CHAPTER 3

LITERATURE REVIEW

The objective of Total Factor Productivity (TFP) studies is to measure the productivity growth to judge the development trend of the units of production. For any country, whether it is developed or developing, measurement of TFP is an important and necessary step in understanding growth of the economy. Productivity studies may be conducted on the whole economy or on the regions of a country. These studies typically use growth accounting technique or index numbers or even distance functions like in case of the Malmquist productivity index. This chapter briefly discusses some noteworthy TFP studies conducted on the whole economy and on the regions of a particular country. Some relevant studies in case of Bangladesh are also discussed.

3.1 Review of Studies on Total Factor Productivity Growth

Among TFP studies at the aggregate level of the whole economy, the survey by Asian Productivity Organization (APO) is worth noting. APO undertook an international survey project on measuring TFP among the member countries in 2004 with the participation of 12 member economies. In this survey, economy wide TFP growth was estimated for these countries and then the factors affecting it were investigated. The survey considered the aggregated capital stock and total employment as productive factors and also estimated the contributions of quality changes of labor and capital and separated them from the TFP growth. The framework for the study was growth accounting which estimated parameters of a translog production function assumed. The survey also separated the effect of the change in capacity utilization on the estimated TFP growth. Another specialty of this survey was that it conducted a coordinated investigation of several Asian economies using a similar methodology and tried to identify factors important in improvement of TFP.

This survey project coordinated the estimation method of TFP growth among participating economies and obtained comparable estimates for at least 20 years. It also estimated the quality change in labor and capital quantitatively and separated their effect on TFP growth and economic growth. The effect of reallocation of labor was also estimated. Using the estimates of TFP growth, it tried to identify the factors that affect TFP growth. It was found that, TFP growth played an important role in the economic growth of most economies, especially in later years. This is contrary to Krugman's (1998) argument that Asian economic growth was largely due to growth in productive factors and that technical progress contributed little to growth in Asian economies. In fact, the survey found that improvement in the quality of labor contributed greatly to economic growth in many economies. Accumulation of capital was another factor that contributed to economic growth. The contribution could have been even larger if the investment had been allocated to more productive sectors and to more productive types of capital goods, and also business fluctuations affected the estimation of TFP growth considerably. Finally, through the investigation of factors determining TFP growth using regression analysis, it appeared that the factors affecting TFP growth vary from country to country. Foreign direct investment showed a strong correlation in separate analyses of several economies.

Tinakorn and Sussangkarn (1994, 1998) used the growth accounting method based on the framework of the Solow-Denison approach to study TFP growth during 1970-96. The study included both the aggregate level and the sectoral level analysis divided into the agriculture, manufacturing and service sectors. The important aspect of this study was the decomposition of TFP growth with the change in the quality of factors of production. The index of adjustment was constructed from the classified data after classification of the labor input data according to age, sex, and level of education. The study separated private-sector, state-owned enterprise, and public-sector employees from own-account and unpaid family workers, and the adjustment was based on the 1995 data from the Social Accounting Matrix (SAM). Use of SAM for calculating wage share for the economy, where reliable wage share data is not available, was another unique feature of this study. They also analyzed the decomposition of the business fluctuation effect from crude TFP growth using the capacity utilization rate, which was constructed from the capital-output ratio. Finally,

the study identified factors determining TFP growth using multiple regression analysis. As the study focuses on a developing country of Asia, the framework can be followed for investigating sources of growth in other Asian countries like Bangladesh, too.

There have been many regional studies on productivity in the world. Domazlicky and Weber (1997) used linear programming technique to construct a Malmquist index measuring productivity change for the U.S. states for the period of 1977 to 1986 and decomposed the productivity change into technical change, changes in pure technical efficiency and changes in scale economies. The study was able to identify the states which are innovative as opposed to those which are in a process of catching-up. The study assumed two outputs (private sector output and public sector output) to be produced from four inputs (private sector labor, private sector capital, public sector labor, and public sector capital). In Asia, Chang et al. (1995) used Data Envelopment Analysis (DEA) to construct a Malmquist productivity index for studying the economic performance of 23 regions in Taiwan considering income level as output and population density, urban planning, local finance, public utilities, medical facility, education and culture as input factors. Since the distance function approach doesn't require price information for measuring productivity, use of this method is becoming common in regional productivity studies in case of unavailability of reliable price information at the regional level of the economy.

3.2 Productivity Studies for Bangladesh

There have been very few studies undertaken in Bangladesh measuring productivity growth. The studies examining TFP growth in the manufacturing sector has in general concentrated on specific industries as in Sahota et al. (1991) and in Harvard Institute of International Development (HIID) and Employment and Small Scale Enterprise Policy Planning (ESEPP) project (HIID-ESEPP, 1988, 1990a, 1990b, 1990c), but none of these studies considered the issue of assessing the overall productivity change in manufacturing sector for the whole economy. On the other hand, studies on TFP growth in Bangladesh crop agriculture are limited to the work of Pray and Ahmed (1991), Dey and Evenson (1991) and Coelli et al. (2003). Although

TFP study for the whole economy at the aggregate level is a requirement for international comparison of production scenario, no study so far has attempted to assess the TFP change in Bangladesh at the national level.

One possible reason for this absence of TFP studies may be the lack of reliable data, specially the data on capital stock. Bangladesh Bureau of Statistics (BBS) publishes investment series for the whole economy, but sector wise capital stock series is not available from the national publications. Besides, BBS does not publish any information on the investment made on the agricultural sector. Also, there is considerable amount of inconsistency in definition of labor force in various issues of the labor force surveys.

However, among the studies on the agricultural sector of Bangladesh, Coelli et al. (2003) examined overall TFP growth in agriculture for the period from 1961 to 1992. This study applied a stochastic production frontier model to measure TFP growth, technical efficiency change and technological change in Bangladesh crop agriculture, using data for 16 regions. The results revealed that technical change followed a U-shaped pattern, rising from the early 1970s, when the green revolution varieties were adopted, giving an overall rate of technical progress at 0.27 per cent per year. However, technical efficiency declined throughout, at an estimated annual rate of 0.47 per cent. The combined effect of slow technical progress, dominated by the fall in technical efficiency resulted in TFP declining at a rate of 0.23 per cent per annum, with the rate of decline increasing in the later years. TFP change was shown to depend on the green revolution technology and agricultural research expenditures.

It should be noted that, the time span considered in this study includes the period from late seventies up to early nineties in which Bangladesh agriculture experienced the substantial reduction of the yield of new varieties of rice as reported in Rahman (1999). The declining rate of TFP growth found in the study for crop agriculture for that specific period thus merely confirms the real picture. But recent studies by Dorosh (2004) and Ahmed and Sattar (2003) indicate that, external and internal trade liberalization efforts of the government after early nineties combined with wider application of fertilizer and increased adoption of the higher yielding winter season rice variety allowed Bangladesh to achieve self-sufficiency in rice in recent years. Hence in the changing situation in the production of a major crop, the

trend in TFP change in Bangladesh agricultural sector requires an updated investigation using data from early nineties onward.

On the other hand, among the few studies on manufacturing sector, Krishna and Sahota (1991) computed technical efficiency and productivity growth for 30 industries covering the period 1974-75 to 1985-86 using a deterministic frontier production function. They found that most of the sample firms were producing at less than 50 percent of their productive efficiency. The study also found that 15 out of 30 industries experienced no significant improvement in technical efficiency and TFP growth for these industries indicated a stagnated stage of efficiency and productivity, while only 5 of the sample industries experienced an acceleration in TFP. The remaining 15 industries suffered deceleration in TFP during the sample period.

Using the conventional growth accounting approach to firm level data, Sahota et al. (1991) measured TFP in a number of manufacturing industries covering the period 1974-75 to 1985-86. They found that TFP declined in most of the enterprises during the sample period and no strong evidence of positive impact of economic reforms on TFP growth was found.

HIID-ESEPP project of the Bangladesh Planning Commission (HIID-ESEPP, 1988,1990a) calculated TFP indices for a large number of industries, both at the firm level and the industry level for the period 1974-75 to 1983-84. The overall results show that only 35 percent of manufacturing firms experienced a positive cumulative TFP growth over the entire sample period. The findings of the HIID-ESEPP study are summarized in Table 3.1, showing the percentage of industries experiencing positive annual and cumulated TFP growth in the consumer goods, capital goods and intermediate goods industries. The capital goods sector performed well in terms of TFP growth. While 50 percent of industries in this sector had positive TFP growth in 1975-76, this figure increased to 53 percent in 1981-82. Over the sample period, 56 percent of industries in this sector enjoyed cumulated positive TFP growth. On the other hand, the performance of industries in the other two sectors deteriorated over the years. About 30 percent of the consumer and intermediate goods industries experienced cumulative positive TFP growth. Overall, only 35 percent of industries in the manufacturing sector enjoyed cumulative positive TFP growth. Although the consumer goods industries receive the highest level of protection in Bangladesh, only

31 percent of such industries experienced positive TFP growth during the period. This is contrary to the argument that the most protected industries enjoy the highest TFP growth. Various studies within the HIID-ESEPP project have investigated the relationship between economic policy reforms in terms of incentive structures, manufacturing value added growth and TFP growth (HIID-ESEPP, 1990b; 1990c). However, these studies reported no significant relationship.

Table 3.1

Annual and Cumulated TFP growth in selected Manufacturing Sectors, from 1975-76 to 1983-84

Financial Year	**Observations**	**Consumer Goods**	**Intermediate Goods**	**Capital Goods**	**Overall**
1975-76	No. of Industries	38	27	14	79
	TFP growth +ve	18	14	7	39
	% of positive	**47**	**52**	**50**	**49**
1981-82	No. of Industries	47	39	15	101
	TFP growth +ve	17	15	8	40
	% of positive	**36**	**38**	**53**	**40**
1975-76 to 1983-84	No. of Industries	48	43	16	107
	TFP growth +ve	15	13	9	37
	% of positive	**31**	**30**	**56**	**35**

Source: The HIID-ESEPP project of the Bangladesh Planning Commission (1988; 1990b)

The brief discussion above indicates that majority of the manufacturing firms in Bangladesh is not experiencing a positive TFP growth despite initiative of economic reforms. In this situation, it would be interesting to examine whether the manufacturing sector as a whole is experiencing stagnation in TFP growth as well.