications.

Voices in Favors of BT cotton:

The Indian field trials data demonstrated that BT technology can significantly reduce pesticide use and increase effective yields (Qaim 2003, ICAR 2002, and Naik2001).

The impact assessment study conducted by IMRB international used data of 3199 farmers spread over six States of India, reported that average per acre saving on pesticides worked out to Rs.1137 for BT Cotton. It also asserted that yield of BT Cotton was 8.02 qtl./acre as against 5.07 qtl./acre for non-BT Cotton. Average profit per acre was Rs.9610 for BT Cotton as against only Rs.3660 for non-BT Cotton.

Narayanmoorthy and S.S. Kalmakar (2003) of Gokhale Institute, Pune carried out a study on BT Cotton in Maharashtra and came out with observation that irrigated BT Cotton have better yield, higher net return, low pesticide cost. BT Cotton growers realized Rs.31880/hect. As against Rs.17790/hect. By non-BT Cotton growers. BT Cotton seeds cost is very high and unaffordable to small farmers. FAO released a report on GM crops in 2004 which painted a very rosy picture of BT Cotton. It said that BT Cotton gives higher yield, improves quality, and reduces pesticides cost and health risks from chemical pesticides exposure.

K. B. Patel (2005), an official of all Gujarat Cotton Producers' Association, said that BT Cotton is more profitable to farmers and farmers of Saurashtra region are switching from cultivation of groundnut to BT Cotton.

A survey conducted by A.C. Nielson ORG Marg (2004) found that BT Cotton yield was 30 per cent higher than conventional cotton. Number of pesticide sprays were less in bollgard than non-BT Cotton. BT Cotton increased farmers' net profit per acre by Rs.3126. BT Cotton lint fetched higher prices. About 90 per cent BT-cotton growers intended to repeat it in next season. Reduction in use of pesticides led to reduction in harmful effect on environment, soil, water and human life.

An impact assessment field study conducted (Gopal Naik, Qaim, A. Subramanian and D. Zilforman, 2003) in 4 States of India confirmed that BT technology generates positive agronomic as well as economic advantages. As compared to conventional cotton, spraying of pesticides was 2.6 times less in BT Cotton. The average per acre gross margins for BT Cotton was Rs.2161 higher than that for non-BT Cotton, a relative income gain of 69 per cent.

Assessing the impact of BT Cotton in China, Pray et al. (2001) observed that the BT cultivators could substantially reduce or eliminate the use of pesticides to control bollworm.

Edge et al. (2002) observed that BT Cotton reduces the number of pesticides sprays for caterpillar and lepidopteron pests. These additional benefits include reduced risk to growers' health, improved environment for beneficial insects and farmland wild life.

Vipin Patel (2005), President of Khedut Sangh, Gujarat, said that BT Cotton is not only increasing productivity and profitability, but it also provides results within 90-100 days as compared to 120-130 days by non-BT Cotton.

Shantharam of Swami Nathan Foundation in Chennai observed that BT Cotton is a huge hit. As per All-India coordinated cotton improvement project (2001-02), BT Cotton is more effective in controlling bollworm than their counterpart non-BT hybrid cotton. Boll damage was also very low in BT Cotton. The pesticides cost reduction was significant in BT Cotton.

Voices against BT cotton:

A study conducted surveying 450 farmers of Warangal district, A.P. and prepared by Abdul Qayum and K. Sakkari (2003) indicated that reduction in pesticides use in BT Cotton was insignificant, cost of cultivation was 10 per cent more and yield of BT Cotton was 35 per cent less than non-BT Cotton. About 71 per cent BT growers reported losses and 82 per cent non-BT growers reaped profit. The fibre quality of BT was inferior and fetched lower market prices.

Recently, a 20 member group of NGO conducted survey in several BT Cotton regions of India and found that BT seed failed to germinate in many places of Tamil Nadu. Further, wilt started in BT cotton fields in M.P. was found to be spreading. BT Cotton was found non-resistant to bollworm in a few cases.

Gene Campaign's study on BT Cotton in A.P. and Maharashtra had shown that 60 per cent of the selected BT Cotton growers in the selected regions suffered losses and they could not recover their investment.

As per paper published by Suman Sahai and S. Rahman (2003), BT Cotton reported premature dropping of bolls, number of bolls per plant was less in BT Cotton and fibre length was also shorter for BT Cotton. Yield of BT Cotton was lower.

The Central Institute of Cotton Research (CICR), Nagpur published paper which showed that India's BT Cotton technology is faulty and inadequate to protect crop from bollworm. BT Cotton seeds produced as hybrids which force farmers to buy seeds for every new planting. BT Cotton cultivation is taking place without mandated insect refuge management strategy.

A study conducted by K. Venkateshwarlu (2002) in Warangal district, A.P. indicates that non-BT cotton produced 30 per cent more than BT Cotton. BT Cotton farmers paid Rs.1150 more for seed per acre and price of BT Cotton was 10 per cent less in local market. The study indicated that claims made by BT Cotton seed companies were far from reality.

In some cases, new pests and diseases emerged and BT Cotton failed to prevent the bollworm attack. Many cases of BT Cotton afflicted with the "leaf curl virus" were found in northern States. In some cases, new pest and disease problems emerged.

The studies done by Greenpeace, Deccan Society and other researchers reported more or less poor performance of Bollgard.

2.7 REVIEW OF LITERATURE ON BT COTTON RELATED TO GUJARAT

This part includes literature review regarding studies on BT cotton at Gujarat level as below:

Gandhi et al.'s study (2007) carried out in Maharashtra, Gujarat, Andhra Pradesh and Tamil Nadu observes that adoption of BT cotton has resulted in significant reduction in cost of production as pesticide use reduced by as much as 36 per cent in Maharashtra and Andhra Pradesh. In Tamil Nadu it reduced by 50 per cent.

Lalitha and Ramaswami (2007) analyzing the pesticide use among the cotton cultivators in Gujarat during the kharif 2003-04, observed that approved BT varieties required as many as 6.3 number of sprays per hectare, while hybrids and unapproved varieties required an average of 5.9 and 4.6 sprays respectively. Desi cotton required the least of just 0.25 sprays. Of the total of 1926 sprays on the cotton crop, 35, 48 and 17 per cent have been sprayed against bollworm,

sucking pests and the other pests respectively. Thus, it emerges that during 2003-04 farmers had to spray an average of 1.8 times on sucking pests, as compared to 1.3 times on boll worm.

Pesticide Use Scenario in Gujarat: The survey revealed that of the total 1014.87 hectares of cotton land cultivated by the 200 farmers during 2007-08, almost 53 per cent was planted with unapproved BT varieties, followed by approved BT with 36.3 per cent and desi variety with 10.7 per cent of the land. Thus, BT adoption is nearly complete with 89 per cent of the area under BT cotton (both approved and unapproved). While majority of the BT cotton adopters have used the Bollgard 1 variety, 1 per cent of the total BT cotton land is under Bollgard II variety.

As per the biosafety regulations, companies selling BT cotton seeds are required to sell a small packet (120grams) of non-BT seeds referred to as refuge seeds along with the regular BT cotton seeds (which are packed together). The purpose of growing refuge is to delay the bollworm resistance to BT the refuge strategy is based on the principle that the dominance of resistance depends on the dose of transgenic toxin. Resistance is often dominant when the dose of a toxin is low, but recessive when the dose of a toxin high (Showalker et al., 2009). Hence, for effective protection, farmers are supposed to grow these non-BT seeds as a border to the BT cotton plot which is indicated in the form of a diagram in the short literature page that accompanies the seed packet. While the approved BT companies are required to sell this non-BT seeds as well, the unapproved seed sellers do Pesticide Applications in BT cotton Farms 20 Asian Biotechnology and Development Review not sell any refuge seeds. It has been demonstrated that wherever refuge is grown around the BT plot, resistance to BT is delayed (Qaim and Janvry 2005) and the technology. However, we found in our survey that only 27.8 percentage of the approved plots were planted with refuge (non-BT seeds), while only 3.8 per cent of the unapproved plots were planted with refuge.

2.8 REVIEW OF LITERATURE ON BT COTTON AT NATIONAL LEVEL STUDY

Subramanian and Qaim, (2008) these studies focused on insect resistant Bacillus thuringiensis (BT) crops, especially BT cotton, because this technology has been adopted by large no of farmer all over the world, The farmers got number of benefit from BT cotton these are insecticide savings, higher effective yields through reduced crop losses, and net revenue gains, in spite of higher seed prices. We show that BT cotton entails positive direct and indirect welfare

effects in rural economy of India. Using a microeconomic modeling approach and comprehensive household survey data, we found that the technology increases aggregate employment with interesting gender implications. Furthermore, it increases household incomes. Our results demonstrate that BT cotton contributes to poverty reduction and rural development.

Subramanian and Qaim, (2009) the impact of genetically modified (GM) crops on the poor in developing countries is still controversy. The previous studies have examined direct productivity effects of Bacillus thuringiensis (BT) cotton, little is known about wider socio economic outcomes. We use a microeconomic modeling approach and comprehensive survey data from India to analyze welfare and distribution effects in a typical village economy. BT cotton adoption increases aggregate employment with interesting gender implications. Likewise, aggregate household incomes increases, including for poor and vulnerable farmers, highlighting that BT cotton contributes to poverty reduction and rural development.

Narayanamoorthy and Kalamkar (2006) examined BT Cotton Cultivation Economically Viable for Indian Farmers. They showed that the costs of cultivation required for BT cotton crop were substantially higher than that of non-BT crop. Contrary to the claim made by the seed company, BT cotton had not reduced the consumption of pesticides. In fact, farmers cultivating BT cotton crop had marginally higher expenditures on account of pesticides. However, productivity was found to be substantially higher in BT cotton than that of non-BT cotton varieties. The cost efficiency as well as profit per hectare was also found to be higher with those farmers cultivating BT cotton crop. BT cotton variety suggested the need to introduce various policy measures to sustain and improve the performance of BT cotton cultivation in India.

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BT cotton crop. BT cotton variety suggested the need to introduce various policy measures to sustain and improve the performance of BT cotton cultivation in India.

In India, Kranthi et al. (2005) found that the commercial BT cotton hybrids introduced in the country, express less than the critical levels of Cry1Ac gene required for full protection against bollworms late in the season and in some plant parts. Hence, they observed that the "BT cotton hybrids in India may require more supplemental insecticide sprays than being used in BT cotton varieties elsewhere in the world". However, studies that have been carried out so far tend to analyses the pesticide use on BT vs non BT and have not focused on the varietal differences within BT or hybrids.

Qaim et al. (2005) and Indira et al.6 (2005) clearly bring out the advantages of BT cotton in pesticide reduction over hybrids and conventional cotton variety. In Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh, during the 2002 season, BT cotton required 2.6 times less pesticide sprays than conventional cotton, which had a positive impact on yield due to less crop losses. However, these savings in pesticide reduction did not compensate for the higher seed costs incurred by farmers on BT seeds (Qaim et al., 2005).

Pesticide Applications in BT cotton Farms Asian Biotechnology and Development Review Narayanamoorthy and Kalamkar (2006) analysed the performance of BT cotton in two districts of Maharashtra. Their analysis of inputs on Mech 184 and Mech 162 compared to other non-BT varieties shows that Mech 184 consumed less pesticide as compared to Mech 162 and both the BT varieties together consumed more pesticides than the non-BT varieties.

2.9 REVIEW OF LITERATURE ON BT COTTON AT INTERNATIONAL LEVEL STUDY

This part include literature review regarding studies on BT cotton at international level as below:

Chaudhry and Khan, (2009) conducted study in Multan on cotton production and the factors effecting on its. Total 100 samples were collected in that sample 60 small farmers, 25 medium and 15 large farmers was randomly selected from two Tehsils namely Multan and Shahabad of district Multan. The Cobb-Douglas Production Function is applied to assess the effects of various inputs like cultivation, seed and sowing, irrigation, fertilizer, plant protection, inter-culturing /

hoeing and labour cost on cotton yield. The Cost-Benefit Ratio for the large farmers was found higher (1.41) than that of small (1.22) and medium (1.24) farmers.

Bennett, Ismael1, Morse and Shankar, (2004) BT cotton adoption of smallholder farmers over three seasons (1998/99, 1999/ 2000, 2000/01) following adoption. The analysis presents constructs and compares GroupWise differences for key variables in BT v. non-BT technology and uses regressions to further analyses the production and profit impacts of BT adoption. BT cotton is monitored in terms of insecticide active ingredient (AI) and the Biocide Index. Results show substantial and significant financial benefits to smallholder cotton growers of adopting BT cotton over three seasons in terms of increased yields, lower insecticide spray costs and higher gross margins.sm, all holder obtained more benefit as compare to large farmer. Analysis using the Gini-coefficient is used to compare the income inequality advantage of BT cotton reduction in non-bollworm insecticide.

Gouse, Kirsten and Jenkins (2003) the adoption rate of insect-resistant cotton in South Africa can obtains of number of benefit. This article focuses on the reasons and effects of BT cotton adoption by large-scale and small-scale cotton farmers in South Africa and considers the impact of the adoption on yields, cost and profit. In addition the paper also analyses the production efficiency of adopters and non-adopters. Both large and small farmer obtained high yield. Who spot the potential benefits of the BT cotton seed.

Yilmaz and ozkan (2004) aim of this study was to examine the effect of land tenure systems on cotton production by using production functions. Data were collected from 64 cotton farms by face to face questionnaire method. Econometric analyses were carried out by using Linear, Cobb-Douglas, Semi Log, Exponential production functions. The data revealed that land tenure systems had no significant effect on cotton production. Moreover, the land tenure systems did not show any difference in cotton production technology pursued by farmers.

Cabanilla et al. (2005) used the estimated percentage difference in the yield and cost of production of BT and non-BT cotton in other countries. They provided an ex-ante Hazoor Muhammad Sabir, Safdar Hussain Tahir, Muhammad Bashir Khan 129 assessment of the impact of BT cotton in China using field trial data supplemented by a general equilibrium model.

Cabanilla, Abdoulaye, and Sanders, (2004) this paper provides estimates of the potential benefits from BT-cotton if introduced in West Africa. Our result shows significant farm-level benefits. Aggregate benefits depend on adoption rate and yield advantage of BT-cotton. These range from a low of US$7 million to a high of US$67 million in Mali; US$4 million to US$41 million in Burkina Faso; US$5 million to US$52 million in Benin; US$4 million to US$38 million in Cote d'Ivoire; and, US$1 million to US$7 million in Senegal. The reduction in insecticide use is an added environmental benefit. Non-adoption of BT-cotton in the region will ultimately result in non-competitiveness in the world market.

Arshad and Suhail (2010) Cotton jassid, whitefly and thrips are important sucking insect pests in cotton fields in the Punjab, Pakistan. The seasonal dynamics of these pests were compared on transgenic BT cotton line, There was no significant difference in population densities of these pests in BT and non-BT cotton, when nothing was sprayed. However, insecticide application effectively controlled theses pests in both BT and non-BT cotton. In conclusion, there is no difference in transgenic BT and non-BT cotton for jassid, whitefly and thrips attack and application of suitable insecticide is required to theses pests on transgenic cotton.

Smale et al. (2009) compiled a survey of 137 peer-reviewed studies conducted during 1996-2007 that examined the impact of biotech crops on farmers, consumers, industry, and international trade in developing countries. This literature is dominated by studies on BT cotton, indicating the importance of this crop in GM economic research. Of the studies, 63 analyzed the impact of insect resistant cotton.

Abdullah (2010) proved that popularity of BT cotton is growing at an exponential rate in Punjab, Pakistan. He viewed that BT cotton was not susceptible to the bollworm complex; however, the incidence of SBW remained consistent on BT cotton throughout the season without any significant change. BT cotton was not found to be resistant against sucking pests, especially the newly emerged MB pest. However, growth regulator was found to be a good choice for controlling the jassids and whitefly populations on BT cotton. The study can be further strengthened by extending the study period beyond 2006 for a year-to-year variability impact for general conclusions.

Nazli (2010) examined the four large cotton producing countries. She found that Pakistan was the only one that had not commercially adopted BT cotton by 2010. She analyzed the data collected through a farm household survey using structured questionnaires in January-February 2009 in two cotton-growing districts of Pakistan: Bahawalpur and Mirpur Khas. The economic impact of BT varieties was examined by addressing the issue of self-selection bias that arises when assignment is not random. The results of the qualitative survey identified the slow legislative process; cumbersome procedures for the development, approval, testing and commercialization of biotech products; lack of skilled human resources; and, weak research infrastructure as the major factors hindering the commercial release of BT cotton.

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Ahsan et al. (2011) identified the superior genotype with comparative growth and yield performance of four cotton cultivars namely, CIM-496, BH-162, VH-144 and BT- 121. They concluded that BT-121 is the most suitable cotton variety for good quality higher seed cotton yield. They recommended for general cultivation in arid to semi-arid tropics. No doubt BH-162 and CIM-496 yielded fiber with better staple length and fineness but unfortunately, agronomic performance of these cultivars was unacceptable which was likely due to several factors such as, susceptibility to virus infection, lack of ability to exploit a long season environment while tolerating intermittent periods of heat and drought stress. There is also a dire need to screen more genotypes and to verify their usefulness for cultivation in broader agro-ecological zones of the world as proved.

BT Technology and Its Impact on Pesticide Use Studies done elsewhere bring out the favorable impact of BT cotton in reducing the pesticide use. For example, assessing the impact of BT cotton in China,

Pray et al. (2001) observe that the BT cultivators could substantially reduce or eliminate the use of pesticides to control bollworm during the middle and late part of the season. Their study carried out during 1999 notes that majority of the farmers could reduce the number of sprays from 12 to 3 or 4 sprays. Hence, assuming that 320,000 hectares were under BT cotton cultivation, it had resulted in reduction in pesticide use by 15,000 tons. Their study observes that reduction has also occurred in organophosphates some of which have been banned due to their adverse impact on health and environment.

A recent study done in China (Huang et al., 2009) emphasizes that introduction of BT cotton led to significant decrease in the use of bollworm insecticide. However, late in the season some insecticides were required to be controlled which varied in magnitude in different locations. The

authors also note that BT cotton in China has been managed with a fairly stable but still quite a high level application of insecticides. They note that insecticide use could be further reduced through education and agri insurance. The authors found that BT cotton growers' insecticide use ratio at 10 Kg/hectare is higher than the optimum as farmers used more than what is recommended in the label.

Qaim and Janvry (2005) report that in Argentina, BT farmers on an average used 50 per cent less insecticides on their BT plots than on plots grown with conventional cotton. Almost all the reductions occurred in a highly toxic chemical, which emphasizes the positive effect of BT on the environment. In Colombia, use of BT cotton is not associated with a significant reduction in insecticide use. As Boll-weevil is the major pest in cotton in Colombia, BT growers spend more on insecticide than farmers growing conventional varieties (Patricia et. al., 2009).

In South Africa, on an average, BT variety reduced the number of insecticide sprays to three. Though producers of BT cotton still used insecticides to guard against pests such as aphids, jassids and thrips, yet the reduction of three sprays for bollworm would reduce the costs, amount of labour and the distance walked carrying the knapsack (Bennett et. al., 2006).

During the 2007-08 Kharif season, farmers reported more of sucking pests' infestation on cotton than bollworm. In fact, farmers reported names of 12 different sucking pests and six types of bollworm that affected the cotton crop in the entire season. Only 22 per cent of the farmers reported the occurrence of any new pests in cotton. Interestingly, among the new pests that the farmers had seen during 2007-08 season were the ones that they had never seen five years before. Mealy bug was the prominent name as reported by 77 per cent of the farmers. Mealy bug that belongs to the category of sucking pests is reported to be devastating in effect among all other types of sucking pests.

Seventeen of the top 40 cotton-producing nations in the world are located in Africa (ICAC, 2005). Although Mozambique is not in the top echelon of producing countries in Africa, the importance of cotton should not be underestimated; cotton ranks second in merchandise exports (Osorio and Tschirley 2003). BT cotton has engendered several large success stories and has endured several smaller setbacks during its first decade in farmers' fields. Yet exporters in Sub-Saharan Africa (SSA) and in Central Asia and Pakistan figure prominently on the BT cotton

nonparticipation list. Because of the intensity, depth, and severity of poverty in SSA, the cost of not deploying BT cotton could be very large (Eicher et al., 2006). Producers in non-adopting regions lose when technological change results in lower producer prices, and several modeling exercises show that cotton-growing households in Sub-Saharan Africa are no exception (Elbehri and Macdonald, 2004, Anderson et al. 2008, and Falck- Zepeda et al. 2007).

Indeed, Anderson and Valenzuela (2007) estimate that the opportunity cost of not deploying BT cotton in SSA is greater than the deleterious effects of subsidized production of cotton in the United States, Greece, and Spain on export earnings in SSA. As many as 20 studies have assessed the impact of BT cotton in SSA. The Republic of South Africa (RSA) released BT cotton to farmers in 1998, where 14 impact assessments on BT cotton have been carried out (Smale et al. 2006). The rest of the literature on the impact of BT cotton in Sub-Saharan Africa has centered on ex ante assessment in Francophone Africa where the major exporters of cotton in SSA are located. Yet cotton is also an important cash crop in several countries of Southern and Eastern Africa. This ex ante assessment adds to the literature in four important ways. First, we provide one of the few examples of ex ante BT cotton assessments in Southern and Eastern Africa outside South Africa. A second addition to the literature is the use of multivariate regression analysis to estimate the potential productivity impact of BT cotton. Third, we assess profitability using both financial and economic values to compare expected private and social profitability of the technology. Fourth, in view of the observed divergence between private and social profitability in the Mozambique case, we estimate the effect on poverty reduction if barriers to private profitability could be overcome.

2.10 REVIEW OF LITERATURE ON YARN AND FABRIC

This review of literature includes studies on yarn and fabric at domestic level as well as on international level are as follow.

Heinrich Firgo et al (2006) analyzed the comfort properties of single layered and double layered fabrics made of tencel/ polyester blended yarns in the face of the fabric and polyester as the skin contact layer. From the experimental results the authors concluded that tencel can be used effectively for the development of high performance sportswear provided that the fabric is carefully designed to maximize the contribution of the tencel to the performance of the fabric.

Friedrich *et al* (2002) presented a comparative analysis of thermal insulation properties of fabrics made of cotton and tencel with different weave structures. The fabrics made of tencel yarn showed lower values of thermal conductivity and thermal absorption and also higher values of thermal diffusion and resistance than fabrics made of cotton yarns. Twill woven fabrics made of lyocell have higher air permeability and thermal resistance compared to plain woven fabrics.

Thomas *et al* (2006) evaluated the skin compatibility of commercially available tencel textiles in patients suffering from atopic dermatitis or psoriasis in an everyday situation. The patients gave excellent scores for tencel textiles regarding improvement of itching, skin sensitivity, thermoregulatory properties, for its properties of cool, smooth and dry feeling, and for its compatibility with the local topical treatment. Hence tencel textiles significantly contribute to well-being also under dermatological conditions. From a dermatological point of view these textiles can be recommended not only for healthy subjects but also for people with sensitive skin or even patients with skin disease, especially atopic dermatitis or psoriasis (Heidelberg 2004).

Avinash (2005) studied about the drying rates of resin treated lyocell fabrics. Cheunsoon (2005) evaluated the physical and fabric hand characteristics of lyocell fabrics made with different wood pulps and stated that, the production of lyocell fibers and physicochemical traits play interrelated roles in making lyocell with desired properties.

Kuruvilla *et al* (2008) made an attempt to study the usefulness of Activated Carbon Fabric mask (ACF) to prevent lead absorption. Indigenous ACF masks were provided to eight workers involved in the manufacture of batteries and their blood lead levels were determined before and after using these masks. There was a substantial decrease in blood lead level after using the mask among those who were under treatment for high blood lead levels.

Han Chien Lin *et al* (2008), examined on the usage of the original bamboo vinegar collected from Moso bamboo (Phyllostachys heterocycla) at six different temperatures to increase the fungi resistance of bamboo.

Splendore *et al* (2010) evaluated the thermo-physiological comfort of a knitted polyester (PES) fabric which contains activated carbon particles in the back-side. The activated carbon particles, added in the PES extrusion process, give permanent attributes to the garment, such as odour

resistance, UV protection and evaporative cooling which makes the modified PES ideal for sportswear.

Brojeswari Das et al (2009) studied the moisture related properties of plain woven polyester/viscose blended fabrics with different polyester proportion, yarn count and twist, using a three variable factorial design proposed by Box and Behnken and concluded that proportion of polyester in the blended fabric affects the comfort characteristics of the fabric.

Nayak et al (2009) probed the effect of polyester content, pick density and weave on the thermal comfort and tactile properties of polyester/ viscose blended yarn fabrics for suiting, by measuring the low stress mechanical properties on Kawabata evaluation system and reported that increasing polyester content increased fabric hand but decreased fabric smoothness, softness, fullness and total hand value and increased thermal insulation and water vapour resistance.

Behera (2007) studied the handle and comfort properties of fabrics made of 100% linen and their blends with cotton and viscose, and reported that total hand value (THV) of linen fabric is higher than that of cotton fabric and blending of viscose and cotton improves the hand value of linen fabric

Tyagi (2009) sorted out the thermal comfort behavior of fabrics made of polyester /viscose and polyester/cotton ring and MJS yarns and states that the hydrophilic groups of man-made cellulosic component of the fiber mix governs the liquid moisture transport through capillary interstices in yarns and concludes that polyester/ viscose fabrics are more promising than polyester cotton fabrics for comfort applications.

Mukhopadhyay *et al* (2002) used KES to determine the effects of blend proportion on the comfort properties of polyester / viscose blended plain and twill suiting fabrics. Increasing polyester content decreased the total hand value and increased thermal insulation and water vapour resistance.

Sharabaty *et al* (2008) have explained about moisture transport through polyester/cotton fabrics stating that the hospital bed sheets are commonly produced from the mixture of cotton and PET fibers. These sheets become uncomfortable in humid days when cotton fibers become saturated

with moisture, producing uncomfortable sensation which may cause frictional festers on patient's skin.

Manas Sarkar *et al* (2009) developed a textile fabric simulating a plant structure with superb liquid water transport properties. He developed some novel weave structures, which emulate the branching structures of the plants and create a continuous water transport passing from the bottom layer to the top layer by interchanging the yarns from the bottom layer to the top layer. The connecting weave has an influence on capillary rise. Fabrics without connecting weave have the smallest wicking coefficient. When the density of connecting crossing is increased, wicking coefficient increases.

Shinjung Yoo and Roger Barker (2005) found that Heat-resistant fabric incorporating structural features that minimize skin contact, while also providing liquid absorption capacity, are predicted to show enhanced comfort performance. Blending of hydrophilic fibers and wicking finishes, however, do not necessarily improve the comfort perceptions in the tested scenarios.

Junyan Hu *et al* (2005) devised a new method and instrument called the moisture management tester to evaluate textile moisture management properties which could be used to quantitatively measure liquid moisture transfer of a fabric in multi directions.

Hasan et al (2008) elucidated that topographical characteristics of the fabrics strongly depend on their construction parameters such as the type and fineness of filaments, yarn fineness, yarn density, and consequently, the type of weave.

Brojeswari Das *et al* (2008) states that the moisture transmission behavior of a clothing assembly plays a very important role in influencing its efficiency with respect to thermo physiological body comfort. Part I of their paper deals with the processes involved in moisture transmission and the factors at play. Part II is concerned with selecting the measurement techniques which are of great importance in determining fabric factors that influence comfort.

Brojeswari Das et al (2008) carried out an experimental study on the effect of fiber cross sectional shape and fiber diameter on moisture transmission properties of the fabric. With the change in shape factor, fiber diameter and increase in fiber specific surface area, wicking rate through fabric increases, whereas water vapour permeability of the fabric reduces.

Jakub Wiener and Petra Dejlová (2003), proposed a model of wicking based on the simplified description of the thread structure considering the parameters like fineness of fibers, and number of fibers at the cross-section in the bundle and the filling.

Petrulyte and Baltakyte (2009) carried out investigations in liquid sorption and transport for three

different variants of terry woven structures. The study carried out by Kothari and Kausik Bal (2006) established a new approach to determine the blend proportion in polyester-viscose blends in woven fabrics. A new rapid conditioning method by drying the samples with infra-red and then conditioning them for a shorter duration was used to compare the moisture content values of different blend levels. In all cases, the moisture content values showed linear relationships with the proportion of viscose in the fabrics.

Adler and Walsh (1984) developed a technique to study moisture transport and made an effort to determine the mechanism by which moisture is transported between fabrics under transient conditions at low moisture contents. Wicking did not begin until the moisture content was high, more than 30% above regain for the woven samples.

Crow and Osczevski (1998), examined the interaction between water and a range of fiber types and found that, when made into fabrics, all fabrics pick up water, with a strong correlation between a fabric's thickness and the amount of water it picks up freely expressed in absolute terms rather than percent of its mass.

Scheurell *et al* (1985) tested the Dynamic surface wetness of fabrics and found a correlation with skin contact comfort in wear for a variety of fabric types and suggested that mobility of thin films of condensed moisture is an important element of wearing comfort.

Sukigara *et al* (1997) made an investigation into the sensation of wetness and dampness by both subjective and objective measurements.

2.11 REVIEW OF LITERATURE ON TEXTILES INDUSTRY

This review of literature include the literature review on the textiles industries study at development stage, domestic level as well as on international level as below.

2.11.1 REVIEW OF LITERATURE ON TEXTILES STUDY

i. Introduction

This presents a brief review of earlier studies related to textile industry Growth, Productivity, Technical progress, Efficiency and Productivity growth of manufacturing industries.

ii. Studies related to Textile Industry

Subramanian M.S (1992) studied the partial and total factor productivity growth of labour and capital, nature of returns to scale and estimate of the elasticity of substitution between capital and labour in cotton textile industry in Tamil Nadu during the period 1975-86. . It was found that partial factor productivity has increased at 2.42 per cent. The real wage of labour has also increased at the rate of 1.36 percent level and the capital intensity substantially declined by 24.50 percent per annum in the partial production of capital. The total factor productivity has also declined in the absence of technical progress in the cotton textile industry. The study suggested improvement in the quality of textile labour, massive investment in textile machinery, healthy industrial relations and use of appropriate technology for the better performance of textile industry in Tamil Nadu.

Balasubramnaiam and Salisu (1993) investigated the proximate reasons for the observed decline in employment in the UK textiles and clothing sectors during the period 1980-89. It provided estimates of important penetration, growth in demand and growth in labour productivity for the two industries groups. Utilizing the statistical techniques, the study analyzed and suggested that the growth in labour productivity rather than export penetration may be the principal reason for the observed loss of jobs in the industry groups.

Mohammad Jaforullah (1999) used Translog and Cobb-Douglas frontier production models to estimate production technology and technical efficiency for the Bangladesh handloom Textile industry. It was found that the technical efficiency of the industry in producing both was only 41 per cent. It was concluded that the industry might improve its technical efficiency by increasing its male/female labour ratio and yarn/capital ratio and decreasing as hired/family labour ratio and labour/capital ratio. The production technology of the industry was found to be characterized by

a linearly homogeneous Cobb-Douglas function. The elasticity of substitution between labour and capital for the industry was found to be unity.

Seshaiah *et al*., (2006) attempted to analyze the "Production Structure of the Indian Textile Industry" by estimating a translog production functions, in which capital, labour, energy materials and liberalization index are the input determinants. The study covered the period of 1979-2002 and a separate analysis carried out for the pre- (1979-1991) as well as post-liberalization (1991-2001) period. The results revealed that the post-liberalization growth in productivity was less than that of the pre-liberalization. The factors that influenced productivity are also identified and found the entrepreneurial skill ratios as negative and low throughout the period of study.

Bhandari and Maiti (2007) analyzed the efficiency of Indian textile manufacturing firms by using Translog Stochastic Frontier Production functions at firm-level on India's textile firms and estimated technical efficiency of firms. They found that the average technical efficiency varied between 68-84 per cent across the select years and individual technical efficiencies vary with firm-specific characteristics such as size and age. Further, public sector firms are relatively less efficient during the post liberalization period.

Kouliavstev *et al* analyzed the productivity, scale and efficiency in the US textile industry by using data for 23 sectors over 39 years (1958-1996). The study estimated Value Elasticity of Substitution (VES) production function. They found evidence in support of the use of a VES function and concluded that there were systematic differences among textile sectors' productivity and performance.

Chaudhary *et al* (2008) examined the effects of Multi-Fiber Agreement (MFA) quota elimination on Indian fiber market. The partial equilibrium model was developed using a theoretically consistent framework and incorporate regional supply response, substitutability between cotton and man-made fibers and appropriate linkage between cotton and textile sectors. Baseline projections were developed for supply, demand and prices of cotton, man-made fibers and textiles under a set of exogenous assumptions. The effect of MFA textile quota eliminations were introduced into the model by conducting the scenarios, i.e. increasing textile exports by 10, 20, and 30 percent from the base line annually. The results suggested that, on an average, cotton

imports rose by 4 to 8 percent annually, while the man-made fiber exports from India declined with opening of textile markets in the developed countries. The highest domestic cotton prices encouraged average expansion in cotton production in all the three regions in India, but not enough to meet rising demand under the condition of higher textile exports. The increase in cotton imports from India had little effect on world cotton prices.

Sasidaran and Shanmugam (2008) empirically investigated the implication of the global textile trade, following complete phasing out of the Multi-Fiber Agreement (MFA) in 2005, on the efficiency of the firms operating in the textile industry. By employing the Stochastic Frontier Approach, it estimated the overall and input specific efficiency values for 215 samples firms for the period from 1993-94 to 2005- 06. The results of the study showed that the average efficiency declined over the years indicating the presence of inefficiency in inputs. They further argued that the Indian textile firms failed to utilize their inputs efficiency during the phase of liberalization which, if done, would have helped them to withstand and overcome the intense competition from other players like China.

Anbumani *et al* (2009) estimated the impact of new textile policy (2000) and post- MFA regime on technical efficiency of Indian textile industry during 2000-07. They found a declining trend in the technical efficiency and negative technical efficiency change during 2000-07, implying negative impact of new textile policy on the technical efficiency of Indian textile industry.

iii. Studies Related to Growth

Nagaraj (1989) studied the trends in compound annual growth rates of textile industry during 1986-87 and concluded that unregistered units recorded a better growth rate (5.8 percent) than the registered units (3.3 percent) and total growth manufacturing was (4.6 percent) during the period under review.

Porter (1992) made a strong case for India's garment sector in the post-MFA regime and cautioned that in garments too, there is room for India to be complacent as there will be tough competition from countries like China which produces in a much larger scale using better technology.

Burange (1999) has made an attempt to analyse industrial structure and growth of the manufacturing sector in Maharashtra over the period from 1979-80 to 1994-95. The main data source is the Annual Surveys of Industries – Summary Results for factory sector (ASI), Economic Survey of Maharashtra and monthly Bulletin of Index numbers of wholesale prices in India. Using the Kinked Exponential Model (Boyce, 1986) the growth rate had been estimated for pre and post liberalization periods. His study revealed that the state was experiencing significant changes in industrial composition, where in capital and intermediate goods were becoming dominant.

During the period from1979-80 to 1994-95, the state realized a high growth rate in fixed capital resulting in decrease in employment. The rising capital intensity and thereby substitution of capital for labour, low growth rates of output and value addition did not indicate a satisfactory performance of the state economy. He concluded that there was a revival in the manufacturing sector in the post reform period.

Thirthankar Ray (1999) studied the growth and recession in small scale industry with special reference to Tamil Nadu power looms, using the examples of an export oriented weaving region. This study described the origin and conditions of the power loom industry, its major handicaps, how it tried to address its handicaps and what kind of policy initiative may be needed to deal with them. An export recession in 1996-98 showed that the growth had happened without basic changes in technological and organizational capability of the industry. The paper suggested that some change in organization and technology in the industry can be attempted to deal with the weakness of the industry.

Chandra (1999) recorded that the global textile trade regime is going to change drastically from the year 2005 with the phase-out of MFA. The Implications of the textile policies in the industry that have been improving their capabilities are the ones that are going to benefit the most. This study discussed the nature of competition that Indian textile firms are going to face domestically and abroad. Some of the characteristics of competitive firms that will emerge in the ensuing period are also indicated.

Uchikawa (1999) observed that the growth rate of Gross Value Added (GVA) is a good indicator of market conditions. As rapid growth of GVA in an industry generates expectation that the

industry will grow in the future, investment in the industry might increase. Gross value added and gross fixed capital formation of textile products including wearing apparel industry had grown throughout the 1980s and their growth rates of GVA and GFCF accelerated in the 1990s.

Goldar (2000) studied the growth rate of gross value added (at constant prices) for different two-digit industries and reported that the growth rate of GVA in Indian manufacturing sector was 8.67 per cent in 1980s and marginally declined to 7.43 per cent in 1990s. The growth of Indian textile products fell to 10.44 percent during 1990-97 as compared to 14.63 percent during 1980s.

Uchikawa (2001) has shown that there was a sharp acceleration in gross investment in the first half of the 1990s. The gross fixed capital stock in ASI industries increased at the rate of 10.1 per cent per annum at 1980-81 prices. A regression equation estimated for the time-series of capital stock showed that a multiplicative dummy for the post-1990 period was significant at the 5 per cent level, confirming the acceleration of investment after the economic reforms.

Bernard Sinclair-Desgagne (2002) examined "Endogenous Aspirations and Economic Growth". The various "theories of endogenous growth" that were elaborated over the last fifteen years have considered some indisputable "engines of growth," such as product and process innovation, market structure, human capital, and public infrastructure. This note submits that economic growth might depend all soon somewhat less tangible socio-economic and psychological factors such as the way the "aspirations" of economic agents, which influence their inter temporal consumption, evolve over time. It is shown that capital accumulation can be sustained in a standard endogenous growth setting, where aspirations are exogenous and constant, while it may not, aspirations can instead change with the per capita stock of physical and human capital.

Unni *et al*., (2001) analyzed the trends in growth and efficiency in the utilization of resources in the Indian manufacturing industry before and after introduction of economic reforms. It used a comparative analysis of all India figures with Gujarat, one of the most industrial advanced states of the country. The study shows that both the organized and unorganized sectors in Gujarat seemed to be doing better than the all India average in terms of growth of value added. Growth in the manufacturing sector in Gujarat was also more efficient than average all-India growth after the reforms were introduced. Gujarat's strategy of physical infrastructure development, leading to industrialization, had been the main reason for the growth of the state's manufacturing sector.

Sahnmugam and Bhaduri (2002) analyzed size, age and firm growth in the Indian manufacturing sector using balanced panel of 392 manufacturing firms during the period from 1989-1990 to 1992-1993 to explore un observed heterogeneity among the firms. The result of their study indicated that the age positively influences growth, which was in contradiction to the result obtained in previous studies. The findings of the study also indicated that the smaller and older firms grew faster than their counterparts. Size effect was found larger in food industry while the age effect was larger in non-metal industry.

Pulapre Balakrishnan and M. Suresh Babu (2003) discussed "Growth and Distribution in Indian Industry in the nineties". In a study of the evolution of the Indian manufacturing sector over close to three decades, the annual average rate of growth in the nineties is found to have risen almost across the board at the two-digit level of industry. Nevertheless, the acceleration is not particularly impressive for what is often hailed as the most significant policy-regime shift since 1950. There is a hefty rise in investment, however, though without a corresponding increase in its efficiency. And distribution has shifted sharply with labour's share declining. Their study attempts to link these developments in a coherent way.

Balakrishnan and Babu (2003) found that the annual average rate of growth in the nineties had risen almost across the board at two digit level of industry. Nevertheless, they argued that the acceleration is not particularly impressive for what is often hailed as the most significant policy regime shift since 1950.

Nagaraj (2003) found from his study that while the total manufacturing gross value added grew at over 8 percent per annum in real terms during 1981-87, the registered manufacturing segment recorded a growth over 10 per cent per annum with reference to National Account Statistics (NAS) data 1989. Further, he observed that, since 1980-81 manufacturing sector output has grown at 7 per cent per year, with economic reforms making little difference to the trend in the 1990s and growth has decelerated over the last seven years after peaking in 1995-96.

Narayanan (2003) examined the determinants of the growth of firms in automobiles. It underwent rapid technological change and saw the entry of new firm in the liberalized era. His sample covered the period 1980-86. The study identified two policy changes during the period, namely, partial deregulations introduced in 1985 and liberalization measures launched since

1991. Consequently, three sets of regressions were presented for three periods – licensing from 1980-81 to 1984-85 deregulations from 1985-86 to 1990-91 and liberalization 1991-92 to 1995-96. Firms in the automobile industry witnessed a change in basic technology configuration of the production process during the sample period. The study used two-way fixed effect estimation of the growth function. The results of estimated model support the hypothesis that inter-firm differences in growth were determined mainly by variables capturing technology paradigm and trajectory shifts. Thus he concluded that the growth was mainly technology driven.

Arvind Panagariya (2004) in his paper "Growth and Reforms during 1980s and 1990s" argued that reforms in India cannot be credited with higher growth because growth rate had crossed the 5 per cent mark in the 1980s, well before the launch of the July 1991 reforms. This is a wrong reading of the Indian experience for two reasons. First, liberalisation was already under way during the 1980s and it played a crucial role in stimulating growth during that decade. Second, growth in the 1980s was fragile and unsustainable. The more systematic and systemic reforms of the 1990s discussed in detail, gave rise to more sustainable growth. The paper concludes with a discussion of why the growth rate in India nevertheless continues to trail that of China.

C. Veeramani (2004) in his study "Growing Intra-Industry Trade in Manufacturing Industry – Implications of Policy" presents disaggregated estimates of the level of intra-industry trade in the Indian manufacturing sector. In this study, the intensity of intra-industry is measured by the well-known Grubel Lloyd index. The analysis in this study reveals significant growth of intra-industry in large number during the post liberalization period. The apprehension expressed by some researchers that trade liberalization would lead to the demise of India's domestic industries is, for the most part untenable. Export promotion strategies should aim at the exploitation of comparative advantages at the finer industry level rather than targeting broad sectors.

Mazumdar and Sarkar (2004) showed that there was substantial increase in the Fixed Capital of manufacturing industries from Rs. 16.74 lakh crores in 1980-81 to Rs. 239.28 lakh crores in 1995-96 and investment rate from 15.57 percent to 54.92 percent respectively. The index of real capital growth had also zoomed to 280 in 1995-96 from 174 in 1980-81.

Rani and Unni (2004) reported that the growth rate in fixed capital of organized sector for the period 1989-95 was 13.56 percent and it marginally declined to 12.09 percent during 1994-2000.

Whereas in unorganized sector it was 5.25 percent during 1989-95 and increased to 6.39 percent during 1994-2001. In particular, the fixed capital growth rate in organized textile industry was 14.75 percent during 1989-95 and declined to 13.29 percent during 1994-2001. The scenario was entirely different in the unorganized sector via; 5.62 percent during 1989-95 and 4.28 percent during 1994-2001.

Landes *et al*., (2005) analyzed the growth prospects for India's cotton and textile industries. They argued that the demand for cotton and manmade fibers India will strengthen, in response to rising consumer demand in India and increased exports of textiles and apparel, the removal of the Multi-fiber arrangement quotas.

Nagaraj (2005) compared the performance of the manufacturing sectors in China and India over the past half century at a disaggregated level. He found that China's industrial growth rate is close to one and half times that of India's over the entire period, with the gap widening gradually. But Indian growth has been more stable. China's superior performance seems understandable in terms of its faster agricultural and exports growth. China's impressive industrial edifice seems to be built on somewhat shaky microeconomic and institutional foundations. In comparison, India's relatively strong foundations and domestic entrepreneurial capital seem to have the potential to improve performance, with a sounder macroeconomic environment: a step up in fixed investment to augment infrastructure supply and agricultural productivity, revival of long-term finance to boost industrialization, and easier credit delivery to small and medium enterprises.

Ratan Kumar Ghosal (2006) in his study "Augmented Solow model of Growth and its Empirical Relevance" Solow model by incorporating human capital in the form of education and health and established its empirical validity in explaining cross-country differentials in the level and growth of real per capita income for two separate periods. It is found that physical capital; human capital and growth of population together explain a highly significant proportion of cross-country differentials in real per capita income. Further, we find a mixed result from the test of convergence in Solow model and its augmented form. It concludes that the endogenous growth models do not make Solow model redundant..

L. G. Burange (2006) in his articles “Industrial Growth and Structure; Manufacturing Sector in Maharashtra” efforts are made to analyze industrial structure and growth of the manufacturing sector in Maharashtra with as much disaggregation as possible. The share of the state in the country’s industrial sector has declined. The share of the secondary sector in state domestic product is stagnating at around 33 percent to percent, while the share of the tertiary sector increasing. The share of consumer goods in value added declined to less than 20 per cent while the share of capital and intermediate goods industries increased to more than 80 per cent over the period of 36 years. The industrial recovery is clearly experienced by the state during the post-liberalization period.

Sampath Kumar (2007) in his commendatory on “Economic Reforms and Industrial Growth- a Regional Perspective” examines the changes in the structure of industrial sector in the four southern states of India viz, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. The study attempts to analyze and compare the structural changes in the industrial sector in the southern states of the country in relation to the ongoing economic reforms of the country. The Divisia-Tornquist (D.T) approximation has been used for the calculation of total factor productivity growth. The increase in capital-labour ratio and a declining the output-labour ratio in the post reform period, at the aggregate and state level, indicate the availability of more capital and relative increase in the labour productivity

Balakrishnan and Parameswaran (2007) studied the economic growth in India and by testing multiple structural breaks to identify phases of growth in India since 1950. The noteworthy feature of the methodology allows the data to parameterize the model, thus the results that are immune to the prior beliefs of the researcher. Their results revealed that there were two growth regimes in India since 1950. Further the study decomposed economic growth by sectors and the contributions to the change in the growth rate across these regimes were estimated. The results of the study indicated little role for a liberalized trade and industrial policy having been the trigger of a new growth dynamic in India via faster manufacturing growth, at least up to the mid-1990s.

Kaur (2007) argues that there is no denying the fact that reforms ushered in a new era of growth and development. The liberalized policies adopted since 1991-92 not only accelerated the overall growth rates but also develop the confidence of foreign investors in the Indian industry.

Sheila Devi (2008) in her study "A Disaggregated Estimation of Growth and Total Productivity in Traditional Industries in India 1973-74 to 1979-80" with reference to ASI data, she has taken into account seven manufacturing industries including basic metal and alloys of three digit level classification. To examine the trends and pattern of growth by analyzing (i) number of industrial establishments, (ii) net fixed capital stock, (iii) employment, (iv) emoluments paid to workers and (v) value added. The conclusions are: the employment growth was about 50 per cent lesser than the growth in capital stock, a more consistent growth in capital stock, value added, emoluments and employment.

Nagaraj (2008) found in his study that there has been a turnaround in Indian manufacturing since 2002-03, ending the period of deceleration that lasted for seven years since 1995-96. The annual average growth rate in manufacturing between 2002- 03 and 2006-07 was 8.8 percent, up from 5.6 percent during previous years. The study ascertained that there is no unanimity among the researchers regarding the impact of reforms on growth of Indian manufacturing.

Kannan and Raveendran (2009) pointed out that, in terms of output growth, all the manufacturing industries seem to have done quite well, many of them registering double digit growth rates during the post-reform period. Unlike, in the case of employment no polarization is discernible. The growth rate of GVA in Indian textile industry was 4.33 per cent during the period from1981-82 to 1991-92 and increased to 5.34 per cent in the period between 1992-93 to 2004-05.

iv. Studies Related to Liberalization and Productivity

Solow (1957) in his study on technical change and aggregate production function has estimated the rate of disembodied technical change for the US non-firm output by covering the period 1909 to 1949. The rate of disembodied technical change was found to be 0.05 representing a trend increase of the order of 1.5 percent per annum. On the whole study pointed out a labour deepening process characterizing the US non-firm and has exerted a great deal of influences in the process of output during the reference period.

Krueger and Tuncer (1982) estimated the growth rates of factor productivity for two-digit manufacturing industries in Turkey during the period 1963-1976. The estimates were presented

separately for both public and private enterprises in each industry. The study hypothesized that Turkish manufacturing have experienced a decreasing rate of TFP as import-substitution policies pulled resources into increasingly inefficient, high-cost industries and also that periods of highly restrictive exchange controls would have been periods of lower TFP than periods of relative liberalisation. The study found some support for the hypothesis that highly restrictive exchange control regimes may result in lower rates of increase in output per unit of input than more liberalised regimes. It was also found despite the fact that the rate of growth of TFP was about the same in the public and private sectors; absolute levels of inputs in the public sector enterprises are much higher than in their counterparts.

Deepak Gupta (1985) made an attempt to study the productivity trends and factor substitutability in manufacturing sector in Maharashtra during the period from 1968- 69 to 1977-78 with reference to ASI data. He used the Kendrick's measure of total factor productivity as well as the Cobb- Douglas production function. He concluded that the wage rate has fallen, though the rate of return has increased that is the price of labour has fallen relative to that of capital.

Rajalakshmi (1985) studied the production function analysis of public sector transport equipment- industry in India. The study, analyzed the public sector transport equipment industry at aggregate level, comprises of nine individual industries which include road transport, rail transport, ocean transport and air transport equipments. The study concluded that the performance records of the public sector transport equipment industry seemed to be unsatisfactory and unimpressive during the recent years.

Goldar (1986) analyzed the productivity trends in the Indian manufacturing during 1951-78. The estimates of productivity for two periods showed that the total factor productivity in the Indian manufacturing sector was rather sluggish and relative contribution of TFP growth was quiet small. The average annual growth rate of TFP growth to output was about one quarter for the first period and one-sixth for the second period.

Ahluwalia (1991) made a detailed study of the trends in productivity growth in the Indian manufacturing sector. Her study covers the period from 1959-60 till 1985-86. She computed the Chenery measures of the contribution of import substitution to growth for 62 industry groups of manufacturing. Using this measure as an explanatory variable in an equation explaining growth

in productivity, she addresses the question of whether total factor productivity growth across the industry groups is systematically related to the degree of import substitution of these industries. The study established a negative relationship between total factor productivity growth and a Chenery measure of import substitution. She concluded that the protective impact of import substitution dominates any market expanding impact on productivity growth.

Mona Haddad (1993) estimated the effects of trade liberalization on firm level total factor productivity in Morocco industry using panel data for the period 1984-89. The effects of trade liberalization on TFP were estimated using various measures of firm level productivity. The results of the regressions linking trade and market structure variables to productivity showed little variation across different TFP measures. In all cases, the study found a strong positive correlation between trade openness, as measured by export share in sales and import penetration, and firm level TFP. Moreover, by separating the samples into protected and unprotected sectors using the average tariff criterion, the results remained unchanged in terms of the signs of the coefficients of trade variables; although a difference in the magnitude of these coefficient was noticeable across the two categories. The study concluded with reasonable confidence that trade openness has had a significant positive impact on firm efficiency in the Moroccan manufacturing sector, the effect being present in all the models in a robust manner.

Fujita's (1994) main objective was to evaluate the effectiveness of liberalization policies in Indian manufacturing industries. Productivity growth rates of manufacturing industries in India were computed for the period from 1981-82 to 1987-88. The study found that the liberalization policies had improved the productivity of the manufacturing industries, and the improvement of the productivity led to the expansion of export of new products. It was also observed that productivity growth rates of most labor-intensive industries were higher than those of capital intensive ones. Since the TFP growth appeared to be affected by liberalization policies, an attempt was made to test the hypothesis of association between liberalization policies and TFP growth. The share of public sector in value added was used as a proxy for trade policy, as the increase in the share usually reflects restrictions on attempts at liberalization. A negative relationship was obtained and the conclusion drawn was that TFP growth decreased.

Tarlok Singh (1996) analyzed Total Factor Productivity in the Manufacturing Industries in India for the period from 1973-74 to 1993-94 The data were collected from various issues of the Central Statistical Organization (CSO) publications viz. National Account Statistics and Annual Survey of Industries, the Reserve Bank of India (RBI) publications viz. Economic Survey and Index Numbers of Wholesale Prices. The total factor productivity was computed in levels using the Solow's residual for different industries in the manufacturing sector in India. He concluded that the TFP in the Food product industry recorded trend growth rate of 2.68 per cent during the overall period 1973-94. TFP recorded improvement in all the sample industries, except for the basic metals industries. The highest growth in TFP was observed in the case of the Food product industry.

Salim and Kalirajan (1997) studied capacity realization and productivity growth for Bangladesh

food processing industries for the period 1981- 1991. Data were derived from the Census of Manufacturing Industries (CMI) conducted yearly by the Bangladesh Bureau of statistics (BBS). Random coefficient production function was used to estimate firm-specific capacity realization indices. They concluded that there was wide variation in capacity realization among firms, though some experienced significant improvement over the sample period.

Deb Kusum Das (1998) made an attempt to examine the view, whether changes in trade policy orientation enhanced TFP growth for 76- three digit industries in Indian manufacturing covering the period from 1980-81 to 1993-94.The TFP growth rates for the sample industries are documented for two different phases of trade reforms, viz. (i) a slow trade liberalisation period ranging from 1980-81 to 1985-86 and (ii) rapid liberalisation period from 1985-86 to 1993-94. The study has dealt with two aspects- first, what was the position regarding TFP growth in the two trade reform regimes and second, did the trade policy reforms captured in terms of the import penetration rate and export-output ratios, contribute to TFP improvements. To measure the productivity growth at industry level, the study used a methodology proposed by Jorgenson et al (1987). The study found that a number of industries recording positive growth in both periods. In terms of improvements or decline over the phases, the study found that around 35 industries has a beneficial impact and in other 27 industries the performance has worsened. It is evident that the impact of trade liberalisation was mixed.

Mitra (1999) explored the factors explaining the inter-state variations in the TFP growth in Indian manufacturing sector by utilizing various socio-economic variables. He used 'Within' estimation procedure for capturing TFP growth. Both value added and gross output specifications of production for each of the 17 industry groups using both Cobb-Douglas and Translog specification have been estimated. He concluded that TFP growth in a large number of industries had improved across most states during the period from 1985-86 to 1992-93 as compared with the rates estimated for the period 1976-77 -1984-85.

Nambiar R.G, *et al* (1999) have tried to assess the impact of import liberalization on domestic industry and employment. They say that free trade encourages economic activity and hence raises production and employment. They made an attempt to examine this with the statistical evidence. This study is based on secondary data collected from Annual survey of Industries, published by CSO and Economic Survey. The study found that trade liberalization has since shrunk India's manufacturing base both in terms of value addition and employment. The adverse impact of import liberalization is more pronounced in intermediate and capital goods industries and their erosion had a direct negative effect on value added and employment.

Ramaswamy (1999) studied the comparative performance of Indian manufacturing industries during relatively recent periods of domestic regulation and de-regulation of plant entry. The growth of labour and Total Factor Productivity Growth (TFPG) was observed to be higher during the deregulation period. He found that increasing effective rates of protection was not associated with lower TFPG. The econometric estimates found a positive association between Net entry and TFPG, after controlling for inter-industry differences in effective protection, asset size of plants and demand growth. The results supported the proposition that competition positively contributes to TFPG during deregulation.

Wu Yanrui (2000) made an attempt to study the all expand APEC countries using the stochastic production frontier approach showed that TFP growth was positive for all countries. This study reveals that APEC developed countries performed better in terms of TFP growth contribution. In all countries, the study found that technical progress was a dominant contribution to TFPG, while the technical change was very small though positive.

Bee-Yan Aw (2002) examined the link between firm size, growth and productivity. It showed that firms grow because they are more productive and not because they are larger in size. Indeed, the statistical analysis shows that while employment growth among Taiwanese firms was positively related to initial levels of total factor productivity, it was negatively related to initial size. The study also showed that the productivity-size relationship has a virtuous cycle built in. More productive firms get larger and, in the process, obtain access to resources and information which enables them to become more productive. One implication of these results was that public policies should target productivity rather than size and should support reforms that make it possible for market mechanisms to weed out low productivity firms while facilitating the entry or growth of high productivity firms. Taiwan's ability to keep entry and exit costs low is one of the reason for productivity gains.

Mahadevan (2002) analyzed the TFP growth using Data Envelopment Analysis (DEA) technique. His study found that of all the 28 industries at three digit level the petroleum industry enjoyed a positive TFP growth. Most TFP growth came from technical efficiency changes, i.e the catching effect rather than technical change/progress or frontier effect. This means that the learning-by-doing benefits or the actual diffusion in the knowledge of technology use outweighed the gains from the use of better technology and capital equipments.

Deb Kusum Das (2003) examined the productivity performance of Indian manufacturing sector

under different trade regimes during 1980-2000. The analysis focused on the overall period and four sub-periods to reflect the shifts in trade policy regime. The study used a set of 74- three digit manufacturing industries for the analysis and the basic data source was the Annual Survey of Industries. TFP was calculated by the standard growth accounting method and Solow index. The study indicates TFP growth of 0.08 per cent per annum over 75 three-digit industries for the entire period. The standard deviation and coefficient of variation showed considerable variations in TFP growth. The TFP growth rates for individual industries are either negative or in the 0-2 percent range. The capital goods sector was the only one to register a positive growth 1.39 per cent per annum throughout the period, the intermediate and consumer goods sectors recorded negative growths. The study also documented the magnitude and direction of productivity growth across different industries and use based sectors for the four phases of trade reforms. TFP

growth in the 1990s is found to be lower than the 1980s. In addition, for all three use based sectors, TFP growth in the second half of the 1990s (1996-2000) is lower than in the first half (1991-1995). The results indicate that productivity performance seemed to be worsen as the pace of trade reform gathered momentum

Goldar and Anita Kumari (2003) studied the Total factor productivity growth in Indian manufacturing industries. Econometric analysis presented in the paper indicates that the lowering of effective protection to industries favorably affected productivity growth. The results suggested that gestation lags in investment projects and slower agricultural growth in the 1990s had an adverse effect on productivity growth. The analysis revealed that underutilization of industrial capacity was an important cause of the productivity slowdown. With corrections for capacity utilization, the estimated productivity growth in the 1990s is found to be about the same as in the 1980s.

Rahul Salim (2003) estimated the productivity growth of Bangladesh food manufacturing industry using firm level data before and after reform. Empirical results showed that the share of output growth was accounted for by input growth in most sectors of this industry. In some sectors, the estimated rate of total factor productivity (TFP) growth is negligible or even negative. Decomposition of the TFP growth shows that technological progress plays a significant role in TFP growth across firms within the sub-sectors of this industry. Empirical results also showed that the relative contribution of capacity realization to TFP growth is not substantial in inhibiting the industry's high and sustained growth. These dismal performances indicated that the industries responded a little to the implementation of economic reforms.

Bulent Unel (2003) examined the impact of reforms of the 1980s and the 1990s on the manufacturing sectors in India by analyzing the productivity performance of 13 manufacturing sector over the period from 1979-80 to 1997-98. The main data source was Annual Survey of Industries (ASI). He concluded that over the period from 1978- 80 to 1997-98, the capital-output ratio has been virtually constant. Output-Labour ratio and Capital-Labour ratio had growth rate of 6 per cent and 7 per cent respectively. The average annual growth rate of TFP was 1.8 per cent, which was about 30 per cent of overall labour productivity growth; under the assumption of

a constant elasticity of 0.6, the average annual growth rate of TFP was 3.1 per cent, which is about 50 per cent of overall labour productivity.

Chattopadhyay (2004) examined the overall industrial scenario of West Bengal for the past three decades. The paper studied the productivity of capital and labour for the two-digit industry groups and the total factor productivity (TFP) of the manufacturing sector of West Bengal as a whole vis-à-vis all-India and also for some selected groups of industries for West Bengal. Productivity of capital of the manufacturing sector has declined, while labour productivity has increased. However, the latter has increased mainly in few industry groups, which are highly capital intensive and have contributed around 85 per cent of the profit of the total manufacturing sector. TFP of the West Bengal manufacturing sector as a whole has declined, while it has been increasing in case of India. TFP of six industry groups which played a dominant role during the early 1960s has gone down except Jute industry, which itself is a sun setting industry. That means no new industry groups have come up to take up the position of these industries, which have been performing badly. Therefore, while the State of West Bengal has shown an impressive improvement in case of rural sector, industrial slowdown has not been arrested as yet in the State.

Pushpa Trivedi (2004) made an attempt to analyze the growth rates of output, employment and productivity of organized manufacturing industries, including machinery industry. The study used time-series data collected from ASI for the period from 1980-81 to 2000-01 and it encompassed 10 major states of India. TFPG was estimated by both. Growth accounting framework and production function approach. It found that the productivity response of various industries and states to liberalization process has been varied. The policy reforms do not seem to have impacted positively most of the industries, except metal industry. In case of machinery industry the TFPG was found to be 1.5 percent per annum. It ranged between 1.2 (Gujarat) and 1.8 percent per annum (Rajasthan) for the various states. During the pre-reform period, TFPG of machinery industry at all India level was 2.0 percent per annum and it declined to 1.1 percent per annum in the post-reform period. This has brought about deceleration in TFPG in all the states, barring Andhra Pradesh and West Bengal. The CV for this industry registered an increase from 0.2 during the pre-reform to 0.9 the post reform period. The study empirically confirms the existence of inter – state differences in productivity levels and growth rates. It points out that

states, such as, Bihar and West Bengal are diverging away rather than converging to the growth rates of output of organized manufacturing sector at the national level. Though productivity growth in Bihar appears to be high, it has been mainly achieved by joblessness. Madhya Pradesh and Rajasthan, which have been considered as BIMARU States, seem to be good performers from a wider perspective and show the promise to get them rid of their economically backward status.

Gounder and Xayavong (2004) analyzed the sources of TFP growth in New Zealand's manufacturing industry for the period 1978 - 1998 utilizing the stochastic frontier approach. This methodology involves decomposition of the sources of TFP growth into four components, i.e. technical progress, technical efficiency, scale effect, and allocative efficiency. The main findings of the decomposition analysis showed that TFP growth was largely due to changes in technical progress and technical change. The change in technical progress has increased in the post-reform period, i.e.1984-98. On the other hand, technical efficiency has declined in the post-reform period. With respect to scale effect its contribution to total factor productivity growth is very small. Overall it can be said that the industries have benefited from scale economies. The allocative efficiency component indicated that resource allocation has improved in the post-reform period. This implies that deregulation in the post-reform period has reduced price distortion. The study found that technical progress and technical efficiency components are the major sources of total factor productivity growth, further examination is needed to understand what drives economic growth at the micro-level.

Sun (2004) identified the sources of output growth using a varying coefficients frontier model in which total factor productivity (TFP) growth can be decomposed into change in technical efficiency and technological progress, taking an account of industry specific characteristics. He also compared high-tech industries on the basis of two proposed hypotheses and anlysed the components of TFP growth using long term trend in technological progress and change in technical efficiency. The empirical result showed that the level of TFP in Taiwan's manufacturing sector increased by 0.2 percent a year during the period 1981-1999, stemming from 0.4 percent technological progress and -0.2 percent declining technical efficiency. The insignificant TFP growth of 0.2 percent over the past two decades was mostly driven by slowdown in the 1990s.

Sarma (2005) assessed the productivity performance of Indian automobile industry using growth accounting approach. Divsia-Tornquist index has been used to obtain estimates of total factor productivity index in this industry. Results on TFP revealed that Indian automobile industry could not experience positive productivity growth in the post liberalisation era. Trend growth rate in TFP came out to be -0.015, which is significant at 5 percent level of significance. The results on partial factor productivity indices also corroborate the TFP deterioration in this industry.

Mononmani and Geetha (2007) examined "Productivity trends in Agro-based consumer goods industries of Tamil Nadu". The outline of this paper contains the trends in productivity of proposed industries. The specific objective of the study is to examine the trends in productivity of the proposed industries in terms of partial factor productivity, total factor productivity and technical progress. The basic data source of the study was Annual Survey of Industries (ASI).

v. Studies Related to Technology and Technical Progress

Kopp and Diewart (1982) have analyzed the decomposition of frontier cost function deviations and measures of technical and allocative efficiency. In this study they analyzed a method for decomposing the deviations from a full frontier cost function into Farrell (1957) measures of technical and allocative efficiency. The method draws heavily on duality theory and requires no direct knowledge of the primal production frontier specification or its parameters. Thus the method is applicable to a broad class of cost functions, including flexible functions such as the translog, which do not possess analytically deviable underlying production functions. The method easily generalizes joint output production technologies where the decomposition or deviation from frontier profit functions would provide measures of technical, allocative, output mix and scale efficiency.

Keith et al (1984) studied the estimates of an aggregate Cobb-Douglas production Function for Nepalese industry. This paper made an initial analysis of the issue related to modern and cottage industries, by estimating the production characteristics inherent in a simple specification for an aggregate technology for Nepalese manufacturing industry for the year 1965, 1972-73 and 1976-77. He concluded that, as industrialization advances, the various factors in industries may change

in more appropriate directions. Public policy might well be redesigned to promote such adjustments rather than hide them.

Grosskopf (1986) measured efficiency with a focus of the theory developed by Farrell. In the Farrell framework, overall efficiency (OE) can be decomposed into two multiplicative components, Allocative Efficiency (AE) and Technical Efficiency (TE); OE=AE.TE . The results from the paper showed that relatively restrictive reference technologies will, in general, yield relatively low values of overall technical efficiency. Those values would, in general, be higher (more efficient) if calculated relative to a less restrictive reference technology by choice of functional form, will in general, affect the magnitude of the resulting efficiency measures.

Tain-Jy Chen and De-Piao Tang (1987) investigated the relative technical efficiency between import substitution oriented and export oriented foreign firms in Taiwan's electronics industry in 1980. Data for 184 electronic firms were obtained from the annual survey of foreign firms conducted by Taiwanese government. The study used two models viz, the Deterministic Frontier model developed by Farrell (1957), Aigner and Chu (1968), Richmond and others (1974) and a Stochastic Frontier model developed by Aigner et al (1977) and Meeusen and Van Den Broeck (1977) for estimating frontiers and measuring technical efficiency. The study found that firms that are constrained to export all their products and thus to compete in the world markets (export-oriented) tend to be more efficient than those allowed to sell their products in the protected local markets (import substitution- oriented). Depending on the model specified, the export – oriented firms were found to be 6 to 11 percent closer to the production frontier than the import substitution oriented firms. Results obtained from both the models indicate that the export-oriented group was more efficient than the import substitution group. In case of deterministic frontier model, the export oriented group implied 61.09 percent efficiency and the import substitution group shared 54.91 percent efficiency. Similarly in case of stochastic frontier model, the export-oriented group indicate 71.95 per cent efficiency than the import substitution group, which shares 60.40 per cent efficiency. The study found no evidence to support the view that superior performance results from larger firm size or local participation. However, the study found that older firms tend to be more efficient.

Abdulkadhim and Pickles (1988) attempted to quantify technology transfer through its agent, technical change, in Iraq's manufacturing sector during the period between 1960 and 1978. The data used in this study were time series of value added, labour and net capital stock. Value added data for Iraq's manufacturing sector were available in Annual Abstract of Statistics published by the Ministry of Planning for the period 1960-74 and 1977-78. The principal findings of the analysis were: Production technology changed at an increasing rate; output elasticity with respect to capital was high relative to that of labour. The implication of the finding is that as long as output elasticity with respect to capital (the faster growing output) is high and technical change growing at a variable rate, output continues to grow at even higher rates. Moreover, technical change plays a more important role in the long-run development of the country.

Erkin Bairam (1990) studied the Aggregate and Disaggregate Production function estimates for the Indian Economy using Annual time – series and Cross – Regional data. In this study appropriate production function for forty-six major industries branches of India and for the total Indian Economy were estimated. These data are the most comprehensive disaggregate statistics available in the Indian Industry. He concluded that the Cobb-Douglas production function can be accepted as underlying production model of the Indian Economy. The estimation of the rate of technical progress from constrained Cobb-Douglas production function suggested that the future growth potential of the economy as a whole is less than 4.0 percent per annum

Subramaniam (1992) analyzed the Growth, Factor Productivities and Technical Change in South India Viscose (SIV) Limited (1980-81 to 1990-91). The data for the study were collected from Manmade Fibre Industry Survey Reports and Annual Reports of the South India Viscose Limited. He concluded that Brown's model of technical progress based on first order differences indicated that the changes in factor inputs have substantial influence over the changes in output. In other words the 'flow' concept had a greater relevance rather than 'stock' in output creation in the S.I.V. Ltd. Since the technology parameter was significant, technical change had a tremendous influence over the changes in output.

Amuthavalli (1992) analyzed the Growth, Factor Productivities and Technical Change in Chettinad Cement Corporation Ltd., during the period 1979-80 to 1990-91. For the study, data was collected from the Annual reports of the Company for the relevant period. She concluded

that though there was heavy accumulation of fixed assets they were not put into effective use. She suggested that recruitment of skilled manpower could solve the problem.

Role Fare *et al*. (1994) analyzed Productivity Growth, Technical Progress and Efficiency Change in 17 OECD countries over the period from 1979 to 98. The data was obtained from the Penn World Tables. These data built from the benchmark studies of International Comparison Programs of United Nations National Accounting data. A non-parametric method (activity analysis) was used to compute productivity growth. They concluded that US productivity growth is slightly higher than the average of OECD counties' average, all of which is due to technical change. Japan's productivity growth is the highest in the sample, with almost half due to efficiency change.

Shenggan Fan *et al*. (1999) developed a frontier cost function approach to estimate empirically the effects of technological change, technical and allocative efficiency improvement in Chinese agriculture during the reform period (1980-93). Time series data were used in this study. The results reveal that the first phase of rural reforms (1979-84), which focused on the decentralization of the production system, had significant impact on technical efficiency but not allocative efficiency. Technical efficiency improved substantially in the early stage of the reforms, while improvement of both technical and allocative efficiency stagnated during the second phase of reforms. Overall economic efficiency has improved substantially, but the rate has declined since 1984. The rate of technological change continued to increase over the whole study period.

Mallikarjun and Kasyap Thakar (2001) made an attempt to examine the impact of economic reforms on the technical efficiency of three major industrial segments in Gujarat over the period 1980-81 to 1997-98. The study used Data Envelopment Analysis and the frontiers were estimated with two types of models (i) Constant Returns to Scale and (ii) Variable Return to Scales. Malmquist Index was also applied to calculate indices of TFP change, technical efficiency change and scale efficiency change. The overall picture as per the Technical Efficiency (VRS) analysis showed that all the three industries were using their inputs efficiently and there were no significant shifts in the figures while comparing pre and post reform period.

The Malmquist analysis found that no industry had registered a notable improvement in TFP over the study period. The study found that the major reason for this was that the industries have not been shifting to the improved technology fast. The highest average pure technical efficiency change scored by the industries was 1.104 only. This indicates that the industries have not been going for better technologies during last eighteen years. Hence the study found no clear evidence that reforms can really improve the technical efficiency levels in the traditional industries, and increased competition may enhance the number of players in the market but it may not really lead to the best utilization of scarce resources.

Neil Dias Karunaratne (2001) studied Trade reform and Technical Efficiency in Australian manufacturing industries. The technical efficiency scores had been estimated by using a combined stochastic production frontier inefficiency model that is free of simultaneity bias. The model parameters had been estimated through maximum likelihood technique using panel data set covering a cross-section of eight industries spanning a time series of 26 years (1969-1995).

Generalised likelihood ratio tests reject the null hypotheses that trade liberalisation and technology transfer had no significant impact on the reduction of technical inefficiency. The reduction of effective rate of assistance and technical efficiency and technology proxies such as intra-industry trade and capital deepening are negatively correlated during the study period. These findings gave credence to the predictions of endogenous growth theories that openness of the economy provides a conduit for accessing new technology that promotes innovation and technical efficiency. The increase in technical efficiency of manufacturing industries was the unsung hero behind the emergence of the `new economy' or the spectacular pick-up of productivity growth observed for Australia during the 1990s.

Bhavani (2002) has studied the problems and prospects of small scale units in the era of globalization. The study focused on the ongoing changes in the business environment and analyzing their implications for small-scale units. Specifically, it looked at possible ways of improving the competitive strength and commercial viability of small-scale units in the changing context. Apart from general purpose analysis meant for the small-scale sector at large, he examined the implications of the changing context with reference to the small-scale units in three industries, namely, garments, electronics and auto components. The author found that

liberalization has exposed all industrial units including small units to market competition to a greater extent. Indian industrial units especially the smaller ones need to improve their productivity and quality, to reduce costs and to go for higher performance of products and better services. This means substantial improvement in various dimensions of technology, namely, transformation (mechanization), organization and information. The author concluded that small units not only need to upgrade their technologies immediately but should also keep track of the changes in technologies.

Balasubramanya (2004) studied the impact of globalization and domestic economic reforms on small industry in India in the 1990s compared to that of 1980s.As a result of the reforms, small industry has suffered in terms of growth of units, employment, output and exports. This has resulted in a less impressive growth in its contribution to nations' income and exports, though not in terms of employment in the 1990s. Lack of reliable and stable economic infrastructure, reduced growth of credit inflow and technological obsolescence, which together have led to inferior quality and low productivity are the major bans of small industry in India. But the policy changes have also thrown open new opportunities and markets for the sector.

Kim and Park (2006) studied the productivity gains in Korean manufacturing and found it was efficiency improvement rather than technical progress which led to the productivity growth. These findings are contrary to those of previous sectoral studies in Korean and Taiwanese manufacturing, but are consistent with those cross-country studies. Regression results estimated by this study showed that both domestic and foreign R& D has more effect on technical progress, while foreign R&D has played a relatively stronger role in efficiency improvement.

vi. Conclusion

This review of related literature attempted to make an overview of studies on the growth and production functions of manufacturing and Textile industries. The studies used various determinants like productivity growth, FDI and Exports in medium and large scale industries in regional and national levels. The studies related to economic reforms and productivity growth used various measures like Growth of various fragment and industries, total factor productivity, technical progress technical efficiency, export promotion and import-substitution, effective rate of protection, import penetration etc. to analyze the link between economic reforms and

productivity. Similarly the issue has been investigated at different levels: plants, firms and industry, national and regional wise analysis with different model specifications.

The results derived from the reviews indicate that the impact of trade liberalization on productivity growth has however been mixed. In some studies, the impact is found to be positive, in others it is otherwise. In other words, it is evident that the available empirical evidence on this issue is inconclusive. Studies for developing countries that use firm/industry-level data do not find an unequivocal positive relationship between economic reforms and productivity growth. Further, studies undertaken at the national and regional level did derive contradictory results and the emerging scenario was not categorical to formulate future development strategies. Most of the studies reviewed had analyzed the concept of productivity and technical progress with reference to firm's characteristics such as firm size, age and ownership. Research work pertaining to the impact of economic reforms on Growth, factor Productivities and technical progress exclusively for Textile Manufacturing Industries were very few and scanty. In order to fill these gaps the present study has been undertaken.

2.11.2 REVIEW OF LITERATURE ON TEXTILES INDUSTRY AT DOMESTIC FRONT

Bagchi (1997) critically examined the removal of quota between 1995-2005 in four phases is not as beneficial as it is projected by developed world. The first two phases are composed of goods which are not of high importance and already almost free. These two phases are not of high importance. The other two phases are of high importance.

Chandra (1998) in his article wrote on challenges ahead of Indian textile and clothing industry in post quota regime. It put special emphasis on production capabilities and efficiencies as most essential elements to fight global competition. It suggests various strategic decisions Indian textile manufacturers have to make to survive the competitiveness in post quota regime.

Simpson and Shetty (2001) did a vast study on India's textile industry. The purpose of study is to analyze India's textile and apparel industry, its structural problems, market access barriers, and measures taken by government of India to enhance the industry's competitiveness in the post – Multi Fibre Agreement (MFA) era. The study also assesses India's textile and apparel market

potential and trade and investment opportunities for U.S. firms as India steps into a more free and transparent trade regime.

Verma (2001) in his article emphasized on the impact on the Indian textile and clothing industry after quota elimination. It says that Indian textile and clothing exporters have to bring in necessary changes in their methods of production, management style, capacities, marketing skills and productivity level in order to remain competitive in international market. Also it put special emphasis on the size of Indian textile units when compared to its counterpart in China.

Verma (2002) did a comprehensive study with an objective to evaluate the export competitiveness of Indian textile and clothing sector. Because Indian textile and clothing sector is predominantly cotton based, the study is focused on cotton textile and clothing and looked at the entire value chain from fiber to garment and retail distribution. The scope of study covers the products in Indian export basket which have shown a promising growth in value. The Study concludes that Indian exports to US and EU are export competitive as a whole. Sector wise analysis of export performance of Indian textile and clothing sectors to US and EU reveals that so far apparel or clothing and made-up is concerned; quota is the major constraint in the growth, while it is not true in case of yarn exports. Indian textile and clothing sector has tremendous potential and only a portion of which is explored till now and this shortcoming is due to policy constraints.

Meenakshi (2003) did a comprehensive study on the opportunities that would be provided by WTO to Indian Textile industry. This paper gives a lot emphasis on new capacity installation to take the benefits to the fullest extent in India has to be a true gainer in competition to other nations. Since India’s own consumption per capita is also on the rise with the rise of income and consumption habits, the profit margins available to Indian textile and clothing producers will be more. But in export market, the prices will be driven by international factors and profits will be under pressure. So the exporters might have to go for strategy of partial exports and partial domestic sale.

Pandey (2003) in his article expected that Indian textile exporter would be benefited with quota elimination. It discusses on various sectors of textile and clothing. Also, he expects that hosiery

industry will be one of the gainer and small scale exporters will be more competitive due to small size and controlled cost and lower overheads.

Vivek (2004) in his article had said that JC Penny a leading retail chain of US looks India for sourcing its garments in woven and hosiery. He is of opinion that India will be fulfilling its major need of Hosiery and woven garments in cotton while China will be good for synthetic fabrics and its garments.

Chugan (2005) emphasized that Indian textile Industry has to change to be more competitive in the long run. This paper emphasizes that merely cost competence is not enough to maintain the lead while Indian companied has to have a global competitive view.

Chugan (2005) in his study emphasized on the role of HR in this booming sector. To maintain its edge over its competitors India has to bring in high productivity per employee. India's productivity is far below than China and Pakistan which are the major competitors. With high productivity, another area is innovativeness to bring in new products and process, where HR plays the prominent role.

Trivedi (2005) in his article concluded that the textile is one sector where India has high ambitions and can achieve robust growth through moderate human skills. India has skilled labour and does better in this sector as compared to others. This will also Increase the employment and the social structure will be better off.

Adhikari (2006) did a study for UNDP regional centre Colombo. It was expected that the effect of quota elimination would not be same for all the countries. It has shown mixed results so far. Moreover countries that have lost out the most had seen their exports decline earlier which means that their dismal performance merely be ascribed to the quota phase out. Several countries that had been expected to loose out in the post quota world not only managed to hold on to their past gains but also achieved significant growth in their export earnings. This is mainly because of the re-imposition of quota on T&C exports from China not only by developed countries but also by some developing countries, which were making use of temporary safeguards measures as agreed to by China during the process of its accession to WTO. Most analysts predicted that the situation will not remain same after the phasing out of safeguard which will expire in2008. At

the same time the entry of Vietnam into the WTO from 11th January 2007, which enables the county to compete in global T&C market without any quantitative restrictions on T&C exports, means that the competitive pressure is likely to be intense for the small and marginal players. Therefore the real adjustment challenges are yet to begin after December 2008.

Chugan (2006) in his article discussed in detail the opportunities available to various sectors of Indian Textiles in the post quota era. Also, it emphasizes the weaker link, competition from china and the schemes run by government to support Indian textile Industry.

Kumar (2006) did study of various sectors of Indian and Chinese textiles. This paper concludes and highlights the various areas where India has efficiency over china and how India should more capitalize on it. Also it gives equal weightage to Chinese advantages and how India can win over its weaker areas to be more competitive in long run.

Singh and Kathuria (2006) in his article discussed in details the problems faced by Indian garment exporters in post quota regime. The study focuses on the analysis of problems of garment exporters located in Ludhiana and Delhi. It highlights the factors which are hindrance in the growth of garment exports from the region and important determinants in increasing the exports share from the region.

Texprocil (2007) concluded that if India has to keep maintaining its edge in hosiery and garment sector, it has to keep in control through various measures. The various measures indicated are Raw material, Methodology, Labor wages, Power cost and utilities that need to be kept in check to keep the cost lower. This paper presents a comparative study of Indian textile industry with other nations like China, Bangladesh, Vietnam, Egypt and Pakistan and elaborates the competitiveness of Indian textile and various sectors in Textiles. It also puts lots of emphasis on the areas where India in losing it sedge and has to keep a close monitoring on it to remain competitive. It concludes that Vietnam and Egypt are coming up fast and can prove to be tough competitor in near future due to high productivity and low steam cost.

Venkatachalam and Palanivelu (2010) did detailed study on marketing strategies adopted by garment exporters in Tirupur. In this paper the authors highlight the problems of garment industries and propose solution to overcome these problems.(shodhganga, 2015)

Chandra (1998) in his paper accentuated on production capabilities and efficiencies and recognized them as the most crucial factors to wrestle global competition. The paper also highlighted various strategic decisions that Indian exporters of textile & clothing must take in order to survive in the competitive market in post quota regime.

Ramaswamy and Gereffi (1998) in their paper emphasized that it is in particular imperative to recognize the nature of the worldwide production system that forms the inclusion of third world countries like India into the global market. He emphasized on three themes: First, the inter linkages in the association of global financial activity and the shifting bloodthirsty conditions in the global apparel market; second, the connected significance of distribution and marketing links in the clothing production chain; and third, the cotton fabric-based nature of India's apparel exports and its competitive advantage.

Kathuriya & Bhardwaj (1998) did a comprehensive study on the opportunities that would be provided by WTO to Indian Textile industry. His study gives a lot of emphasis on new capacity installation to take the benefits to the fullest extent in India so as to be a true gainer in competition to other nations.

Verma (2002) in his study concluded that Indian exports to US and EU are export competitive as

a whole. Sector wise analysis of export performance of Indian textile and clothing sectors to US and EU reveal that so far apparel or clothing and made-up is concerned; quota is the major constraint in the growth, while it is not true in case of yarn exports. Indian textile and clothing sector has tremendous potential and only a portion of which is explored till now and this shortcoming is due to policy constraints.

Marwaha (2008) in his dissertation studied that to survive and succeed in garment manufacturing business in today’s era of globalization and increasing competition, it is important for firms to analyse the environment in which it is working.

Kumar (2011) observed that India’s share of the global textile industry is expected to grow from 4% to 7% by 2011-12 and the share of apparel in the export basket is expected to increase from 48% to 60%. A Vision 2010 for textiles formulated by the government after exhaustive interaction with the industry and Export Promotion Councils to capitalize on the positive

atmosphere aims to increase India's share in world's textile trade from the current 4% to 8% by 2010 and to achieve export value of US $ 50 billion in 2010.

Chaudhary (2011) concluded that no doubt the Indian textile industry has benefitted from the MFA phase out; threats of the open market condition have also become vibrant. The removal of the quota system has brought the strong players in full swing. China and Korea are the biggest threats to India. In India the big firms are gaining from the phase out as they have the capacity to stand boldly and fight the fierce competition. On the other hand the medium and small firms are more vulnerable as they are finding it difficult in survive in the tough competition.

Sharma (2011) in his research observed that rapid changes in the World trading system have endangered the stability of the textile industry and created an atmosphere of uncertainty and turbulence in the industry. But it is also a fact that turbulence is necessary for any change in the system.

Manojit Saha (2005) emphasizes on the end of quota regime that ushers a new era for the Indian textile industry, and offers a huge opportunity for the textile and apparel sector in India. This development is expected to result in higher export possibility for Indian manufacturers to the US and the EU which was restricted previously.

Meenu Tiwari (2005) examines India's recent integration into the global apparel trade and the attempt of Indian government to attract FDI into textiles, apparel, and retail. The paper argues about India's quick emergence as a successful textile and garment exporter after years of inward orientation. Trend analysis of India and China's textile and apparel export to USA post MFA has been undertaken by the FICCI Research Division (2005) for both India and China at three levels: overall export to the US, category-wise exports to the US, and category-wise export to the US. Agarwal and Dhruv (2004) mention the phasing out of MFA as a one-time event that can lead to drastic shifts in economic wealth from one part of the world to another. The study tries to analyse those segments and companies that stand a chance of gaining from this opportunity. Ram Upendra Das (2004) explores the prospects for horizontal specialization and industrial restructuring with the help of strengthening trade-investment linkages in this sector in the SAARC region along with adopting some other policy measures. The paper also argues that it will not be easy to change the production processes in these countries especially in the post-

MFA era and thus regional cooperation in this sector could be one of the ways to meet the challenges in the post MFA regime.

The objective of Samar Verma's (2002) paper is to evaluate the export competitiveness of the Indian textile and clothing sectors. His study first identified the products in the export basket which show promising growth and have weight in the Indian export basket on the basis of recent performance of this sector in the US and the UK market. To enhance the competitiveness, the study highlights the areas requiring government policy intervention. The study concludes that Indian textile industry has immense potential, yet several policy reforms are needed urgently in order to unlock these latent capabilities.

2.11.3 REVIEW OF LITERATURE ON TEXTILES INDUSTRY AT INTERNATIONAL LEVEL STUDY

Bagachi (1994) studied that the abolition of quota system is not favorable for the developing nations as it was anticipated by the majority of the studies. The study also analyzed the importance every phase being removed in the context of developing countries.

Jayaswal and Sayed (2006) in their article presented how Pakistan has done excellent and dominates the home furnishing and bed linen section in US and EU. Indian Bed linen is no more preferred in US. Pakistan is completely dominating the US markets. If Indian companies become more competitive in quality, price and deliveries, Pakistan will not be preferred destination for EU and US.

Uraiwan (2004) had worked extensively on the knitwear/hosiery products development process to understand the complexities underlying in it; because a well-defined development process assists the organization to determine its future direction, plan for rapid changes, create new product line with profits and plan for technology adaptation and implementation. The goal of this research was to propose an optimal product development process for a knitwear/hosiery company by examining the process used by major US Sweater Company and comparing its process to established processes.

Thomas (2005) in his article wrote on why in the competitive scenario wholesalers like Nike are

shy from keeping long inventories and stocks. So pressure is on garment companies to deliver the goods in time. India has bottleneck in infrastructure, which hinders the time receipt of raw material and delivery of finished goods. This would cause rapid airfreight and would squeeze the margins. Government has to invest heavily in Infrastructure to keep the pace of growth of garment industry intact and take the benefits to fullest extent.

Elsayeed, Kulich, Lake & Megahed (2006) gave deep insight into the success factors of Guangdong textile cluster of China. Also it discusses the national diamond analysis which describes the competitive advantage and weakness in context of firm strategy, rivalry and strength in the related and supporting industries and limited demand conditions. Also it discusses the trade relations between China and Hong Kong and role of Chinese Diaspora and its role in success of Guangdong textile cluster. Also, it put emphasis on China – H.K relations as win-win situation for both. Then it discusses the cluster analysis.

Elbehri Aziz (2004) examines the global trade implications of MFA quota removal on cotton and textile industry. This study compares alternative scenarios of MFA environment and focuses on three sets of issues: (i) impact at the global level, sorting out the global expansion as well as the critical shifts in bilateral textiles and apparel trade pattern; (ii) trade implications for the US in the textile and apparel markets; and (iii) impact of the textile and clothing expansion on global fibre demand. The analysis supports significant trade in apparel shifts in favour of Asian and South Asian suppliers.

M. Knappe (2004) emphasizes that market access in 2005 will be free of quota restrictions, trade will become more liberal, but it is also likely to become complex. This paper gives an overview about possible trade perspectives beyond 2005 and the challenges and trade uncertainties with which manufacturers in developing countries are confronted. Quotas gave some transparency to the trade flows, this transparency will disappear and will be replaced by an insecure environment. Enterprises in developing countries need to adapt to new requirements imposed by importing governments and buyers but the ability to do so is less developed in least developed countries (LDCs) and small economies than in larger developing economies. All this causes confusion and complexities at the level of importers and exporters. Hence no market player will risk concentrating imports or exports too much on one or two countries.

Nordas (2004) in his policy paper concluded that both China and India will gain market shares in the European Union, the United States and Canada to a significant extent, but the expected surge in market share may be less than anticipated, as proximity to major markets assumes increasing economic significance and tariffs are increasingly restraining trade due to the fact that products cross borders several times.

2.12 LITERATURE REVIEW ON INDIAN IMPORT- EXPORT

This review of literature includes the literature on Indian import export. This part divided in Exports and Economic Growth, India's Exports (1951-1991), India's Exports (1991-2006) Economic Reforms and India's Exports and World Trade Organization and India‘s Exports.

Foreign trade and payments have assumed a central role in development plans of many underdeveloped countries. For most of these countries, exports represent an important share of total output and hence trends in foreign sales are critical in fostering overall growth. For some underdeveloped countries, export trade is such an important factor that an estimate of foreign exchange earnings represents a first step in the formulation of development plans.

Many developing countries of the world had initiated the process of economic reforms in their economies during 1980s. India like other developing countries during 1990s has launched economic reforms in its economy such as in financial sector, fiscal sector, social sector, public sector, trade sector, etc. On the other hand, establishment of WTO in 1995 has provided a lot of opportunities and challenges for both developed as well as developing countries. Many countries of the world have changed their foreign policies from inward oriented import substitution to outward-oriented export promotion to reap the benefits from the opportunities provided by globalization by accepting WTO norms and commitments and also introducing capitalist economic reforms in every sphere of their economies. Establishment of WTO on the one hand and the introduction of economic reforms on the other, have influenced Indian trade sector as a whole and export sector in particular. The objective of this chapter is to provide an overview of the research work on the various aspects of economic reforms, World Trade Organization (WTO), and their effects on India‘s exports. For this purpose, the chapter is divided into following sections:

2.12.1 Exports and Economic Growth

Post-war development theory also provided several intellectual foundations for the establishment of post-war international economic institutions such as the World Bank and the International Monetary Fund. Much of this work presupposed the idea that there were distinct stages of economic development (Rostow 1960), and it focused on the relationship between economic growth and savings as the basis for capital formation. The role of trade in economic development also played a central role in these theories.

W. Arthur Lewis‘s theory (1955) of the dual economy was particularly prominent as a basis for attempting to understand the economies of the previously colonial world. Other economists such as Adelman (1978) and Chenery (1974) cast doubt on the stage theory and further broadened the perspective by bringing distribution and welfare into the discussions.

Exports and economic growth relationship constitutes a vast literature. The empirical studies on economic growth and export relationship have been carried out in two broad directions: firstly in terms of country and cross-country comparison to find out this relationship and secondly in terms of testing impact of export promotion based outward-oriented or import substitution trade strategies. Herberler, 1959; Emery's, 1967; Michaely, 1977; Krueger, 1978; Balassa, 1978; Chenery, 1979; Fasana, 1979; Tyler, 1981; Feder, 1982; Kavoussi, 1984; Ram, 1985; Chow, 1987; Alam, 1989; Fosu, 1990; Liang, 1992; Attri, 1996; are prominent country and cross country level studies in this direction. All these studies contend that there exists a strong positive association between economic growth and export growth and thus exports play a key role as an additional variable in the process of economic growth by one way or the other.

Hultman (1967) discussed various models such as foreign trade multiplier model, growth models, leading sector approach, export base approach and development stages (location theory) approach, which show the possible relationship between exports and economic growth of the national economy. The author concluded that exports by one way or the other are associated with the economic growth of an economy, especially of an underdeveloped one.

Rodriguez et al., (1999) also observed open trade policies in the sense of lower tariff and non-tariff barriers to trade significantly associated with economic growth. According to Hanson II,

good export performance is associated with countries having internal attributes conducive to economic development (Hanson II, 1977). Several structural theorists have questioned the wisdom of relying heavily on external market particularly for contemporary third world economies (Myrdal, 1957). Because of their traditional exports frequently lie in sectors that offer unattractive demand prospects and limited inter-sectoral linkages such as primary products and very low wage assembly, significant expansion of existing industries may neither be possible nor desirable (Prebisch 1962; Cline 1982).

Jung and Marshal (1985), while examining the relationship between exports and economic growth during the period 1950-81, strongly argued that the evidence in favour of export promotion was weaker than what the previous studies have indicated. Cline (1982) and IRMA (1984) have also found export led strategy inferior to alternative strategies.

Moon (1998) found that nations characterized by following outward-oriented development strategies do not trade notably different than those regarded as inward oriented and those nations do not expand their trade strikingly different from other countries. Furthermore, it is not apparent that export expansion is the principal source of the superior macroeconomic performance of so called ―outward-oriented nations.

Galtung (1971); Frank (1966); Emmanuel 19 (1972) provide a strong evidence to the fact that trade dependence may lead to distortions which compromise future growth opportunities. Moreover, heavy reliance on trade may leave a nation dangerously vulnerable to market disruptions or political pressures, particularly if trade is concentrated in a small number of products and a small number of trade partners.

It is widely recognized that there are important factors at work, emanating from industrial countries, which are preventing a fast-enough growth of the export demand for the products of underdeveloped countries. Some of these factors as listed by Nurkse (1961) are: a shift in the composition of industrial output (in advanced countries) from industries with a high raw material content; low income elasticity's of consumer demand for many agricultural commodities, once a high standard of life is reached; growing technological advances leading to economies in the industrial uses of primary raw material; and displacement of natural raw material by synthetic and other man-made substitutes, made from a few basic elements mostly of local origin. As a

consequence, if the rate of economic development in underdeveloped countries were left to be determined by rate of the growth of foreign demand for their exports, the pace of development for most of these countries must be painfully slow.

Furthermore, Prebisch (1964) added that there is a long run tendency for the prices of the primary products to deteriorate as compared to the prices of the manufactured products. As developing countries export mainly the primary products, they have to face secular deterioration of terms of trade that ought to be unfavourable to their exportables. Therefore, international trade cannot be an effective engine of growth. In their strategy of growth, underdeveloped countries have to emphasize on balanced growth, a coordinated development of local industries in accordance with the growth and structure of domestic demand.

In between the above two positions is Kravis (1970), whose challenge to Nurkse‘s interpretation depicts trade as ―handmaiden of growth and contends that trade was as much as a consequence as a cause of growth, that trade only is one cause among many for economic growth, that is worked only for some nations under specific conditions and most importantly, that mainsprings for growth were internal. In support of Kravis‘s pessimism about the role of exports, Lewis (1978) adds another analogy that the engine of growth should be technological change with international trade serving as lubricating oil not as fuel.

Export earning instability and its impact on economic growth is another core area of research in number of studies. Nurkse, 1958; Myrdal, 1956; Hirschman, 1959; and Helleiner, 1972 examined impact of export instability in LDCs during different periods. The authors revealed that violent and sudden fluctuations in prices, quantum, and total proceeds, of exports have an adverse impact on the overall growth of LDCs. It is generally agreed that excessive fluctuations in export earnings originate from variations in supply or demand or other non-market factors and hurt economic growth by one way or the other.

Murray (1978); Massell (1964); Naya (1973); and Lawson (1974) in this line concluded that export earning fluctuations are largely positively correlated with degree of commodity concentration of exports, and with proportions of export obtained from sale of primary goods, and negatively correlated with per capita income GDP and with concentration of exports by geographical area of destination. Macbean (1966) and Coppock (1962) question and even refute

some of these views strongly and cast some serious doubts about their general applicability both in short and long run.

Coppock (1963), by analyzing export instability during the post Second World War period for world trade and for 83 countries, states that instability of primary goods exports (value) was less than in the manufactured goods (value) during the 1948-58. Base metals, minerals, other manufacturers, capital goods, fuels, food, consumer goods, and raw material are the sub groups of exports that had classified in descending order of instability of exports.

Aggrawal (1982) highlights that fluctuations in the export earning in LDCs do not appear too much detrimental to countries‘ stability and growth particularly in short run, but other structural factors are not only responsive for causing alarming disturbances in domestic activity but also putting heavy constraints and limitations in economic development of these countries to a significant extent.

Rangarajan (2004) made an attempt to understand the relationship between income growth and export fluctuations in eleven countries. Study states that an increase in the instability of exports leads to an increase in the instability of income but the impact is not same in all the countries there has been strong controversy in the literature about the exact causes and consequences of export instability. The exports of both developed and underdeveloped countries fluctuate. However, many studies such as Macbean, (1966); Massel (1970); Glezakos, (1973); Savvidos, (1984) and Lanceiri (1987) report that the developing countries have substantially higher degree of export earnings instability than the developed countries. Many causes of instability have been put forward such as low price elasticity, sudden variations in supply due to natural factors and business cycles in developed countries, etc. but commodity and geographic concentration of exports have been considered as the major causes of export instability in developing countries.

Coppock (1962); Massell (1964) and Macbean (1966) established that there was a weak relation between concentration of exports and exports instability. Contrary to this, Massell (1970) found a significant relationship between commodity concentration and instability of exports.

2.12.2 India’s Exports (1951-1991)

The period (1951-1991) has been characterized by import substitution inward oriented development strategy. A lot of research has taken place on India‘s exports during this period. Because of the general perception that Indian exports are facing severe demand constraints and partly due to the fact that supply side aspects are difficult to model, most of the studies on India‘s merchandise exports concentrated on demand side. Empirical studies on demand for India's exports examine the demand pattern of export in terms of price and income elasticity.

Dutta, 1964; Pandit, 1973; Sinha, 1986; Bahmani-Oskooee, (1986), Ram and Rath (1989); and analyzed the demand pattern of Indian exports on aggregative level. Several studies such as Dutta, 1965; Da Costa, 1965; Wadhwa, 1974; Biswas, 1983; Lucas, 1988; Rath and Sahoo, 1990; Virmani, 1991 and Kaur, 1993 analyzed the same by dividing total exports into several groups (i.e. on disaggregate level). The important factors according to all these studies that influence exports can be broadly classified into three types’ viz. demand factors, supply factors and non-market factors. The principal demand factors influencing exports are basically the level of economic activity in rest of the world and price (unit values) of exports. Exports are also found to be influenced by competitiveness of goods in world market. In some studies, the relative importance is given to export market, vis-à-vis domestic market by entrepreneur and government. Apart from the price and income factors, demand for exports also found to be depended on non-market factor i.e. other aspects of sales terms.

Patel (1959), by analyzing long-term trends in Indian exports until the end of the first five-year plan in terms of volume, composition and direction of exports, attributes that the falling world demand for Indian traditional exports is the main factor responsible for relative stagnation of Indian exports during the concerned period.

Maizells (1961) and Nurkse (1961) argued that stagnation of export in LDCs is the consequence of slowly expanding world demand in LDCs 23 traditional primary exports. But, Cohen (1964) statistically observes that the stagnation in Indian exports during 1951-60, has been more due to the higher domestic production costs and rising domestic demand leading to higher relative price of Indian exports in world markets than due to the relative inelastic or falling world demand for India‘s traditional exports. The author also points out that it is reduced competitiveness of Indian

exports primarily due to price factor, which has lead to falling share of India‘s traditional export items in the world market.

Singh (1964) examined India‘s export performance and trends and highlighted the future prospects for self-sustained growth during the period 1951-60. The study explained that intensity or relative importance of external and internal factors influencing India‘s export performance varied from one commodity to other, but stagnation in India‘s export earnings and even declining share in world exports during study period was partly a consequence of faulty economic policies of import substitution adopted by the government during 1951-60.

Samuel and Mote (1970) analysed the competitiveness of Indian exports at micro level both theoretically and empirically and pointed out that the competitiveness of exports depends both on non-price (i.e. quantity and service) and price factors, but the price factor is dominating in determining competitiveness.

Nayyar (1976) analyzed India‘s export performance and policies during 1960s and stated that the process of the export growth was influenced by variety of domestic and external factors. Benerji (1975) has examined the emerging pattern of Indian manufactured exports. Bhagwati and Srinivasan (1975) examined India‘s foreign trade regime, in its interaction with domestic policies and objectives, so as to assess its efficiency and growth during 1951-70. These studies claimed that import substitution policy played a bias against the export promotion and resulted in poor export performance. Thus, these studies emphasized the need of change in the attitude towards the export promotion from the import substitution one.

Besides, Panchmukhi (1978) has discussed India‘s overall trade and other policies covering the period of 1960s. Sainy (1979) examines the role of foreign trade in India‘s economic development and tried to locate weak spot in the policy formulation and institutional arrangement and also suggested measures designed to rationalize imports and argued for diversification of Indian exports.

Nayyar (1988) examined the underlying factors and assessed the relative importance of domestic and foreign constraints in affecting India's exports during the period of 1977-1985. Lack of competitiveness of Indian exports due to price and non-price factors, pressure of domestic

demand, infrastructural and supply bottlenecks are found to be the major constraints of Indian export growth. External factors such as steady increase in protectionism in industrialized countries and fierce price and non-price competition led by near stagnation in international trade during 1980's are found to influence India's export growth adversely.

Nambiar (1979) has traced the role of exports in employment generation in Indian economy during the period 1963-64 and 1973-74. The author concluded that exports have contributed much less to employment generation in India. Export-related employment increased only by half a million between 1963-64 and 1973-74 and only accounted for roughly two per cent of total domestic employment. There were no major structural changes in the overall exports. The significant observations are that the fastest growing exports are least labour-intensive and the outward-orientation of industry is inversely related with labour-intensity of the industry. Export promotion offers no substantial relief from unemployment problem in India.

Dhindsa (1981) has examined the trends in exports of major traditional commodities such as tea, cotton manufactures, and jute manufactures and major causes of slow growth in their exports in major importing countries over last three decades. Main factors which have adversely affected the exports of these commodities are increasing profitability of domestic sales vis-à-vis foreign, heavy exports taxes, and increase in domestic demand, low production and productivity and relative higher production costs. All the selected commodities face stiff competition from their own substitutes.

Wadhawa (1988) has attempted to examine a few specific aspects of the India’s export performance in quantitative terms and impact of real effective exchange rate on it. The econometric results confirm that exchange rate depreciation had an important effect of all five selected products. The results further confirm that for all five selected products, exports in real terms are highly elastic with respect to both the Real Effective Exchange Rate (REER) and the incentive adjusted Real Effective Exchange Rate (REER).

Kantawala (1996) examined differences in price and income elasticity of demand for exports and imports at disaggregative level on the basis of Indian data for the period 1969-70 to 1989-90. The study shows that majority of commodity groups, exports and imports are both price and income elastic and sum of price elasticity of demand for exports and imports is not less than one

during the study period. The study concluded that manufactured exports from India will increase at a faster rate in light of the growth of the developed countries and income elasticity of demand for manufactured exports.

Paul (1992) described new imperatives and vistas of India‘s export given the emerging Asia-pacific Nexus. Kaur (1993) evaluated instability and performance of Indian exports covering the period from 1970-71 to 1989-90.

Sathe (1995) examined the impact of diversification of composition of Indian exports on various aspects of Indian economy during the period 1951-52 to 1983-84.

Bhide *et al*., (1997) highlighted the pattern of Indian exports in terms of their composition and direction, the importance of supply factors in determining the composition of Indian exports and also mentioned the importance of political and other events, which can influence the destination of Indian exports during the period 1960-61 to 1993-94. The pattern and composition of exports and the share of Indian exports reflect either supply bottlenecks of Indian exports or the more aggressive exports by other countries. The composition of Indian exports also indicates the rising share of manufactured exports and decline of agricultural exports.

The study carried out by EXIM of India (1999) examined the instrumental role of international trade in general and that of exports in particular in India‘s growth process during post Second World War period and brought out positive impact of volume growth of exports on country’s overall economic growth.

2.12.3 India’s Exports (1991-2006)

This period is characterized by two most significant events in India‘s economic history. On the one side there is paramount shift in strategy for development from inward oriented import substitution to outward-oriented export promotion and on the other side creation of WTO, which provided a new world economic order. India‘s export sector felt many sweet and bitter experiences during this period, i.e. faced many opportunities and challenges as highlighted in the following two sections.

Economic Reforms and India’s Exports (1991-2006)

India adopted an inward-oriented import substitution heavy industrialization strategy which fostered a large and diverse industrial sector. All this is done to serve some of the domestic interests such as to save domestic industries from foreign competition, to encourage import substitution etc. Over the time, this sector accumulated impressive technological capabilities, but this system created various types of inefficiencies and slowed down the rate of growth of the economy. This model suffered a crisis in early 1980s due to falling production and eroding its position in world exports. India‘s share in world exports has rapidly decreased to 0.5 percent in 1980 from a respectable one of two per cent in 1950. Several studies have argued that the import substitution policies had created a bias against exports in India. In spite of the various export promotion schemes adopted in the 1970s and 1980s, profitability in the heavily protected domestic market remained significantly higher than that in the export market (Kathuria 1996).

Economic policy reforms in India, initiated hesitantly around mid–eighties, experimented with internal liberalization like selective price control and deregulation of industries, increased exchange rate adjustments, monetary policy reforms and some institutional creations. But, the process was reluctant intermittent and patchy. It is only after the severe macro-economic crisis that a serious attempt was made to free up trade, domestic competition, and technology inflow and attract foreign investment (Joshi and Little, 1996). Thus, major policy reforms like widespread decontrol of prices and delicencing of industries, external liberalization of imports and investment, market determined exchange rates and interest rates, and a major strategy shift from import substitution to export promotion started in early 1990s.

In India as in many developing countries, international trade has been dominated by regulations and controls. But throughout much of the developing world since 1980s, there has been an important policy reversal in favour of eliminating these controls. India‘s latest phase of economic reforms was initiated in mid-1991 with a primary focus of trade policy reforms. Trade policy consists of imposition of taxes on trade and other restrictions and regulations which prevent or control trade. Reforming foreign trade policy was the first step in the process of India‘s external sector reforms and an integral part of the programme of macro-economic stabilization and structural adjustment‖ initiated in the economy in July 1991. This step was very significant in the sense that the size of the trade deficit during the fiscal year 1990-91 was abnormally large amounting to over US $ 9.4 billion, which constitute 3.20 per cent of GDP (GOI, 1999). Here

our interest is to investigate the impact of economic reforms on India‘s exports and we concentrate particularly on trade reforms.

Over the period of reforms, some new measures have been added to, and a few of them have been withdrawn from the policy package from time to time, depending upon the changing performance and position of this sector. The measures that have been taken in this regard can be grouped under four broad heads:

(1) Rationalization of exchange rate policy;
(2) Liberalization of imports;
(3) Incentives and encouragement to exports; and
(4) Simplification of procedural formalities and fostering of transparency.

The redesigning of foreign trade policy covers quite a broad area and a variety of measures. A major objective of the trade reforms has been to reduce and eventually eliminate the gap between domestic and export profitability. The focus of the export policy, by and large, shifted from product-specific incentives to more generalized incentives based primarily on the exchange rate. A major element of this policy shift was the downward adjustment in the exchange rate of the rupee against the major currencies in July 1991 (Veeramani, 2007). Further, rupee was devalued twice in July 1991 leading to 20 per cent depreciation in its value. It was held that a more realistic exchange rate would make exporting inherently more attractive. In 1993, the government adopted full convertibility of the rupee on the current account. The exchange rate was henceforth to be determined by demand for and supply of foreign exchange in the foreign exchange market (Veeramani, 2007). Exchange rate has been used as the general instrument for export promotion and import management. Several steps have been introduced for export promotion. These included sufficiently large exports credit at internationally competitive rates, special import licenses to import items and relaxing restrictions related to agricultural exports. All these policy changes are the indication of export friendliness of government, which will enhance the competitive strength of Indian exports in international markets.

Exports were encouraged more actively, quantitative restrictions on imports were relaxed (though not removed, particularly on consumer goods) and tariffs (particularly on industrial inputs and capital goods) lowered. The government eased domestic licensing, and gave large

private firms greater freedom to grow. It also launched a somewhat reluctant privatization process. The trade regime inward oriented import-substitution is now replaced with outward-oriented export promotion. New foreign equipment and technologies are more accessible and there is a significant rise in inward foreign direct investment. In 1992-93, EOU-EPZ system was expanded to agricultural and allied exports. An electronic Hardware Technology Park Scheme was introduced at par with the EPZ in 1994-95. Besides trade policy reforms, establishment of World Trade Organisation in 1995 has also led to steep reduction in tariffs and non-tariff barriers to trade in all the member countries.

The concept of Free Trade Zone was accepted in 1999-2000 and Foreign Exchange Management Act (FEMA) was introduced in June 1, 2000 replacing the earlier Foreign Exchange Regulation Act (FERA). Special Economic Zone (SEZ) policy was announced in April 2000 to overcome the shortcomings of EPZs such as multiplicity of controls and clearances, absence of world class infrastructure and instable fiscal regime. SEZ policy act 2005 supported by SEZ rules came into effect on February 10, 2006 (Economic Survey, 2006-07). Apart from the SEZs, a number of export promotion schemes such as Special Import License Scheme (SILS), Export Promotion of

Capital Goods Scheme (EPCGS), Duty Free Import Exemption Scheme (DFIES), etc. were also introduced (Joshi and Little, 1996).

Table 2.1: Main Measures Affecting India's Exports Introduced since 1991. Years

Measures

Year	Measures
1991-92	Removal of product specific export incentive coupled with a two stage devaluation of Indian rupee (20 Per cent in value).
1992-93	Expansion of EOU-EPZ system to agricultural and allied exports with 50 per cent DTA sell allowed.
1993-94	Partial convertibility of rupee on trade account subsequently followed by full convertibility on current account.
1995-95	Introduction of an Electronic Hardware Park Scheme on par with the EPZs.
1999-00	Acceptance of Free Trade Zones.
2000-01	Introduction of Special Economic Zones, Export Promotion Zones to promote exports.
2000-01	Introduction of FEMA.
2005-06	Establishment of Inter-State Trade Councils. Besides, SEZ policy act 2005 supported by SEZ rules came into effect on February 10, 2006

Source: Economic Survey, Government of India, Ministry of Finance (various issues).

Further, these reforms also include sufficiently large export credit at internationally competitive rates, creation of private bonded warehouses, green channel facility for speedy clearance for certain categories of exporters and importers, special import license to import items from the restrictive list as a reward to exporters for superior performance and quality maintenance, introducing a new category of Super Star Trading House (SSTH) to reward large exporter and relaxing or removing restrictions relating to agro-exports. The forgoing policy changes are an indication to create an environment that will enhance the competitive strength of Indian exports in international market (Kaundal, 2006).

Peak rate of customs duty for non-agricultural products was reduced from 20 per cent to 15 per cent. An additional 108 items, including 30 items in the category of textile products, including hosiery, were identified for de-reservation from the ambit of small-scale industries to help textiles and clothing exports in the post-quota regime. State governments were actively involved in providing an enabling environment for boosting international trade by setting up an Inter-State Trade Council. Some minor administrative measures such as removal of minimum price restrictions on some exports were also initiated. The procedural regime had been streamlined and designed to reduce transaction costs.

Besides the measures to promote exports, various efforts were made to liberalize imports primarily of the intermediate and capital goods. The main objective of import policy is to make necessary imported goods more easily available and promote foreign trade. The economic needs of the country, effective use of foreign exchange and industrial as well as consumer requirements are the basic factors, which influence India's import policy. It takes an integrated view of the overall development of India's foreign trade. Custom duties were cut drastically. Tariffs on capital goods and intermediate goods were significantly brought down to 25 per cent and 40 per cent respectively. Moreover, there was a reduction in the level of tariff on a large number of imports, including special provisions for preferential duty regime. Major measures affecting exports and imports are presented in the Table 2.1 and Table 2.2 respectively.

The objective of the Foreign Trade Policy 2002-03 was of twofold: to double India's percentage share of global merchandise trade by 2009 and to act as an effective instrument of economic growth by giving a thrust to employment generation, especially in semi-urban and rural areas. It

was assumed that coherence and consistency among trade and other economic policies would help India to become a major player in the world trade. It took an integrated view of the overall development of India's foreign trade (Foreign Trade Policy, 2002-03).

Table 2.2: Main Measures Affecting India‘s Imports introduced since

Year	Measures
1991-92	More than a half reduction of tariff rate (150 per cent from the peak of 355 per cent), import licensing system has been dismantled.
1992-93	Another cut in peak rate to 110 per cent, free imports of almost all intermediate and capital goods.
1993-94	Reduction of Unweighted Nominal Tariff from 125 per cent (with peak of 350 per cent) to 65 per cent, removed 146 items from negative (restricted) list.
1995-96	Phased out all non-traditional barriers from all tradable except consumer goods. Further reduction in tariff rates to maximum of 50 per cent
1998-99	Removal of all quantitative restrictions on imports of around 2300 items from SAARC countries.
2000-01	Reduction of peak tariff rates to 35 per cent.
2002-03	Reduction of peak rate of customs duty to 30 per cent Removal of quantitative restriction on bulk of import items.
2005-06	Reduction of peak rate of customs duty for non-agricultural. products from 20 per cent to 15 per cent
2009-10	Peak rates fell sharply to 10 per cent.

Source: Economic Survey, Government of India, Ministry of Finance (various issues).

There are a number of studies that examine foreign trade reforms and their impact on the foreign trade sector as a whole and on export sector in particular. Joshi and Little (1996) described various dimensions of India‘s economic reforms as whole. Various reforms of trade controls and reforms of tariff and protection during 1991-2001 have been analyzed in fuller detail. Withdrawal of various quantitative restrictions, reduction of tariff protection, and introduction of special export promotion scheme has been highlighted as major reforms on trade front.

Sharan and Mukhreji (2001) presented a complete picture of India‘s foreign trade reforms and also highlighted their impact on trade sector. They found that foreign trade reforms have not lived up to expectations. It is true that terms of trade have gone in India’s favour conferring gains from trade. It is also true that the structure of trade has diversified in favour of larger number of commodities and countries, which is a positive trend. But trade deficit has been on the increase despite lowering of the growth rate of imports in recent years making the development process more vulnerable. There are, of course, some supply constraints that the Indian government has not been able to remove completely. But more importantly there are external factors not within

the control of the Indian government that have been responsible for slow growth of several exports.

Sharma (2000), using annual data for 1970-98, investigated the determinants of export performance in India in a simultaneous equation framework. The Results of the study suggest that demand for Indian exports increases when its export prices fell in relation to world prices. Furthermore, the real appreciation of the rupee adversely affected India's exports. Export supply was positively related to the domestic relative price of exports and higher domestic demand reduces export supply. Foreign investment appeared to have statistically no significant impact on export performance although the coefficient of FDI has a positive sign.

Kathuria (1996) examined the impact of recent policy changes on India‘s exports with special reference to export incentives during pre and post reforms periods. Since July 1991, there have been dramatic changes in the trade policy regime in India. The objective of these reforms has been to enhance export performance by improving export incentives and eliminating discretionary controls. By means of a simple model, this paper sets out to examine whether export incentives actually improved as a result of the policy changes. The model is divided into two parts: one compares export profitability (EP) across regimes, and the other compares the gap between domestic and export profitability across regimes. The export basket is divided into eight sub-sectors, and the model applied to each of those sectors. Several sets of simulation exercises have been performed. The dominant results are that relative to export profitability in the pre-July 1991 period, EP declined in the dual exchange rate regime (March 1992-February 1993) for most export sectors. The gap between domestic and export profitability also increased in this period, meaning that domestic sales became even more attractive relative to export sales than they already were. This adverse movement in export incentives was reversed with the unification of the exchange rate in March 1993.

Kaushik *et al*. (2000) verifies the growth, variability, sources of variability, and its impact on economic growth during the process of ongoing policy reforms. To this end, export instability and variance of export earnings around an exponential trend are estimated to examine the relative importance of price and quantity fluctuations. The major findings of the study are as follow: Firstly, the exports of Indian agricultural and allied products and manufacturing products have

increased significantly since initiation of liberalization. Secondly, export-earning instability is mainly due to volume instability rather than that of price variability. Thirdly, study confirmed that export instability does make an adverse impact on domestic economic performance, more pronouncedly by inducing instability in capital goods imports, and less significantly through jeopardizing the pace of domestic capital formation.

Srinvasan (1998) analysed overall trends of India‘s export performance since 1951 and competitiveness of Indian exports since mid-1980s. The author found Real Effective Exchange Rate to be significant in explaining export performance. The author also concluded that Indian export grew relatively rapidly since mid-1980s (barring crisis years), but in comparison with other countries, particularly China, India does not seem competitive in a number of commodities.

Bhatachariya *et al.*, (2000) examined the India's export performance in the post liberalization era.

An attempt has also been made to find out whether the demand for knowledge or capital intensive products is increasing faster than that of labour intensive products. The analysis shows that India‘s exports have shifted towards more value added product categories. The gain has primarily come at the cost of labour intensive products. Further the study reveals that demand for knowledge intensive or capital intensive products is increasing at the faster rate than that of labour intensive products which is in line with global trend.

Ghomawat and Patibandla (1999) examined export performance of Indian diamond, garments, and software industries and also quantified the impact of economic reform on competitiveness of these three exports. The authors argue that economic reform have enhanced India‘s competitiveness in the labour and skill-intensive industries; helped to reduce the dependence of competitive industries on inefficient domestic suppliers and infrastructure. Devaluation of rupee, reduced tariffs from import of capital goods, freer imports of raw materials, formation of alliance for technology transfer and international marketing due to liberalization of FDI and reduction in dependence of sub-optimal domestic inputs and technology are identified as such aspects of reforms process which benefited exports of these three industries a lot. Nonetheless, they find causes for concern about each industry‘s ability of sustain growth, pointing out the need to continue extend and deepen the reform process.

Mehta (1997) has analyzed the impact of India‘s trade reforms on external trade by using the Cordon‘s measures of Effective Rate of Protection. The study concluded that the liberalization process has enhanced the importance of international trade in our domestic economy and the share of trade in GDP has increased to 24 per cent in 1995-96.

Nidugala (1999) has analysed the impact of exports on economic growth in India for the period 1960-80 by using Esfahan‘s (1991) modified growth model. The study concludes that the growth of manufactured exports had significant positive relationship with GDP growth, while growth of primary exports hardly had any influence on GDP growth. The study suggested that there is a need to deepen the reforms further to sustain the current growth and to attain high levels of growth.

Prasad (1997) highlighted the impact of economic reforms on India‘s exports during the period from 1990 to 1994. The study concluded that reforms process has helped India‘s exports, despite relatively lower world demand. This period has witnessed rise in India‘s competitiveness vis-à-vis its competitors. This has also paved the path for India to reap the benefits of any increase in world demand.

Marjit and Chaudary (1997) analyzed India‘s export performance and trade policies during 1970-90 and also highlight the prospectus of recent reforms in the light of past performance, especially in the context of external sector. The study shows that India‘s export performance is far from satisfactory. Lack of price competitiveness is the most important lacuna in Indian exports. The study recommend an increasing role of market mechanism, reducing the scope of distortionary taxes and subsidies to improve India’s export performance as well as to make Indian exports price competitive vis-à-vis its competitors. The authors also clarify that besides price competitiveness, non-price factors especially the aspects of quality, timely delivery, organic nature of products, etc. are most important aspects to improve export performance.

Hargopal (2001) has evaluated the performance of external sector of India in the light of trade policy reforms for the period 1980-81 to 1997-98 by dividing whole period into sub periods i.e. pre-liberalization (1980-81 to 1990-91) and post- liberalization period (1991-92 to 1997-98). The study concluded that on the whole, trade liberalization measures had a positive impact on external variables. Post liberalization period saw a tremendous growth of exports, imports,

foreign exchange, and a decline of internal debt. The only concern found was the faster growth of imports as compared to exports.

Sekhar (2003) analyzed the likely implications of agricultural trade liberalization for the rice sector in India with a special focus on determining the role of major exporters in world rice market. The results indicate that the world markets for rice are mainly influenced by reduction in income levels in the major importing countries. Demand functions showed high elasticity with respect to Indian exports prices relative to that of Thailand and Pakistan.

Marjit *et al,* (2000) have tried to find out the impact of currency devaluation on India‘s exports for the period 1951-94 by using US import statistics. The study concluded that in developing countries like India, where foreign exchange markets are subject to stringent rules and regulations, actual exports may not undergo much change following devaluation and the official statistics often tend to overestimate the actual impact of currency devaluation. Further, the study observes that the impact of exchange rate devaluation was strongly realized on reported sales than on the actual exports to US during the concerned period.

Aggarwal (2003) analyzed the inter-firm determinants of export performance in Indian manufacturing in late 1990s by taking a sample of firms from Indian manufacturing. The results show that high tech industries are not attracting efficiency seeking FDI as had been expected. In case of medium high-tech sectors, performance is somewhat better. In low-tech industries, firms with high foreign stake are found to be performing better. The results also suggest that in technology based sectors own technological capabilities of the firms are crucial determinants of export performance. It was also found that export performance was linked with firm size and import of raw material in component in almost all technology groups. Further, the liberalization of markets and technological changes taking place has changed the kind and determinants of trans-border activities engaged in by MNEs.

Chand (2004) has investigated India‘s agro export performance and competitiveness in changed international scenario. Policy of reducing controls over exports and exchange rate adjustments boosted growth of farm exports. Study concluded that despite several odds such as TBT-SPS issues and domestic infrastructural bottlenecks, in the new international trade environment India performed much better in exporting horticultural, livestock, and processed products whose

demand is more elastic. India has an advantage and potential for promoting exports of rice, groundnut, soybean, cotton, and sugar, but it is in a disadvantageous position to compete and benefit from wheat. Domestic factors such as improvement in efficiency which includes reduction in production cost as well as other costs and processes which reflect into price like cost of marketing, cost of transport and cost of processing, are key to improve export performance.

Kaushik and Karol (2001) backed by an econometric exercise, confirm that export instability does make an adverse impact on domestic economic performance, more pronouncedly by including instability in capital goods imports, and less significantly through jeopardizing the pace of domestic capital formation.

Devi and Rao (2004) also examined the impact of economic reforms on India‘s external sector as a whole and on exports in particular. They argue that reforms have enhanced India‘s competitiveness in labour and skill intensive industries, reduced dependence of competitive industries on inefficient domestic suppliers and infrastructure and enhanced domestic competitive conditions. Exports have been growing at 20 percent in dollar terms. What is more significant is that the share of manufactured goods in the export basket has risen while that of primary goods has fallen.

Kaundal (2005) examines the patterns, causes and determinants of growth and instability of India ‘principal exports. He also evaluates the impact of trade policy reforms and that of export growth and instability on economic growth. The structure of India‘s exports has undergone radical changes during 1970-71 to 2001-2002. Share of important traditional items like tea, jute manufactured and cotton textile , raw jute and cotton raw has sharply gone down while that of new non-traditional items like machinery, transport and metal manufactures including Iron and steel, chemical and allied products and developmental imports have gone up during the period under study. The direction of exports has remained mainly towards the industrialized countries of the west. Early post reforms experienced considerable buoyancy in exports. The analysis also explored the relative importance of supply and demand forces and the resultant price and quantity fluctuations in identifying export instability in India‘s principal exports in general and agricultural exports in particular.

Sharma and Dietrich (2007) assesses empirically structural change in the Indian manufacturing based export sector during the period 1980-2000 by using trade indices such as Balassa‘s Revealed Comparative Advantage (RCA) index, and other variants commonly employed in the literature are used. Three technology categories (high technology, medium technology, and low technology) are analysed individually. The results of the study indicate towards substantial industrial restructuring in manufactured exports. It also indicates towards despecialisation within India‘s manufactured exports for the time period studied, which is consistent with increasing specialisation in a subset of manufactured exports.

Establishment of World Trade Organisation has also led to steep reduction in tariffs and non-tariff barriers to trade in all the member countries. Seattle (1999) ministerial conference launched new round of multilateral negotiations focused on agriculture, services and intellectual property rights. Due to the failure of the third conference, fourth conference at Doha (2001) presented Doha Development Agenda (DDA), especially related to Agreement on Agriculture (AoA). But, majority of the commitments related to Doha round are still in deadlock even after the Cancun (2003) and Hong Kong (2005) ministerial conferences. Indian economy embraced the process of globalization since early 1990s, which has got intensified in the post-1995 (i.e. post WTO) period and influenced export sector by one way or the other. The openness index (trade to GDP ratio) of the economy has increased three fold since late 1980s and almost doubled over the last couple of years.

The findings of Barua and Chakaborty (2004) show that in the post-WTO period, scale efficiency of the net exporting sectors has increased. However, it has been pointed out from time to time that Indian exports have been subject to various Non-Tariff Barriers (NTBs), which inhabit the level of market access they enjoys. Newly emerged NTBs such as safeguards measures, anti-dumping duty, countervailing duty; Technical Barriers to Trade-SPS; environmental standards; labour standards and intellectual property rights, etc., have widespread implications for Indian agricultural and manufactured exports.

Rana and Singh (2003) backed by simple econometric exercise, discovered that foreign tariff played a decisive role in promoting our exports in the same way that domestic tariff structure

significantly influences our imports. Implications of uneven play of tariff rate restructuring for exports from and imports into the developing economies come up robustly.

Chakraborty *et al.,* (2005) compared the recent Indian export performance with that of China and attempted to analyse the situation through various features of Indian export basket, namely competitiveness, diversification trends and instability and examined the recent stance adopted by India at WTO. Results of the study reveal that while diversification of the export basket has slightly been increased, the instability index is quit insignificant for a number of commodity groups at major export destinations. Besides the competitiveness, the number of product groups has declined in post WTO phase. Agriculture sector is very important for India due to its contribution in GDP and employment and also due to continuous surplus in agricultural trade.

Bakhshi (2005) explains how Sanitary and Phyto-Sanitary (SPS) Agreement acts as non-tariff barriers to developing countries 'agricultural exports with special reference to India. The author argues that developed nations like EU and US are using this agreement for discriminating against developing countries 'exports. For India, as being one of the largest producers of food products in international market, SPS issues are great cause of concern. The author also analysed the cost of implementing higher standards like product related standards, production related standards, testing procedure standards and process standards at domestic level.

Chakraborty and Singh (2006) focus upon the present scenario of agricultural subsidization with special reference to India and try to formulate a suitable negotiation strategy to be followed by the developing countries. They contend that agricultural subsidization is the actual hurdle in freeing agricultural trade. Several WTO member countries enjoy a synthetic price advantage, buoyed by agricultural subsidies, while main losers are the poor developing countries due to their dependence on primary produce as a major source of export earnings.

Ramphul (2006) analyses the impact of WTO on world agricultural trade and agricultural trade performance of developed, developing, and least developed countries. In WTO regime, the annual average growth rate of the world agricultural exports has worsened implying deterioration of in share of agricultural commodities in world total merchandise trade. The developing and the least developed countries are found to be net importers of agricultural commodities. The share of

LDC‘s in world agricultural exports has declined while in case of imports it increased. Export subsidy is also a core area of concern.

Nack and Singh (2006) presented a detailed price analysis for major commodities and reported that heavy losses of Indian exports are mainly due to distortions in world market adding worse, sometimes in their domestic market by developed countries. Market access and domestic support are the another problematic issues like export subsidies.

Benerjee (2006) laid out the issues related to TBTs, in particular the SPS Agreement, from an Indian point of view, keeping in mind Indian interests, with special reference to India‘s agricultural trade. India‘s concerns with SPS-TBT agreement (widely shared by other developing countries) are with flawed working of the mechanisms of SPS-TBT agreements within WTO and lack of implementation and violation of some of the basic tenet of these agreements by developed countries. Such concerns are related to harmonization issues, institutional politics of standard formation in international bodies, protectionist trade policies, and use of standards. Most of the SPS-TBT concerns are related to India‘s agricultural exports and imports.

Deodhar (2002) examines the implications of agreement on SPS measures and the agreement on Technical Barriers to Trade for India and found that food safety and quality norms in importing countries affect trade in agricultural products. In order to minimize the adverse effects on India‘s exports of these norms, he suggests the steps for encouraging the adoption of the food quality management system called Hazard Analysis and Critical Control Points and for training manpower to handle post-harvest quality management practices and food processing activities. He also emphasizes the need to participate actively in the development of standards undertaken by international standardizing bodies and for certain amendments in SPS agreements.

Singh (2001) found TBT and SPS measures as new barriers for India‘s agro-food industry and agro-exports. Further, India‘s agro-food industry and agro-exports have been found to be adversely influenced by imposition of such non-tariff barriers. Among the major reforms in the post WTO phase, the most discussed area is probably textile and garments sector, where India stands to gain massively from quota-removal.

Kathuria et al., (2003) provide an introduction to the economics of MFA and use available empirical evidence to examine the impact of the MFA on exports of textile and clothing, focusing particularly on India. A review of the basic economics of the MFA shows the discriminatory character of the arrangement. Although exporting countries can gain from quota rents, much of the gain is likely to be offset by exports to unrestricted markets and by efficiency losses resulting from inability to put the resources to their best uses or to be shared with industrial country importers. Looking through the performance of agro and textile-readymade garment exports during the 1990s,

Mukhpadhyay (2001) concludes that India does not seem to have gained much out of the Uruguay Round negotiations.

Nanda and Raikhy (2003) examine the implications of Environmental and Labour Standards in WTO context for India‘s textile exports on the basis of a painstaking analysis of the changing composition and direction of India‘s trade in textile and ready-made garments. They discover that reduced off-take by Germany, Netherlands and other European countries very largely owes itself to strict environmental and labour standards imposed by them. Study found that the developed countries still remain the major destination for India‘s textile exports and imposition of strict environmental and labour standards is a cause of worry for India‘s textile exports. A number of suggestions, most notably the needed precaution for the use of industrial chemicals, are made to ward off restrictions that are likely to follow from the U.S.A and many other European countries.

Furthermore, Bandhyopadhyay and Sengupta (2006) examined implications of MFA phase out for Indian textile exports. The study shows multiple positive effects of MFA phase out, i.e. elimination of ATC quotas for Indian clothing and textile exports. They have also made an attempt to identify factors responsible for relative poor performance of textile sector. They also identify sectors in the textile industry where India has a comparative advantage or disadvantage and also examined India‘s position vis-à-vis its competitors in the backdrop of MFA phase out.

Nordas (2004) pointed out that welfare gains to India from ATC quota would be three times as high if combined with domestic reforms. Taking full advantage from complete phase out of market restrictions requires not only increasing competitiveness through the removal of

distortions arising out of incorrect government policy, but also for better marketing network that India presently lack. Besides, removing reservation for small scale industries in garment segment, it is needed to remove restrictions on raw material imports and rationalize existing excise rates of different types of fiber and fabrics.

Verma (2001) gives a brief pre and post-Uruguay Round history of textile and clothing sector exports in particular. Product group wise differences between applied and bound tariff rates in developed against the developing economies are brought out in brief. The study found the positive impact of WTO agreement on Indian textile and clothing industry. Again, the formation of custom unions and free trade areas (i.e. NAFTA, CBI, Sub Saharan African Region, etc.) has adverse effect on textile exports 'rather than the newly emerging non-tariff measures.

Porter (1994) and Prasad (1997) asses India's competitiveness in export of garments in the MFA phase out and post MFA phase out periods and observe that India's garment sector is one of the sectors where India have a competitive advantage and has a wider scope of export expansion in post MFA phase out period.

EXIM (1995) also confirms that India has fully utilized its quota in most cases except Finland and unit values of India's exports are lower than most of its competitors. Thus, there is not much basis for the argument that lower floor prices should be fixed for exports under quota. Indian pharmaceutical and cotton textile industries have a huge export potential.

Saqib (2003) presents a picture of technical barriers to trade and also discusses the role of Indian standard setting institutions in address these issues. Despite growing concerns that SPS-TBT measures may be inconsistent with WTO provisions and may impede India's exports, the Indian government is not well positioned to address these issues.

Ray (2006) enumerated the sources of Non-Tariff Barriers in case of India's exports and also discussed incidence of such NTBs. The study found many NTBs faced by India's exports such as TBT-SPS, social clause , tariff rate quota, procedural issues, import policy and TBT, MFN violation, circumventing under export subsidies, environmental issues, antidumping duties, social and environmental clauses, strict registration procedures, quantitative restrictions,

safeguard duty, countervailing duties, local content requirements, government procurement, rules of origin labour issues and procedural delays and provisional safeguard measures.

Dutta *et al.,* (2006) has examined environmental standards as problem of market access in the WTO context with special reference to India‘s exports. They found both the issues respectively worked as NTBs to India‘s exports and influenced India‘s export performance of concerned products in respective markets adversely.

Narayan and Thomas (2005) analyzed WTO agreement on safeguards measures, custom valuations and pre-shipment inspection and observe that safeguard measures would lead to grave disruptions for trade.

2.12.4 Summing Up of export-import literature

The review of available economic literature on India‘s exports, WTO and economic reforms highlighted the following facts:

1. Export and Economic Growth relationship is a controversial phenomenon in economic literature. There are many studies, which discover strong positive relationship between exports and economic growth and thus, an increase in the export leads to multiple changes in national income as in Keynesian Foreign Trade Multiplier theory and growth models especially of Harrod-Domar. On the other hand, Following Singer–Prebisch model of Secular deterioration of terms trade and Dependency theory (given by Andre Frank, Paul A Bran and Samir Amin, etc.), many other studies refute the existence of such a relation between the two and found export promotion outward-oriented strategy inferior to that of import substitution one with respect to impact of such strategy on economic growth in the long run.

2. Economic literature on India‘s exports during the period1950-91 shows that exports during this period were subject to many tariff and non-tariff trade controls and protections. Export promotion up to 1980s is a totally neglected area in Indian policy making. India‘s Export performance during this period found to be very weak due to restrictive trade policy. In some studies, domestic demand for exports and supply bottlenecks are termed as the reasons for poor export performance during per-reforms period. Some studies observed that domestic factor were more responsible for stagnation and even degradation of India‘s export sector. Some prominent

studies found external factors responsible for export stagnation in the economy in the pre-reforms period. Meanwhile, all the studies examining export performance during this period found restrictive trade policy primarily responsible for poor performance of export sector and emphasis an export promotion outward-oriented strategy to improve this.

3. In most development planning, the importance of exports to domestic growth has been approached in terms of importation of goods and services. But, it is misleading to assess the contribution of the export sector solely in terms of foreign exchange earnings, as many underdeveloped countries, while stressing exports, also hope to reduce their relative dependence on foreign markets as economic development proceeds at a more rapid pace. In fact, the export sector assumes a much broader and useful role than that reflected in terms of foreign exchange earnings. Therefore it should be given paramount importance in policy making. Almost all the reviewed studies show that India‘s exports have been found positively affected by the implementation of economic reforms. India‘s export sector took the full advantage of reforms in foreign trade sector such as reduction in tariffs, withdrawal of non-tariff restrictions, favourable exchange rate policy, freer import of raw material and the introduction of several export promotion schemes as well as creation of EPZs and SEZs. The only dissatisfaction related to economic reforms is that import bill has increased sharply even during the era of economic reforms.

4. Impact of WTO on India‘s export sector is a mixture juncture. A few studies show that domestic economic reforms combined with WTO commitments has lowered down the tariff barriers to export in the markets of member countries and exports have benefited from the reduction in tariff barriers by the WTO member countries. Thus, progressive reductions in tariffs due to WTO agreement, Indian export see its massive price effect on exports volume. But, on the other hand, most of the studies related to WTO and India‘s export confirmed that newly emerged NTBs such as safeguards measures, anti-dumping duty, countervailing duty; TBT-SPS measures, environmental standards, labour standards and IPRs, etc. have restricted growth of several Indian exports during post WTO by one way or the other. Issues of WTO agreement related to SPS-TBTs, export subsidies, market access, domestic support, and TRIPS all had influenced India‘s agricultural exports adversely by preventing freer flow of exports in some specific destinations. On the other side, WTO had proved beneficial for India‘s manufactured exports especially for

textile and Garment exports, and pharmaceutical exports. Textile and garment exports have gained a lot from MFA phase out. But, labour standards set by the developed countries worked as constrains to textile exports in their respective markets. Most of the studies show that domestic economic reforms combined with WTO commitments has lowered down the tariff barriers to export in the markets of member countries and exports have benefited from the progressive reduction of trade barriers. Careful analysis of the literature on Indian exports shows that most of studies have analysed mainly agricultural exports, textile exports and pharmaceutical exports and even some specific exports within these during the post-reforms period. Exports of POL, iron and ore exports and other manufactured exports except textile and pharmaceutical exports are neglected and covered only fewer studies and there is a need to peruse further research in this area.

Thus, an extensive review of related study has been done and a brief of the literature has been detailed above. Based on this review of literature objectives and methodology for this study were decided. The same has been presented in the following chapter titled research methodology.