LABOUR PRODUCTIVITY IN A MANUFACTURING INDUSTRY : THE CASE OF COTTON TEXTILE INDUSTRY IN BANGLADESH, 1962-82

A Thesis
Submitted to Dhaka University
For the Award of the Ph.D. Degree

A.F.M. Mafizul Islam

Department of Economics
University of Dhaka
Dhaka, Bangladesh

March 1987

ACKNOWLEDGEMENT

Dr. Muzaffer Ahmad, Professor of Economics, Institute of Business Administration, Dhaka University is the Supervisor of my present thesis. I had earlier worked on Handloom and Small Powerloom Industries for my M.Phil. thesis and I am grateful to all those who kindled my interest to work in cotton textile industry for my Ph.D. programme under the guidance of Professor Ahmad. A dissertation is the product of student's hard labour but it is enriched by the breadth of vision and depth of knowledge of a cooperating and inspiring supervisor who gives time unhasitatingly and instantaneously, who is reflective as well as expansive, who conserves tradition but produces innovatation as well and above all who demands quality in work and inspires consistent hard work. In Professor Ahmad, I was fortunate to get such a Supervisor whose constant guidance and continuous encouragement, whose breadth of experience and depth of ideas and whose patience and endurance helped me to complete the thesis in time and without much difficulty. I feel bonded to him not merely for his intellectual contribution but for his exceptional quality as a man of kind disposition and uncompromising academic values.

I am indebted to Dr. Ashrafuddin Chowdhury, Professor, Department of Economics, University of Dhaka for thoroughly revising an earlier draft of the thesis. But for his painstaking scrutiny and valuable suggestions, the quality of the thesis would have remained poorer than what it is. I am thankful to Dr. Nuimuddin Chowdhury, Senior Research Fellow, BIDS and Dr. Khondker Mustahidur Rahman, Associate Professor, Department of Economics, Jahangir Nagar University for helpful comments.

I am grateful to Mr. Abu Sayed, the then Chairman of BTMC and to Managers, staff and workers of sample mills for their cooperation in collecting data, hospitality and time for endless discussions.

I must record my deep appreciation of the work done by Mr. Md. Khairul Alam of Local Government Engineering Bureau for typing this thesis with care through stress and strain.

Finally, no research is the product of one's own work only. I owe great deal to theoreticians and empiricits, some acknowledged in foot notes and references, while others remain unmentioned and my intellectual debt to them is enormous. However, any imperfection that remains is mine and mine only.

A.F.M. MAFIZUL ISLAM

CERTIFICATE

I am pleased to certify that the thesis entitled, "LABOUR PRODUCTIVITY IN A MANUFACTURING INDUSTRY : THE CASE OF COTTON TEXTILE INDUSTRY IN BANGLADESH, 1962-82", submitted for the award of Ph.D. degree in Economics by Mr. A. F. M. Mafizul Islam,

(1) was carried out under my supervision,

(2) is the product of his own work,

(3) is original in respect of methodology of analysis and measurement of variables,

(4) is contributive to furthering over knowledge about productivity performance of a major industry in Bangladesh,

(5) is self-contained in nature and comprehensive in presentation,

(6) is satisfactory in terms of literary presentation, and

(7) highly suitable for publication by the University.

I recommend it for submission for the award of Ph.D. degree in Economics.

MUZAFFER AHMAD
Thesis Supervisor
&
Professor of Economics
Institute of Business Administration
University of Dhaka

ABSTRACT

LABOUR PRODUCTIVITY IN A MANUFACTURING INDUSTRY : THE CASE OF COTTON TEXTILE INDUSTRY IN BANGLADESH, 1962-82

by

A. F. M. Mafizul Islam

The focus of the thesis is measurement and analysis of labour productivity in a manufacturing industry with particular reference to cotton textile industry of Bangladesh. The study measures productivity in physical terms, while most of the earlier studies used value measurement. The analyses have been carried at three levels, viz; macro level, plant level and process-by-process level, while most other studies have studied at an aggregate level only. The process-by-process productivity analysis is claimed here as an original contribution.

The study, as expected, concludes with the note that the productivity of labour in cotton textile industry of Bangladesh is far from satisfactory. The factors contributing to this poor performance are many and multi-dimensional. In this regard, the study analyses and distinguishes factors affecting productivity at two levels, viz; aggregate level and production process level, and comes up with suggestions at both the levels.

In fine, the study comes up with some major policy observations relevant to the mills/BTMC as well as to the Government of Bangladesh. In this regard, conclusion of the study is not mere theoretical in nature but has practical application.

****

The Case of Cotton Textile

TABLE OF CONTENTS

INTRODUCTION

Productivity as a fact of life has existed from time immemorial, but as a concept of efficiency and a means of improving the standard of living of people it is of recent origin. It is only after the Second World War that the productivity movement gathered momentum and witnessed the establishment of national productivity organisations. Productivity movement in Asia began around the mid of 1950's. The Indian Productivity Centre was establised in 1955 in Bombay. In 1955 the National Productivity Council was establised similar to the Japan Productivity Centre which was an autonomous body [51]. The Asian Productivity Organisation(APO) was set up in 1961 as inter-governmental organisation with the objective of increasing productivity and consequently accelerating economic development by mutual cooperation among member countries [85]. The last two decades have seen a growing awareness and an increasing activity for strengthening the productivity movement in the region.

The importance of productivity in economic development can not be overemphasized. As such, productivity study, in particular input productivity assumes an integral part of the process of development planning which besides other goals aims at achieving some desirable rate of growth of national income. The relevance of the study of input productivity can easily be seen with the aid of simple production function of the Cobb-Douglas type as shown below :

$$Y = AL^{a}K^{b}e^{nt}$$

Where Y represents quantity of output, and L and K represent the quantities of labour and capital inputs respectively. The variable t is the time trend whose coefficient n represents rate of technological change. A, a, b and n are parameters of the function. The parameters a and b indicate responsiveness of output with respect to the inputs, and are termed as 'productivities' of labour and capital respectively [87].

The productivity of labour (and also capital) is discussed in the theory in terms of 'Laws of Returns' where labour (and also capital) has been regarded as important factor in contributing to the growth of income [74]. More specifically when :

$(a+b)>1$, output increases at a faster rate than that of the inputs
$(a+b)=1$, output increases at the same rate as the inputs, and
$(a+b)<1$, output increases at the slower rate than that of the inputs

No doubt greater productivity at the individual firm level might be effected by having fewer people required to do a given volume of work. If repeated throughout the economy, this would mean a great deal of job displacement. But it has been well-demonstrated by Sibson that this approach does not work. Rather increased productivity ultimately means more jobs.*

Increased productivity of labour would thus mean higher growth rate as well as higher wage income and higher level of employment. Thus to the extent higher productivity of labour gives rise to increased income, wage and employment, productivity indices will serve as useful guides to the solutions of development problems.

In Bangladesh there does not exist any national productivity organisation, and researches on productivity are few and far between. The importance of productivity study in a country like Bangladesh is enormous. While such study for a particular sector like agriculture or industry is useful, studies at a more disaggregated level would provide more insight in this regard and would be of much relevance for policy purposes. In this sense the cotton textile industry of Bangladesh merits special attention because the share of the industry in total manufacturing employment and value added varied from about 40 percent in 1962-63 to about 35 percent in 1978-79. In terms of capital invested and employment, cotton textile is the second largest industry of Bangladesh. Unlike jute, it is also a growing sector.

But unfortunately barring a few surveys conducted by the Industries Development Bank of Pakistan (IDBP), Pakistan Industrial Credit and Investment Corporation (PICIC), East Pakistan Industrial Development Corporation (EPIDC) and Central Statistical Office (CSO), serious research into the various aspects of the industry has been very scarce. Published document during the period before partition of India (1947) is almost nil. During the Pakistan period (1947-70) a number of surveys were conducted. 'Census of Manufacturing Industries -1955' is, of course, the first survey in which cotton textile industry has been reflected in part. It provides sketchy information. Census of Manufacturing Industries for the preceeding years (28) also provide partial information of the same nature. Next document which is available on cotton textile industry in Bangladesh during Pakistan period is 'A Survey of

*For detail see, R.E. Sibson, Increasing Employee Productivity, (98) Cotton Textile Industry of Pakistan' undertaken by IDBP [55]. It was published in 1965 which simply contains informations only on the magnitude of handloom and mill industry of the two wings of the then Pakistan in terms of number of units, number of persons engaged, fixed investment, raw materials consumed and output produced. It provides little about the productive efficiency of labour and these data have little relevance to the subject of this study. Next to this survey, there is another survey, namely, 'The Cotton Textile Industry in East Pakistan' conducted in 1969 [56]. This survey is of the similar nature as the previous one. Also there is a study report done by Muslim, namely, 'Market Report of the Cotton Textile Industry in East Pakistan' prepared for EPIDC [84]. This study was published in 1969 which provides an idea about the prospects and constraints of cotton textile marketing in Bangladesh. This is, of course, the last but most informative report on cotton textiles in the pre-liberation period of Bangladesh. After liberation, the first work on cotton textile industry was done by Chowdhury [32]. It provides trend analysis of growth and structural change of the industry. It simply analyses the growth of spindles and looms during the period of Pakistan and also after liberation. It also focuses on the structural changes of the installed capacity. In addition, locational distribution of capacity in the industry is reflected in the study. The drawback of this study is that the findings are mostly based on official information. More important in the present context, the study takes no account of labour productivity.

Recently two studies, namely, 'Comparative Productive Efficiency of Large Scale and Small Scale Cotton Weaving Industry in Bangladesh, 1976-77' and 'A Study of the Relative Efficiency of Handlooms and Powerlooms versus large mills' both prepared by the Bangladesh Institute of Development Studies have touched upon some vital aspects of the industry such as output, cost, capital intensity, profitability, employment and technology [35,64]. Both the studies basically provide various ratio analyses to compare the three sectors (handloom, small powerloom and large mills) of the industry. Though the studies focus on some important parameters, the analysis of the problems seems to be over-simplified in nature. Inspite of that, these two studies have undoubtedly filled in some important gaps on the contemporary knowledge on cotton textile industry of Bangladesh.

Analysis of labour productivity of cotton textile industry in Bangladesh as a separate study is missing. There is a study on productivity in which cotton textile industry is reflected, although in part, is done by Ahmad and Anwaruzzaman [2]. This study is concerned with the measurement and analysis of the total and partial productivities of four key industries of Bangladesh, viz., jute manufacturing, cotton textile, cigarette and match. This is a macro level study. The main focus of the study is to provide a comparative picture of trend growth rate of productivities among these four selected industries. However, the limitation of the study is that it neither measures productivity at the production process level nor discusses the factors affecting productivity. Recently Mandol and Ahmad [82] worked on productivity in which labour productivity in cotton textile industry is reflected in part. This study is in no different from the above one except that it uses extended data in the temporal sense.

It is worthwhile to note that in measuring productivity of labour, one should be careful in consideration of the measurement of the variables and the area of measurement. An appropriate measurement would be one in which the variable is measured in physical terms rather than in value terms and labour input in terms of actual hours worked. Also in the area of measurement, the process-by-process level need be taken care of along with the measurement at the macro level and the plant level. Unfortunately, none of the studies in the developed and developing economies covered all these aspects simultaneously.

The present study intends to fill in some of the gaps of knowledge in the cotton textile industry of Bangladesh as mentioned above. The main purpose of the study is to measure and analyse labour productivity in cotton textile industry. The study is carried out at the levels of inter-temporal, inter-firm and inter-process variations. In the first place the trend of growth rates of labour productivity covering a 20-year period from 1962 to 1982 is seen in relation to productivity performances of two sub-periods called the pre-liberation period (1962-71) and the post-liberation period (1973-82). The analysis of productivity trends is expected to show how macro factors affect productivity of labour at two time planes with differential structure of ownership and control.[17] In the next place, a cross-section analysis for the

[17]The cotton textile industry during the pre-liberation period was predominantly at private hands. After the liberation of Bangladesh in 1971, the industry was brought under the control of nationalised management.

year 1981-82 is done to look into the inter-firm variations in productivity of labour. In the third place, an attempt is made to study nine mills to analyse labour productivity process-by-process in order to find micro factors affecting productivity.

The plan of the study has been carried out through several stages of operations. The different chapters represent the stages. Chapter I deals with an overview of cotton textile industry of Bangladesh which highlights growth and policy differentials of the industry during the pre- and post-liberation periods. Chapter II concentrates on the review of literature while methodology and the levels of analysis of the study are provided in Chapter III. Findings and analyses are provided in chapters IV to VI. Chapter IV devotes itself to measure and analyse trend growth rate of labour productivity over 1962 to 1982, and makes a comparative analysis between the pre-liberation and the post-liberation periods at the macro level. A plant level analysis is done in Chapter V with cross-section data, and the required statistical analysis was done to test various hypotheses regarding the factors affecting productivity of labour, while Chapter VI deals with process-by-process level analysis of labour productivity. Finally, Chapter VII provides conclusion which includes summary of the study and policy recommendations.

CHAPTER I

COTTON TEXTILE INDUSTRY IN BANGLADESH : AN OVERVIEW

One of the principal concerns of the present study is to measure and analyse productivity of labour in cotton textile industry of Bangladesh during the pre- as well as the post-liberation periods. In order to place the subject-matter in proper perspective, it is deemed necessary to highlight growth and policy differentials of the industry during these two sub-periods.

1.1 Cotton Textile Industry During Pre-liberation Period :

The first cotton textile mill began its operation in the area now comprising Bangladesh in 1908 with the establishment of the Mohini textile mill in Kushtia. Over the next forty years or so, a few other cotton textile mills were also established. At the time of partition of India in 1947, the total number of mills were 9 only, all of which were composite in nature, and the total capacity in question was about 110 thousand spindles and 2.7 thousand looms of which only 99 thousand spindles and 2 thousand looms were operational.

During the Pakistan period (1947-1970), the mill sector of the cotton textile industry expanded quite rapidly. The number of mills increased from 9 in 1947 to 22 in 1961 and further to 41 in 1965. Over the next five years, more 3 mills were commissioned thus bringing the total number of mills to 44. Table-1(1) below depicts growth of cotton textile mills during 1947-70.

The number of installed spindles and looms also increased rapidly during the Pakistan period. The installed spindleage in the industry rose to 359 thousand at the end of 1960 from 110 thousand in 1947 which implies that the number of spindles increased more than three times during 1947-60. Over the next ten years, it again doubled. That is, the total number of spindleage stood at 750 thousand in 1970. Similarly the number of looms also increased from 2717 in 1947 to 3419 in 1960. The number of looms went up to 7 thousand at the end of the year 1970.

Table-1(1) : Growth of Cotton Textile Mills During Pakistan period, 1947 - 70

Year	No. of new Mills	Cumulative Number
1947	-	9
1954	6	15
1957	1	16
1958	1	17
1959	2	19
1961	3	22
1962	3	25
1963	8	33
1964	2	35
1965	6	41
1966	1	42
1968	1	43
1969	1	44
1947	9	9
1947-1960	10	19
1960-1970	25	44

Sources : [15], [16], [19] & [29]

Table-1(2) below shows the rates of growth and per year changes of spindles and looms during the Pakistan Period. For spinning capacity, the average rate of growth between 1947 and 1960 is found to be 9.5% per annum, the corresponding figure for the period 1960-70 being 7.64%. For weaving capacity, the average growth rate for the period 1947-60 is found to be 6.39% per year, the corresponding figure being 7.43% for the period 1960-70. It is to be noted that the rate of growth of spinning capacity relative to weaving capacity is higher in both the periods. The Second Plan period of Pakistan witnessed the largest absolute increase in capacity for spinning and weaving. As many as 295,000 spindles and 2657 looms were established in these five years [58]. In contrast, the addition to capacity during the Third Plan period was lower than that in Second Plan period and much lower than the targets envisaged by the Third Five Year Plan [59].

The absolute yearly increase in installed loomage during the Second Plan period significatly exceeds the corresponding figures for both the First [57] and the Third Plan periods. It is to be noted that the yearly increase in loomage during the Second Plan period is faster than the corresponding rise for installed spindles. This may partly be the result of a number of spinning mills having turned composite during this period. In fact, seven spinning mills were converted into composite mills between 1960 and 1965 [84].

As regards effective capacity 99,000 spindles and 2,000 looms were in operational condition in 1947 out of installed 110,000 spindles and 2700 looms respectively. The ratio of operable to the installed spindleage fell continuously during the Pakistan period. The ratio fell from 94 per cent during the period 1948-55 to 91 per cent during the Second Plan period, and further to 87 per cent during the Third Plan period. Table-1(3) below depicts the installed and idle capacity of spindles over the years ; number of idle spindle increased in absolute as well as in percentage terms. The increase in the idle spindles are to a large extent due to old vintage, generally poor maintenance and the scarcity of requisite type of spare parts [54].

The ratio of workable looms to the installed ones have been lower than the corresponding ratio in spinning. This may be due to the fact that the

Table-1(2) : Growth of Installed Spindleage and Loomage in Bangladesh Cotton Textile Industry, 1947-70

Year	Spindleage			Loomage			Spindle-loom ratio
	Number ('000)	Rate of Growth (%)	Per Year Change ('000)	Number	Rate of Growth (%)	Per Year Change	
1947	110	-	-	2717	-	-	40.5
1955	234	9.8	15.5	3260	2.3	61	71.8
1960	359	9.0	25.0	3419	1.0	32	105.0
1965	654	13.8	59.0	6076	12.2	531	107.6
1970	750	1.5	19.2	7000	2.9	185	107.1

Note : Growth rates are compound, and based on corresponding value in the preceeding row, if any.

Sources : [34] and [84]

Table-1(3) : Operational Status of Installed Spindleage and Loomage in Bangladesh Textile Mills During Pakistan Period, 1947-70

Year	Spindle			Loom		
	Installed	Operational	Idle(%)	Installed	Operational	Idle(%)
1947	109,704	99,000	9.97	2,717	2,000	26.4
1954-55	218,000	-	-	3,000	-	-
1959-60	359,000	354,000	1.40	3,000	3,000	0.00
1964-65	617,000	564,000	8.59	5,000	5,000	0.00
1969-70	750,000	660,000	12.00	7,000	4,000	42.9

Sources : [15], [16] and [19]

installed spindles grew at a faster rate during the Pakistan period than the installed loomage. As there is no reason why maintenance and the situation regarding availability of right types of spares should be better for the looms compared with spindles, the higher growth of installed spindleage may mean that proportionately greater number of looms as compared with spindles will not be in running condition. So as time went on, the large-scale industry failed to augment the effective spinning and weaving capacity to rise at the same rate as nominal installed capacity.

Although there was a tendency in the proportion of idle spindles and looms to increase over time, installed spindles and looms grew rapidly during Pakistan period.

The growth in cotton textile industry in Bangladesh during Pakistan period was quite impressive. Two major factors can be mentioned to have contributed to the growth of cotton textile industry during Pakistan period:

i) a ready home market
ii) government incentives through various policy measures

The first factor was stressed by Lewis (79), others, however, mention of policy incentives as no less important. Cotton textile received a higher price of foreign exchange for its exports under the Export Bonus Scheme, used its principal raw materials at a lower than export price, and was subsidised heavily. It has been estimated that about 68 per cent of the value-added in cotton textile production was due to protection (64). Even though this implies that around two-thirds of the value-added in this sector was due to protection, Hossain & Rahman state that the social rate of return was high enough to justify its production(64)

In the growth of cotton textile industry the then East Pakistan Industrial Development Corporation (EPIDC) played a much less important role than the private sector. Government industrialisation and trade policies provided much incentives to the private sector during the Pakistan period. The over valued currency and the wide-spread practice of over-invoicing the import of machinery helped to reduce the cost of machinery in the private sector. By over invoicing the machinery, the money was taken out of the country and saved in foreign exchange which could then be subsequently converted at the unofficial rate to finance part of the investment cost. The government loans could be secured easily at a low rate of interest. All these factors were largely responsible for the high rate of growth of cotton textile in Bangladesh during the Pakistan period.

If the growth of the cotton textile sector was impressive and almost entirely through the private investment, the incentive and initiative mainly came from the Government in the form of cheap and easy credit, tax-holiday and protected home market. Moreover, there was considerable overinvoicing of machinery and equipment, tax fiddling and other devious means to overstate expenses and understate profits of the industrialists. According to one estimate, it was possible to set up and own a cotton textile mill of 12.5 thousand spindles costing a total of Tk. 8.3 million by contributing as low as TK. 1.4 million by the private industrialist [100]. Private capitalism was therefore sponsored and backed by the state finance.

The above incentives suggest a massive indirect subsidisation of large-scale industry including cotton textile during the pre-liberation period.

1.2 Cotton Textile Industry During Post-Liberation Period :

At the time of independance of Bangladesh in 1971,there were a total of 44 mills with 836 thousand spindles and 7 thousand looms. In 1981-82, the total number of mills increased to 56, while the numbers of spindles increased to 1012 thousands, the number of looms decreased to 6 thousands. Table-1(4) below shows the growth of the industry during the post-libe -ration period under study. The salient features of growth pattern may be described as follows. The spinning capacity grew at an annual rate of 2.10% during 1971-82. The loomage capacity remained constant over 1971-76 and then it fell in the next year to 6 thousand from 7 thousand.

Table-1(4): Growth of Cotton Textile Mills and Spindleage & Loomage Capacity During Bangladesh Period 1971-82

Year	No.of Reporting Mills	Operational Spindles ('000)	Operational Looms ('000)
1971-72	44	836	7
1972-73	45	853	7
1973-74	46	871	7
1974-75	48	810	7
1975-76	48	818	7
1976-77	49	839	6
1977-78	49	982	8
1978-79	49	994	7
1979-80	49	1030	8
1980-81	56	1059	8
1981-82	56	1012	6

Source : [15]

In the year 1979-80, it increased to 8 thousand, but in the year 1981-82 it again came down to 6 thousand. Thus, spinning capacity growth has been in excess of weaving capacity growth over the period suggesting lack of a policy at balancing the two capacities.

In terms of policy change, it has been observed that soon after liberation the government of Bangladesh announced the nationalisation programme of the large-scale enterprises. On March 26, 1972, all the large-scale cotton textile mills were nationalised with the promulgation of the Bangladesh Industrial Enterprises (Nationalisation) Order, 1972 (President's Order No. 27, 1972). Bangladesh Textile Industries Corporation (subsequently renamed as BTMC) consisting of all the nationalised textile mills formally started functioning from July 01, 1972. The first and a subsequent schedule of nationalisation order brought the total number of enterprises under the BTMC to 74. Among them, only 72 units were actually capable of producing textile goods. The rest 2 had no tengible assets worth mentioning. The mills brought under the nationalised sector had more than 90 per cent of the total capital employed in cotton textile production. Table-1(5) below shows the posi -tion of the Bangladesh Textile Mills Corporation (BTMC) as regards the number of nationalised mills in different years since the nationalisation of the sector. Since nationalisation of the mills by first two orders, the BTMC brought under its control another unit in 1975-76 thus bringing the total number of mills under it to 75.

However, the Government started disinvesting a number of specialised mills and in 1976/77, a total of 7 mills were disinvested/transferred to their former owner. A number of on-going mills were however commissioned. As of June 1980, the BTMC has a total of 56 running cotton textile mills consisting of 31 spinning mills and 25 composite mills.

From 1982 disinvestment/transformation began accelerating. Table-1(6) below shows that within three months (December 12, 1982 to April 03,1983), about 22 of the BTMC mills were transferred to the private hands.

Table1(5) : Number of Mills under the BTMC in Different Years

Particulars	July 1974	June 1975	June 1976	June 1977	June 1980
Total enterprises as per gazette	74	74	75	75	73
Add: New enterprises taken for construction	-	4	5	9	5
Deduct: Projects with no tangible assets	10	8	8	8	8
Double counting	2	2	2	2	
Disputed	1	1	1	1	
Units disinvested	-	-	-	7	
Actual number under BTMC	61	67	69	67	60
Composition					
Running spinning mills	23	25	25	25	31
Running composite mills	23	23	24	24	25
Sub-total	46	48	49	49	56
Running specialised mills	9	10	11	7	3
On-going specialised mills	2	2	2	-	-
On-going spinning mills	3	7	7	11	-
Workshop	1	-	-	-	1
Total number of mills under BTMC	61	67	69	69	60

Source : [64]

Table-1(6) : Names of Mills Transferred to the Private Hands

Name of Mills		Date of Handover
1.	Al-Haj Textile Mills	12.12.1982
2.	Ashraf Textile Mills	30.11.1982
3.	Asiatic Cotton Mills	05.12.1982
4.	Bogra Cotton Spinning Mills	14.12.1982
5.	Chand Textile Mills	09.12.1982
6.	Chittagong Textile Mills	06.12.1982
7.	Gausia Cotton Spinning Mills	05.12.1982
8.	Halima Textile Mills	14.12.1982
9.	Ibrahim Cotton Mills	30.11.1982
10.	Jalil Textile Mills	15.12.1982
11.	Jaba Textile Mills	05.12.1982
12.	Muslin Cotton Mills	12.12.1982
13.	Mainamati Textile Mills	02.12.1982
14.	Serajgonj Spinning	30.11.1982
15.	Mowla Textile Mills	05.01.1983
16.	Quasem cotton Mills	01.02.1983
17.	Raza Textile Mills	13.02.1983
18.	Calico Cotton Mills	28.02.1983
19.	Afsar Cotton Mills	06.03.1983
20.	Kushtia Textile Mills	06.03.1983
21.	Habibur Rahman Textile Mills	09.03.1983
22.	Goalando Textile Mills	03.04.1983

Source : Bangladesh Textile Mills Corporation

The policy of disinvestment was due to the ideological shift of the new government as well as the result of the pressure from the aid donor agencies, particularly the World Bank [5].

In the growth strategy and policy planning of cotton textile industry in the pre- and post-liberation periods of Bangladesh, the question of labour productivity was not sufficiently highlighted in the past. In recent times, low productivity of labour has been increasingly discussed as a common phenomenon in the cotton textile industry of Bangladesh, but the area suffers from lack of detail information .

CHAPTER II

REVIEW OF EXISTING LITERATURE

Many authors have contributed to the problems on productivity measurement and analysis in general but a few on labour productivity in particular. In reviewing the subject it is, however, difficult to locate precisely the point of origin in the time-space dimension. Furthermore in a study like this, it is neither feasible nor worthwhile to go through all of these. So an attempt is made to illustrate only those that are considered improvement and also relevant to the present context. We have made an attempt to review the literature in terms of two approaches. These are :

- Production Function Approach, and
- Ratio Approach

2.1 Production Function Approach :

One can best trace the subject in terms of empirical studies by taking Cobb-Douglas the starting point. Cobb and Douglas have pioneered research in this area of applied economics with the proposition of the function [36] :

$$Y = AL^{a}K^{1-a}$$

The denotations Y, L and K represent output, inputs of labour and capital respectively. A and a are parameters ; a representing the productivity of labour and (1-a) the productivity of capital.

The function, which subsequently has assumed the name 'Cobb-Douglas Production Function', as first conceived is intended to test the neo-classical assumption of constant returns. By the method of least square, Cobb and Douglas have estimated a to be 0.75 approximately. Therefore, the exponent of K is 0.25. The weakness of the function lies in that it allows only co-efficient a to be estimated and the other is dependent on it, being estimated as (1-a). Thus to verify the neo-classical assumption of constant returns to scale, Cobb-Douglas assumes this property, a priori.

David Durand has modified the Cobb-Douglas production function by suggesting that the productivity of labour and capital be estimated freely so that the function takes the form [46] :

$$Y = AL^aK^b$$

This function does away with the priori assumption of constant returns to scale. Still the function has other weaknesses. It specifies, a priori, another property (as applied to Cobb-Douglas original function also) which is the elasticity of substitution. By assuming it equal to unity, the function assumes that factors are substitutable and therefore excludes the possibility of estimating a production function in which the factors are complementary. Besides the productivities of labour (a) and capital (b), the function does not discuss anything regarding the technological change which might have impact on output growth.

The earliest attempt to measure explicitly technological change can be attributed to Professor Jan Tinbergen. He has used the Cobb-Douglas function and specifies the efficiency component by using an exponential time trend [104] :

$$Y = AL^aK^be^{nt}$$

Tinbergen has asserted that production function can "....... obtain a higher volume of production with the same volume of labour and capital". Tinbergen has found that the rate of growth of technical change was 1.1 per cent per annum for the American economy during 1870-1914. However, there are numerous deficiencies in this model. Actually in his study, Tinbergen has not estimated the productivities of labour (a) and capital (b). Instead, he has specified those, a priori, on the basis of Cobb-Douglas findings (a=.75, b=.25). This restriction is unnecessary. The property of constant returns to scale is a matter of fact, which Durand has already mentioned, and should be established or refuted by appeal to facts. Tinbergen has not permitted the economies of scale to vary as a function of changes in the scale of operations of the economy. By specifying the Cobb-Douglas function, he assumes unitary elasticity of substitution. He also assumes that all productivity change is of natural type.

Solow accepts the role of factor substitution. The famous Solow method of measuring productivity can be defined as [10] :

$$\bar{A} = \bar{y} - b\bar{k}$$

Where y and k are Y/L and K/L respectively. $\bar{y}$ and $\bar{k}$ are rates of changes of the respective variables.

Using observed factor-share, Solow applies this function to the non-farming private sector of the U.S. economy for the period 1909 - 1943 and separates shifts in aggregate production function from movements along a given production function. An entire A(t) series is obtained for the whole period, giving an annual rate of growth of total productivity of 1.5% per annum. That means, about 90% of the growth of output per head remains unexplained which Solow calls 'technological progress'.

Solow recognises the role of factor substitution and maintains this point by saying that though his function attributes 90% of the increase in per capita income to technological change, this progress would not come about with a smaller rate of investment.

The Solow-model also is not without its critics. It has some restrictive properties and these are the well-known Cobb-Douglas restrictions i.e. constant returns to scale, unitary elasticity and neutral technical change. The Solow model looks suspiciously at Cobb-Douglas. Hogan maintains that Solow's estimates may not be "independent of any hypothesis about the exact shape of the production function" [50] and further maintains that Solow has assumed a Cobb-Douglas function. Solow maintains that his actual estimating equation is :

$$\frac{\Delta A}{A} = \frac{\Delta y}{y} - r_k \frac{\Delta k}{k}$$

This equation is not Cobb-Douglas function because Solow has allowed capital's share, r_k to vary with time. However, if capital's share is constant, his method produces a Cobb-Douglas function. Taking logarithms of both sides of a Cobb-Douglas function and differentiating totally with respect to time, the rate of growth of the index becomes :

$$A = Y - (aL + bK)$$

which is identical to Solow's formula. Solow has not directly estimated the co-efficient of capital using the Cobb-Douglas production function. The Cobb-Douglas function remains implicitly hidden in his formula and he has obtained the estimate indirectly from factor-shares.

Solow has used his model on a high level of aggregation. As a result there is a confounding of changes in the composition of output and changes in the production function. If the economy utilizes more intensively the sectors which enjoy comparative advantages, the overall productivity index will increase even though each individual sector's production function remains the same [25]. But this difficulty is common to all aggregates.

Solow's residual is the result of many other forces, such as economies of scale, learning by experience, increased education, resource shifts, organisational improvements and any errors in the measurement of the variables. Kennedy and Thirlwal maintain that Solow's study is by far the most sophisticated of the various attempts made by that time to estimate the rate of technical change [92]. It has been popular in research works. Many researchers like Bruton [26], Gaathon [49], Correa [86], Massel [83] and many others have used his method. It has given vent of the renewed application of production function to analyse productivity, initiated by Tinbergen in 1942. Niitamo and Aukrust have made more elaborate attempts to measure productivity in the fashion of Tinbergen and Solow.

Niitamo tries to measure changes in the number of persons graduating from secondary school. He has fitted a number of functions, the best fit being [87] :

$$Y = 1.011 L_m^{.779} K_{mx}^{.221} Ws^{.130} Hr^{.545}$$

where Y is the volume of industrial production L_m labour input in man-years, K_{mx} machine capacity used in industry, Ws volume of export divided by trend, Hr number of persons graduated from lower secondary school divided by the population in the working class.

Like Niitamo, Aukrust has developed a production function for the Norwegian economy and tries to measure the efficiency of 'organisation' by an exponential trend term [13] :

$$Y = 2.262\ L_t^{.763}\ K_t^{.203}\ e^{.018t}$$

where Yt is the national product, L_t employment in man-years, K_t real capital (at depreciation replacement cost) and e^{nt} the index of organication. Like Solow, Aukrust mentions that capital cannot increase without an increase in 'organisation' suggesting the importance of factor substitutability.

The models of Niitamo and Aukrust suffer from statistical problems of autocorrelation and multicolinearity respectively. Except the assumption of a priori constant returns to scale, other criticisms of Solows method apply in these models too. However, these studies have been able to disintegrate Solow's residual.

The Cobb-Douglas function is further extended to form two important functions called CES and VES which are also used to measure the productivities of labour and capital.

The production function was initiated by Cobb and Douglas and elaborated by different authors in measuring productivities. Although the functions measure productivities, it seems to be in the process of being established as a method of measuring success of growth.

2.2 Ratio Approach :

There comes a reversal of the production function approach in the hands of Abramovitz, Kendrick and many others. They use traditional ratio method. In fact, they have improved the ratio method by elaborating the partial productivities (ratio of output to only one input) to total productivity (ratio of output to combined input index).

Abramovitz compares change in observed output to an estimate of the change that would have occured in the absence of technological change [1]. The latter estimate is the index of total resource inputs which is obtained by weighting the labour and capital inputs by their base year incomes. The index of relative increase in output that occurs between the base and the current period is given by the formula :

$$OI_1 = \frac{K_1r_0 + L_1W_0}{K_0Y_0 + L_0W_0} \qquad \frac{K_1/K_0(K_0r_0) + L_1/L_0(L_0W_0)}{K_0r_0 + L_0W_0}$$

Abramovitz compares this index to the actual change in output, Y_1/Y_0 to find that the index of net national product per head of the population for the period 1944-53 with a base of 1869-78 = 100 is 397 ; the increased resources per head accounts 114 of the productivity of resources per head. Abramovitz calls it, "measure of our ignorance". He states :

> "This result is surprising in the lop sided importance which it appears to give the productivity increase and it should be, in a sense, sobering, if not discouraging to students of Economic Growth. Since we know little about the causes of productivity increase, the indicated importance of this element may be taken to be some sort of measure of our ignorance about the causes of economic growth".

The accuracy of the Abramovitz index depends partly on the assumption that productivity may be measured by earnings which Abramovitz has used as input weights. Holmes criticises Abramovitz that it does not make explicit allowance for the effects on output of changes in the age-sex composition of the labour force, changes in average hours of work or changes in the excess capacity of the capital stock [62]. As a result the effects of these factors are implicitly attributed to technological change - which is inappropriate. Moreover, these are the factors which cannot be easily ignored, since the number of teenagers, women and old men in the labour force have changed drastically in recent years, average hours have declined steadily, and unemployment rates have fluctuated widely.

Kendrick's study [69] of the U.S. economy for the period 1899-1953 attempts to correct the pitfalls of Abramovitz model. Kendrick has measured the total productivity of 33 industry groups and also the private domestic economy. The labour input used in his study denotes man-hours worked in various industries by all types of persons engaged in productive activities. He takes the wage-rate of each industry to be used as weights of labour input. He thus takes into account the quality of labour. As regards capital input, Kendrick uses capital stock net of depreciation. He has used the average rate of return on capital as the weights of capital input. Domar remarks, "Since the average rate of return is apt to be high in expanding and low stagnant industries, Kendrick's weighting of capital in each industry by its rate of return seems to be a step in the right direction" [44]. Kendrick's arithmatic index of productivity can be defined as :

$$A = \frac{Y}{W_0 L + r_0 K}$$

where W and r denote real wage rate and real return to capital respectively and the subscript 0 refers to the base year. Expressing all variables as index number, the arithmetic index of productivity can again be defined as :

$$A = \frac{Y_1/Y_0}{W_0(L_1/L_0) + r_0(K_1/K_0)}$$, where subscript 1 refers to the current year.

With this index Kendrick has found the residual which he calls "Total factor productivity" to be increasing at the rate of 1.75% per annum while the real product has increased at the rate of 3.3% per annum. Kendrick's result suggests that the very high residual of Abramovitz can be due to his unadjusted data.

2.3 Conclusions:

The two approaches, production function and ratio, seem to be in the process of being established as the methods of measuring productivity as well as sources of growth. Ratio method is in much use in both developed and developing economies because of its simpleness. On this count, the present study uses the ratio method for measuring productivity.

It is worthwhile to note that in measuring productivity of labour, one should be careful in consideration of the measurement of the variables and the area of measurement. An ideal measurement dictates that the variables should be measured in physical terms and labour input in terms of actual hours worked. In the area of measurement, process-by-process level should be taken care of along with the measurement of productivity at the macro level and plant level. Unfortunately, none of the studies in the developed and developing economies covered all such aspects fully.

The present study attempts to embrace all these aspects, i.e. output in physical terms and labour input in actual hours worked in approaching labour productivity. It has also gathered relevant data for individual processes within textile manufacturing to measure productivity process-by-process in addition to macro and plant level analysis.

CHAPTER III

RESEARCH METHODOLOGY AND LEVELS OF ANALYSIS

The distinctive feature of the present study stems from the fact that it measures all variables in physical terms and the analysis is attempted at the three levels, viz., macro level, plant level and process-by-process level. This chapter devotes itself to discuss the methods of measuring different variables and to provide a theoretical framework of how the macro, plant and process-by-process level analyses have been applied to the present study.

3.1 Measurement of Variables

Labour Productivity :

There are two alternative measurements of labour productivity - output per man and output per manhour. It is rather difficult to choose between these two different measures. Dension prefers both on different grounds. He argues that 'hours of work' is preferable as an indicator of real cost and on this point 'manhour' is preferred. On the other hand, he favours 'employment (man-years)' as effective labour input in terms of the contribution of labour to production[42].

There are however further refinement to be considered in either case. In the first place, in estimating 'output per worker', we may have in mind either the workers employed in producing the particular product who are on the books, or the workers on the payroll or the workers actually at work. Workers on the payroll will probably include those who are absent for part of the month, those who left during the month or were taken on during the month or those who went on holidays during the month, all of whom worked therefore only a part month. Workers on the payroll may or may not include those on holiday for the whole month. 'Workers actually at work' would exclude both the absentees and those on holidays and would make allowances for those working only for part of the month. On the other hand, in estimating 'output per manhour' there will be differences between 'productive hours' and 'hours actually paid', which latter, at least for time-workers, include payment of time spent in meal-breaks and other non-productive time. The widest concept is 'output per man-year' inclusive of absentees and those on holidays, and it is usually used when estimating national income or labour requirements. In measuring productivity in the technical sense, output per worker actually at work or output per productive manhour is relevant. It is generally held that for productivity comparisons 'hours actually worked' is a better concept. The justification of doing so is that average hourly earnings should 'represent total compensation' [69, 92].

Whatever may be the relative merit of either measure, the choice of our macro level study is limited by the fact that available employment data are probably nearer to the concept of 'workers on the payroll' than to the concept of 'workers actually at work'. Number of workers is usually ascertained in one day in each month and thereby can be regarded as a reliable yearly average. At the plant level and the process-by-process level study, 'manhours actually worked' by labour is available at mills only for recent years. In measuring labour productivity for the purpose of our study we have therefore taken :

a) 'man-year of employment' as a measure of labour input for inter-temporal analysis at macro level, and

b) 'manhours actually worked' by the labour as a measure of labour input for inter-firm analysis at plant level and also at process-by-process level.

Labour Input :

There is disagreement as to whether 'operatives' only or 'all employees' should be used in the labour input measure. Lomax [89] argues in favour of confining the measure of labour to operatives only. On the other hand, Rostas [95] considers that both the measures are of equal significance. In the present study only 'production worker' has been considered as labour input. Here labour (production worker) means an employee engaged in any manufacturing process of yarn and cloth or in the repair and maintenance of the plant and machinery or any other kind of work directly connected with the manufacturing process. A non-production worker means a member of the administrative or technical staff working on the established premises or elsewhere, whose salaries are chargeable to the establishment. 'All employees' used in this study is the summation of the series of production and non-production workers, weighted by their respective shares of wages and salaries in the base-year. The overriding merit of this measure lies in that it makes an allowance for differences and changes in the occupation mix, and thus provide due importance to all types of workers.

Output :

Gavrilov reveals that there are about 34 measures of output [50]. The most ideal measure of output is the quantity of output in physical form [2]. In Bangladesh, the cotton textile industry consists of two types of mills - spinning mills and composite mills. The spinning mills, by definition, produce only yarn, while the composite mills produce both yarn and cloth. As both yarn and cloth are two different products and they vary in quality from firm to firm and also within the same firm in terms of various counts of yarns and various picks per inch of cloth, they are required to be converted into a standard single product structure.

Our data sources which supply most of the basic materials for the purpose of this investigation are very satisfactory in the sense that they give a consistent set of statistics, covering the industry :

- the quantities of various 'counts of yarns' as separate categories from which 'physical output of yarn' of different counts can be obtained ;

- the quantities of various 'picks of cloth' as separate categories from which 'physical output of cloth' of various picks can be obtained ;

- the 'multiple factor of yarn' by which various counts of yarn be converted into 32's ;

- the 'multiple factor of cloth' by which cloth of different picks can be converted into 54 picks ; and

- the 'equivalence factor' by which cloth of 54 picks can be converted into yarn equivalence of 32 counts.

For the purpose of our study, we have converted all output (both yarn and cloth) into 32's of yarn in order to have a standard single product structure in the following way :

a) yarns of different counts are converted into 32's by using 'multiple factors of yarns' ;

b) cloths of various picks are converted into 54 picks by using 'multiple factors of cloths'. Cloth figure of 54 picks thus obtained is now converted into yarn figure of 32's by using 'equivalence factor' (i.e., 1 yard cloth of 54 picks $\simeq$ 0.2 lb yarn of 32's).

Now by adding a) and b), we get a standard single product structure of yarn of 32's. BTMC uses the following multiple and equivalence factors for conversion and equivalence purposes which is provided in Table-3(1) below. We have used these without making any change in them. It is to be stressed therefore that the shortcomings if any of BTMC's will also affect our results. It is, however, to be noted that for 'productivity comparisons' these shortcomings are not serious.

Capital Input :

The most difficult variable to be measured is the capital input. Solow remarks that the capital time-series is the one that really drives a purist mad [101]. Generally capital is measured indirectly by value, and as such, there are two approaches to measure capital by valuing in terms of cost or in terms of its contribution to production. The latter approach entails the consideration of the efficiency of capital by appropriate weights and this course is followed particularly in embodied models. Valuation of capital in terms of cost is the most acceptable measure [89]. But this cost criterion implies the assumption that if the cost of two machines is the same, they would be considered to be of equal amount of capital although they may contribute unevenly to production. The criterion also assumes that the increase in the cost of a machine represents an increase in the quantity of capital. Thus the increase in cost represents a change in its productivity.

Table-3(1) : Conversion Multiplier for Yarn and Cloth

Yarn		Cloth	
Count	Conversion multiplier (for 32's)	Pick	Conversion multiplier (for 54 Picks)
		36	.6666
10^s	0.3405	38	.7037
12^s	0.4015	40	.7407
14^s	0.4625	42	.7777
16^s	0.5270	44	.8148
18^s	0.5768	46	.8518
20^s	0.6341	47	.8730
21^s	0.6481	48	.8888
24^s	0.7526	50	.9259
26^s	0.8214	51	.9444
28^s	0.9053	52	.9629
30^s	0.9451	53	.9814
32^s	1.0000	54	1.0000
34^s	1.0625	55	1.0185
36^s	1.1160	56	1.0370
38^s	1.2250	57	1.0554
40^s	1.3220	58	1.0740
$42/2^s$	1.3887	59	1.09258
46^s	1.5472	60	1.1111
50^s	1.7058	61	1.1296
60^s	2.2590	62	1.1481
64^s	2.4900	63	1.1665
68^s	2.7316	64	1.1851
70^s	2.9592	65	1.2025
80^s	3.4055	66	1.2222
84^s	3.5759	67	1.2407
		68	1.2592
		70	1.2592
		72	1.3333
		74	1.3703
		76	1.4074
		78	1.4444
		80	1.4814
		82	1.5185
		84	1.5555
		86	1.5925
		88	1.6296
		90	1.6666
		91	1.6851
		96	1.7777
		98	1.8147

Yarn Equivalence: 1 yard cloth of 54 picks $\simeq$ 0.2 lb yarn

Source : Bangladesh Textile Mills Corporation

Our available sources provide capital data under two different definitions. These are respectively working capital and fixed capital. Working capital includes inventories and cash on hand, etc. Inventories consists of such items as stock of fuel, raw materials, finished products and work-in-process. Working capital consisting of inventories and cash holding is important without any doubt in industrial production. But these are more determined by supply and market expectations than technological pipe-line requirements. Gaathon argues that their volume are to a large degree subject to transitory influences such as credit conditions and short term expectations of price change and shortages, whereas fixed capital formation is determined in the main by long term considerations such as the prospective yield of additions to capacity [49]. Therefore, the measure of capital is restricted to fixed capital rather than working capital for the purpose of our study.

Now fixed capital, according to our data sources, consists of land and buildings, plant and machinery, and other fixed assets (e.g. furniture and fixtures, trade marks, etc.). Land has been excluded, because the relation -ship between land and output growth is unlikely to be significantly affected by technological changes. But by excluding land we are rather forced to exclude buildings since our data sources do not provide separate figures for land and buildings. We also exclude other assets. Fortunately, the exclusion of land and buildings and other assets is unlikely to affect our results significantly. In the index form, error due to this exclusion will be negligible since land and buildings and other assets have tended to form more or less a constant proportion (around 35 per cent) of total fixed assets in monetary terms.

Now we are left with plant and machinery. We have available informations about 'looms and spindles' which may be defined as capital in terms of 'machines' in our study. The gross and net concepts of capital (machines) present another problem. The gross stock concept is simple and least ambiguous. It means that a machine is carried at its original condition until it is scrapped. The net concept acknowledges that the condition of machine declines with age and use. Exhaustion, deterioration and obsolescence cause this decline in the condition. The importance of net concept of capital depends on the importance of these factors. Therefore, these factors need more examination. If there is proper repair and maintenance this should offset the decline in the productivity of capital due to wear and tear [49].

Therefore, there remains only one factor which is obsolescence and depreciation of capital is due only to this factor. Due to the existence of this factor, Kendrick prefers the net concept of capital (machines) because 'gross output capacity of various type of machinery tends to fall with age' [69]. However, the importance of this factor i.e. ageing of capital should not be a serious problem in the case of Bangladesh cotton textile industry. This is because its manufacturing process does not have a long economic history like the USA or the U.K. Therefore, it can be argued that the 'looms and spindles' which are defined as machines can be taken as capital for the purpose of our study.

As all outputs are taken in yarn equivalence, it requires that all machines (looms and spindles) should be taken in spindle equivalence to establish similar nature of output and capital input. All looms can be converted into spindles equivalence by using the following formula[1], and total machines in spindle equivalence can be obtained thus :

$$L = (S \times C_{54} \times 0.2) \div Y_{32}, \text{ spindle equivalence}$$

.. Total machines, $M = L + S$

$$= (S \times C_{54} \times 0.2) \div Y_{32} + S, \text{ spindles}$$

Where, L = total no. of looms

S = total no. of spindles

C_{54} = all kinds of cloths converted into 54 picks

Y_{32} = all kinds of yarns converted into 32's

The machines and capital are interchangeably used in the present study.

Fuel and Power Input :

Fuel and electricity data are available in terms of their own physical units as well as in monetary terms. Electricity is measured in kilowatt (KW) and the fuels of various categories are measured in terms of different units such as maunds, gallons, etc. because of different types of fuels. As the units are different

[1] The method of estimating formula is explained in Appendix-A(1). The formula is developed by the author of the present thesis.

for different types of fuels and also the unit of electricity differs from those of fuels, it poses a problem to sum up electricity and fuels to get an aggregate figure in physical form. There is no conversion factor to aggregate all these heterogeneous fuel items as is done in case of output. We may, however, apply the following method to get an aggregate figure in physical form in a rough way :

- let x_i (i=1,2,3, ... , n) be the amount of different fuels consumed, and c_i (i=1,2,3, ... , n) be the cost per unit of the respective fuels,

  $\therefore$ total cost of fuels = $\sum x_i c_i$, in taka ..... (a)

- let 'm' kwh be the amount of electricity consumed and 'r' be the total cost of electricity in taka. By applying 'unitary rule of arithmatics' we get,

  cost of 1 taka = $\frac{m}{r}$ kwh .... (b)

- now, total cost of fuel is converted into kwh by using (a) and (b).

  i.e. total fuels in physical form = $\sum (x_i c_i . \frac{m}{r})$ kwh

- adding electricity consumption to fuels, we get an aggregate figure in physical form,

  i.e. aggregate fuels and electricity consumption

  $= (\sum x_i c_i . \frac{m}{r} + m)$ kwh

The drawback of this method of conversion is that the electricity and fuels are not given weightage. In the index form, however, error due to this exclusion of weightage is negligible since the total cost of electricity in our study has tended to form around 80 per cent of the total power & fuel cost leaving only about 20 per cent to fuels.

Industrial Conflict :

It is usually thought that the sharp contradiction between labour and management leads to open disputes i.e. stoppage of work, strikes, lockouts. In this study we are only concerned with industrial disputes stopping work. These disputes arise for reasons relating to wages, personnel, bonus, leave etc. For any period, it is possible to define these conflicts in terms of the number of disputes stopping work, the number of workers involved and the number of mandays lost. The measures are more or less self-explanatory. Taken separately, they relate to only one aspect of a conflict situation. One needs 'composite measures' of the conflict which duly weight each of the above partial, if useful, measures. Four ratios can be estimated from these three variables. They are :

a) 'Duration of dispute (DD)' defined as the number of mandays lost per worker involved in the industrial dispute ;

b) 'Disputes Coverage Ratio (DCR)' defined as the number of workers involved in industrial dispute per industrial dispute ;

c) 'Time Loss Ratio (TLR)' defined as the number of mandays lost per industrial dispute ; and

d) 'Employee Involvement Ratio (EIR)' defined as the number of workers involved as a ratio to the level of industrial employment.

In our study we have excluded 'EIR' because the available data seem to be inconsistent. Since the remaining three ratios are partial indicators, one has to weight each of them in arriving at a 'composite measure of conflict'. Lacking any published information on such weights, we employed the estimate for similar weights used in a published Indian contribution by Khurana [73]. The weights computed by Khurana for three variables, viz., workers involved, mandays lost and industrial disputes were 1.6, 2.2 and 1.8. We have used these weights without making any change in them. It is to be stressed therefore that the short-comings if any of Khurana's estimates will also affect our own results. However, having adopted the weights for the variables at hand, the second step was that for each of the three ratios, namely, DD, DCR and TLR under study, a ratio weight was arrived at on the basis of the above weights. This reflects the assumption that ratio weights (and not any one weight) were the appropriate weights for ratios. The weights for DD, DCR and TLR stood at 1.38, 0.88 and 1.22 respectively. In order to obtain a composite criterion on industrial conflict, these ratio weights are applied to the estimates of the yearly ratios in terms of the following equation :

$$C_t = \sum_{i=1}^{3} W_i R_i$$

Where, C = Composite index of industrial conflict ;

W_i= Ratio-weight appropriate for ratio i ;

R_1= Duration of dispute (DD) ;

R_2= Disputes coverage ratio (DCR) ;

R_3= Time Loss Ratio (TLR) ;

t = Subscript for a sub-period.

It is, of course, assumed that the composite conflict measures is a linear summation of the component ratios, appropriately weighted.

3.2 Levels of Analysis : Macro, Plant and Process-by-Process :

The study is undertaken at three levels. The first or the macro level analysis is based on the analysis of trend growth rate of labour productivity over a 20-year period including two sub-periods i.e. pre- and post-liberation periods using census data for all the mills. This will give a macro view of inter-temporal variations of labour productivity. The second or sample method is based on 13 mills chosen from three categories of mills on the basis of their year of establishment by applying stratified random sampling technique, which provides inter-firm variations of productivity. The third or the process level method is based on 9 mills which is done to look into the level and problems of productivity at process-by-process.

Macro Level Analysis :

The data used for macro level analysis are the published accounts provided by the Central Statistical Office [28, 29], Bangladesh Bureau of Statistics [14,15,16,17,18,19], Ministry of Industries [54], EPIDC [84] and Bangladesh Textile Mills Corporation [20].

The year 1962-63 has been chosen as the base year for macro level analysis. The justification behind this is that it seems reasonable to choose a year in the early 1960's as the base year because a reasonable industrial growth had taken place by then and 1962-63 is the only year in that period and, in fact, also the year for which detailed data required for this study are available. Also, all relevant evidences i.e., behaviour of industrial output, industrial employment, etc. in 1962-63 suggest that 1962-63 was reasonably free from abnormalities. The year 1970-71 has been chosen as the final year of the pre-liberation period. This year is in many ways a turning point in the manufacturing activities. On reflection, however, it is the latest year of the private ownership of the mills.

The years 1971-72 and 1972-73 are not considered as normal years for Bangladesh due to the after-effect of the war of liberation. On the other hand, except output and capital input data, all other relevant data are not available for this period. It is because of this we are forced to exclude these two years in the post-liberation period.

The year 1973-74 is taken as the initial year and 1981-82 as the final year for post-liberation period. A considerable period after liberation has passed, and by this time a general picture as to the basic characteristics of the industry such as nationalised management and economic environment in which the industry operated is already settled. The justification of taking 1981-82 as the final year is that the majority of the mills had been transferred to the private hands after July, 1982.

The macro study is applied, broadly speaking, in the following manner. The quantitative data on the production of output are computed and the number of labour are ascertained as has been described earlier. Then physical output per man-year of labour for 1962-63 to 1981-82 is worked out in index form. The trend growth rate of labour productivity for the total range as well as the sub-periods is obtained by using the following semi-logarithmic function :

$$\text{Log } L = a + bT$$

Where, L is labour productivity and T is the time, a and b are constants. 'b' represents per cent growth per annum of labour productivity. The differences in values of 'b's among the total range and the sub-periods will indicate the differences in the labour productivity growth among the periods concerned. Then the productivity differentials between the sub-periods will, however, be explained in terms of human resource and capital resource utilisations depending on the availability of data at the macro level.

It should be mentioned here that one important aspect of human resource utilisation is the 'duration of the working time'. Due to the non-availability of data, this could not be done in macro level analysis. Another factor is the 'skill of labour' [63]. Because of the data limitations, the question of skill could not be evaluated also. But whether the labour is more effectively used in comparison to non-production worker and whether the labour is more effectively used in one sub-period compared to other may be observed in a rough way by fitting regression equations separately for each sub-period. In addition to that industrial conflict, if any, may be carefully analysed to explain fall in labour productivity in the pre- and post-liberation periods under study. Capital resource utilisation affects labour productivity [47] through structural change in the industry, which could be analysed in our study, depending on the availability of data, by establishing correlations between : (i) labour productivity & capital productivity, (ii) labour productivity & power and fuel productivity and (iii) regressing capital intensity (capital-labour ratio) on labour productivity. The regression equation relating to capital intensity (K) and labour productivity (L) will be of the form :

$$\text{Log } L = m + n \text{ Log } K$$

Where, n is the rate of change of capital productivity with respect to capital intensity.

Plant Level Analysis

The definition of mills sector of the cotton textile industry in the plant level analysis is limited by the coverage of the BTMC owned mills. These mills are running under nationalised management. The reason for taking only BTMC mill is that the quality of data for the mills which are BTMC owned is expected to be better than that of privatley owned.

The study of plant level analysis is concerned with inter-firm comparison of productivity for the year 1981-82. This year seems to be a fairly normal year and it is also the final year of our macro analysis covering all mills. For plant level analysis we have used sample from the mill production.

In our sample method, one important aspect is that the labour productivity is measured as ratio of physical output to actual hours worked by the labour.

Data for the sample mills were collected by the author through personal investigations, particularly from the Accounts Section and the Section of the Technician of the sample mills.

For the purpose of sampling, all those BTMC mills which were set up after 1950 were taken into considerations. It is observed that there were 26 such BTMC mills as of 1981-82. All these mills are now grouped into three categories on the basis of their year of establishment, the distribution of which is shown in the Table-3(1) below.

Table-3(1): Categorisation of the BTMC mills in terms of year of establishment

Category Code	Established between years	No. of Mills
Category : A	1951 - 1960	6
Category : B	1961 - 1970	13
Category : C	1971 - 1980	7
Total :	1951 - 1980	26

Source: Appendix Table-A(2)

A stratified random sampling was done to select the mills from amongst the 26 mills. The stratification is based on the category of mills on the basis of their period of establishment. On the basis of such stratification, 13 mills out of 26 i.e. 50% were randomly pcked up (fraction of the number of mills in the sample is adjusted by giving more weightage to the category of greater number of mills category to obtain round figure). Of these, as sampling Table-3(2) below indicates that 3 mills fall in category A, 7 mills in category B and 3 mills in category C.

Table-3(2): Sample mills indicating the category and coverage of the total

Category Code	Total No.of mills	No. of sample mills	Coverage by sample (%)			
			mills	capacity	output	employment
Category A	6	3	50.00	52.00	50.43	53.70
Category B	13	7	53.84	51.49	58.54	56.57
Category C	7	3	42.86	49.61	52.89	47.53
Total :	26	13	50	51.10	54.50	53.46

Source : Calculated from appendix Table-A(5) and Appendix Table-A(6)

Notes : 'Capacity' means aggregate figure of installed looms and spindles converted into spindle equivalence.

: 'Output' means aggregate figure of yarn and cloth converted into yarn equivalence.

The sample thus includes mills from all the three categories. A close examination of the sampling Table-3(2) above shows that the sample covers 50 per cent of the mills, and fortunately it covers more than 50 per cent of the factors like installed capacity (51.10), output (54.50) and employment (53.46). Therefore, there is no reason to suspect that the sample is unrepresentative.

In the sample method study, we shall first analyse the variables that explain the overall variations of labour productivity of the sample mills as a whole. Following this, we shall present an analysis of the inter-firm variation of labour productivity of the three categories of firms under considerations.

We shall make use of linear multiple regression model to find out which of the variables are important in explaining the variations in the productivity of labour. The choice of explanatory variables are guided by the literature survey & experts opinion of the mills under study. The following explanatory variables and hypotheses are chosen for our analysis :

i) Man-capital equipment ratio (x_1) :

Manning rate per unit of capital equipment has a significant implication for productivity of labour. The coefficient of manning rate per unit of capital equipment will indicate how effectively the human resource is used in the enterprises. Since our concept of manning rate in our cotton textile industry is related to the utilisation of human resource optimally, an index of man-equipment coefficient composed of man-spindle (as all looms and spindles are converted into spindle equivalence to form a homogeneous capital equipment) ratio (x_1) will be more consistent and appropriate for our analysis. This variable (x_1) is expected to have a negative relationship with the level of productivity of labour (L), that is, higher the proportion of man behind a spindle that invites over-manning, the lower will be the productivity of the enterprise.

ii) Power & fuel-output ratio (x_2)

Improved technology may be taken as another independent variable to explain the variation in labour productivity at the plant level. The indicator used for our analysis is power & fuel-output ratio (x_2), which is an indirect measure of improved technology. A positive relationship is expected between this ratio (x_2) and the level of productivity of labour (L).

iii) Manhour lost-actual hours worked ratio (x_3) :

The ratio of manhours lost to actual hours logged (x_3) will be a very important variable for analysing the variation of labour productivity. This ratio (x_3), as a variable, is expected to have a negative relationship with the level of productivity of labour, that is the higher the proportion of man-hour lost to total hours logged the lower will be the productivity (L) of the enterprise.

iv) Capacity Utilisation (x_4) :

Underutilisation of capacity is another factor often mentioned by the economists as the cause of low productivity of the enterprise particularly in developing countries. Capacity utilisation (x_4) is, therefore, used in our analysis as a variable to explain variation in productivity of labour (L) at the enterprise level. (If a firm has a high level of capacity utilisation compared to another, it means that along with the other things, the quality of labour force is also relatively high in the particular firm). Needless to mention that a positive relationship is expected between the degree of capacity utilisation (x_4) and the level of productivity of labour (L).

v) Age of the plant (x_5)

Age of the plant and machinery is taken as another variable to explain the variation in the level of productivity at the enterprise level. Since age reflects the advantage of learning-by-doing and correction of production imbalances, older enterprises are expected to have a better performance compared to enterprises established more recently. As we have categorized the enterprises into three on the basis of the period of establishment, a dummy variable is assigned to these three categories of establishment. The value 2 is put to the A category of mills which were set up between 1951 and 1960, the value 1 is put to the B category of mills which were set up between 1961 and 1970 and the value zero is put to the category C which were set up between 1971 and 1980. Thus a positive relationship is expected between the age of the plant (x_5) and the level fo productivity (L).

vi) Size of Enterprise (x_6)

Firm size can be an important factor in determining labour productivity. A positive correlation between firm-size and productivity is expected. This is because divisibility of plant & equipment at higher level of production gives rise to technical economies of scale. It is sometimes argued that even a minimum sized specialised machine is likely to lie idle much of the time in a small plant like handloom industry, whereas in a larger plant it can work continuously[91]. Then there are managerial economies of scale also associated with large plants where managerial functions can be subdivided in specialised areas and allow easier product flow within the plant. Again, there are other important factors connected with large firms ; for example political power and influence on government decision-making which can be more easily handled by large firms than by smaller ones.

The index to be used to represent size of enterprise has, however, been an issue of controversy at the realm of empirical research on industrial studies including cotton textiles. The controversy arises as to which of the alternatives like (a) Gross output (b) value of production (c) value-added (d) value of fixed assets (e) number of employees, and (f) installed spindleage and/or loomage etc. is to be used for the purpose. In our analysis, we have taken installed spindleage as a measure of the size of enterprise, on the ground that it appears to be a fairly homogenous measure of the size. It is also taken to represent the technological & managerial economies of the firm in the industry.

Size of the enterprise (x_6), as a variable, is expected to be positively correlated with the level of productivity of labour (L). The test of this hypothesis is of great policy significance because if productivity is found to be positively related with the scale of plant, the economies of scale can be easily achieved and the situation may become more amenable to policy manipulations.

Besides, there are other variables the data of which are not available in that form or a problem of identification arises which could not be desentangled. This by no means suggests that particular variables not included in our analysis are not important for explaining the variations of labour productivity of cotton textile industry in Bangladesh.

Being observed explanatory variables which cause variation of labour productivity of the sample mills as a whole, we look into other . factors affecting inter-firm variations of labour productivity. There are innumerable visible and invisible factors causing inter-firm variations of productivity. An ideal explanation depends on the adequacies of concerned information . Depending on the information available, which are very much limited, the following areas will be covered to find out the factors affecting the level of productivity of labour in sample firms : a) differential employment structure, (b) differential technology and (c) production management.

Process-by-Process Level Analysis :

This method is essential when it requires an intensive study to find out the level of productivity and the problems at each stage of production process. There are great many advantages attached to this method. The main advantage is that it gives more information than the macro level and plant level analyses in the sense that it investigates individual stages of production process, and thus indicates at what stage and at which parts of the process are there problems to be observed.

It would have been ideal if we could adopt process-by-process method to all the sample mills under study. But, as it is first study of this kind on the one hand, and due to complexity in the production process along with serious constraint in collecting required data stage by stage on the other, we are forced to take up only spinning mills. In our samle study we have 13 mills, out of which 9 are spinning in nature. We have taken all these 9 spinning mills for the purpose of our process-by-process level study.

CHAPTER IV

LABOUR PRODUCTIVITY TRENDS IN COTTON TEXTILE INDUSTRY OF BANGLADESH : A MACRO LEVEL ANALYSIS

4.1 Trend Growth Rate of Labour Productivity

Labour productivity indices in the cotton textile industry of Bangladesh over a period of 20 years are provided in Table-4(1) below. It appears that after a drop of about 7 per cent in 1963-64, the labour productivity index made steady progress until 1965-66, when it grew by over 47 per cent compared to the base-year index of 1962-63. In the next three years, the indices were somewhat lower than in 1965-66, but were still about 8 to 23 per cent up from that of the base year. In 1969-70, the index rose to the height of 186.

Just after liberation, the productivity index came down to 88.29 in the year 1971-72. In the next year the index recorded was so high as to arouse some question as to accuracy and consistency of data. But after that year a falling trend ensued and this continued till 1977-78 when the index went down to 59.11. In the remaining years, the productivity index exhibited some fluctuations around a declining trend. The regression equations below show the trend growth rates of labour productivity of the entire time series and also of the pre- and post-liberation sub-periods.

$$\text{Log } L_{1962-82} = \underset{}{24.08} - \underset{(0.003)}{0.011}\, T \quad : \text{Whole period}$$

$$\text{Log } L_{1962-71} = -\,35.78 + \underset{(0.011)}{0.019}\, T \quad : \text{Pre-liberation period}$$

$$\text{Log } L_{1973-82} = 26.68 - \underset{(0.006)}{0.013}\, T \quad : \text{Post-liberation period}$$

Figures within parentheses represent standard errors of estimates. It appears that the falling rate of the labour productivity in the post-liberation period outweighs the rising growth trend of the pre-liberation period giving rise to an overall negative growth rate. This is not surprising because though the productivity growth trend in the pre-liberation period is positive, it is not significantly different from zero.

Table-4(1)

Labour Productivity Indices in Cotton Textile Industry of Bangladesh, 1962 - 1982

(Base: 1962-63=100)

Period	Year	Labour Productivity
Pre-liberation Period	1962-63	100.00
	1963-64	93.25
	1964-65	126.43
	1965-66	147.33
	1966-67	113.80
	1967-68	108.18
	1968-69	123.11
	1969-70	185.59
	1970-71	127.68
	1971-72	88.29
	1972-73	136.65
Post-liberation Period	1973-74	67.63
	1974-75	67.04
	1975-76	62.92
	1976-77	62.33
	1977-78	59.11
	1978-79	62.79
	1979-80	45.55
	1980-81	52.65
	1981-82	61.54

Source : Computed from data presented in Appendix Table-B(3) and Appendix Table-B(4).

4.2 Factors Affecting Productivity :

As to the causes of differential labour productivities in the two sub-periods, we have examined below the utilisation of labour and capital because effective utilisation of these two traditional resources bears a direct relation to labour productivity. Regarding the first resource, we have examined the aspects of manning in the industry and the industrial conflict. Before this exercise, it is however instructive to look more closely into the productivity index by relating it to other indices like productivities due to non-productive workers, all employees, etc.

Table-4(2) below shows the trend growth rates of productivity of labour as well as non-production workers and all employees in the cotton textile industry of Bangladesh during the pre- and the post-liberation periods under study.

Although statistically insignificant, productivities of all categories of workers exhibit a rising trend in the pre-liberation period. In the post-liberation period, labourers turn out to be a little more effectively used than the non-production workers. However, productivities due to both labour and non-production workers show a declining trend.

Manning in the Industry :

In the pre-liberation period during 1962-69, employment increased by 42.61 per cent while the level of output increased by 65.35 per cent. In 1969-70, the employment level came down to a lower level than that of the base year, keeping output level at the peak. This would suggest that given the technology, redundant workers existed before 1969-70. One of the reasons of higher productivity of 1969-70 is that the imposition of Martial Law in 1969 helped to increase actual hours worked by the labourers.

Coming to the productivity performances of the post liberation period, the impact of the break up of Pakistan was felt severely by the cotton textile industry when the entire supply of raw cotton

Table-4(2)

Trend growth rates of productivity of labour, non-production workers and all employees during pre and post-liberation periods

Period	Categores of workers	Trend growth rates	Standard errors of estimates
Pre-liberation Period	Labour	0.019	0.011
	Non-production workers	0.048	0.028
	All Employees	0.022	0.013
Post-liberation Period	Labour	-0.013	0.006
	Non-production workers	-0.019	0.022
	All Employees	-0.014	0.007

Source : Computed from Appendix Table-B(5) which was previously imported from Pakistan (the then West Pakistan) had to be obtained from abroad, particularly inferior quality of cotton under barter trade. This bad quality cotton caused much wastage of the material and energy of the labour in the different stages of production process causing, in part, fall of productivity. In addition to this, employment in the cotton textile industry of Bangladesh whether in terms of labour or non-production workers showed a marked increase after 1972-73. During 1973-80, the employment level increased by about 50 per cent while the production level increase by about 5 per cent only. A high level Committee in 1976 'reveals an alarming excess of 9,095 workers in various mills'. Coupled with these, a considerable number of skilled workforce, most of whom were non-Bengali, left Bangladesh that created a skill vacuum in the industry. Thus the increase in the employment level combined with the changed skill composition of the workforce due to migration of the non-Bengali workers along with the imported inferior quality cotton contributed to the fall of labour productivity in the post-liberation period. The rather unwarranted increase in employment can be attributed to the political pressure prevalent in those days.

Industrial Conflict :

Besides the manning rate, behaviour of the workers is an important consideration of productivity analysis. Industrial conflict originates from a set of behavioural responses of the workers. Indices of measured yearly industrial conflict as well as the components thereof are estimated and the results are set out in the Table-4(3) below. We have excluded the years 1970-74 from the analysis on account of unavailability of reliable data. The table depicts that, as expected, the movement of the index of the composite measure of conflict is not entirely synchronous vis-a-vis the indices of the partial conflict measure. For example, the index of 'duration of dispute' fell in the year 1967-68 relative to all other years in the pre-liberation period, and also in the years 1975-76 and 1976-77 relative to all other years in the post-liberation period. In contrast the conresponding index for the 'dispute coverage ratio' is much higher. In view of this somewhat conflicting indices of partial measures, what was happening

Table-4(3)

Indices of measured yearly industrial conflict in cotton textile industry of Bangladesh

Period	Year	Duration of Dispute	Dispute Coverage Ratio	Time loss Ratio	Composite conflict meausre
Pre-liberation Period	1962-63	100.00	100.00	100.00	100.00
	1963-64	58.89	85.86	50.56	51.32
	1964-65	71.50	34.27	24.50	24.76
	1965-66	10.92	71.68	7.84	9.20
	1966-67	18.30	60.23	11.02	12.07
	1967-68	5.05	296.22	14.85	20.77
	1968-69	120.46	84.73	102.09	101.74
Post-liberation Period	1975-76	5.30	274.37	1.46	7.89
	1976-77	3.22	329.35	10.56	18.83
	1977-78	17.60	120.20	21.17	25.29
	1978-79	17.57	112.46	19.78	23.64
	1979-80	21.27	149.05	31.73	37.19
	1980-81	30.81	138.24	42.61	48.51
	1981-82	32.68	24.22	7.92	9.01

Source : Computed from Appendix Table-B(7) to the index of the 'composite conflict measure' assumes greater importance. It has been observed that during the pre-liberation period the index of composite measure of industrial conflict of each year always lies below that of the base year except in 1968-69, when it was 1.74 per cent higher than the base year. During the post-liberation period, though all the indices lie below the base year 1962-63, except in 1981-82, the overall picture shows considerable increasing trend suggesting a situation of increasing industrial conflict. Regressing productivity of labour (L) on measured composite conflict (C), the following results are obtained :

$$\text{Log } L_{1962-69} = 76.97 - \underset{(0.059)}{0.0006}\, C \quad : \text{ Pre-liberation period}$$
$$R^2 = 0.1448$$

$$\text{Log } L_{1975-82} = -\,80.83 - \underset{(0.026)}{0.0027}\, C \quad : \text{ Post-liberation period}$$
$$R^2 = 0.5749$$

Figures in the brackets indicate standard errors. Although arithmatically the adverse effects of industrial conflicts on labour productivity appears to have been more than four times in the post-liberation period than in the pre-liberation period, statistically the estimates indicating influence of industrial conflicts have been insignificant in both the sub-periods.

It is now required to examine the determinants of the peculiar experience regarding industrial conflict affecting productivity of labour. One important determinant has of course been the trend of real wages in this country. During early part of 1960's the real wages in general in manufacturing industry in Bangladesh has declined [68]. Curiously this is a period which was characterised by a high rate of growth of manufacturing value added [81]. Also manufacturing industries registered very high rates of reported profits in this period [7,109]. The actual profits made were most probably higher. The distribution of manufacturing incomes during this period has most probably been rather unequal and became more unequal over time [31]. Such a situation is particularly apt to create wide-spread disaffection among the workers. This wage-based explanations, however, do not explain the industrial conflict fully, particularly during the pre-liberation period. As because, it has been observed that during 1962-70, unskilled urban wage rose by 4 per cent [8], while the industrial wages over this period rose at anything more than 10-12 per cent. If so, the reasons for the marked improvement in the productivity of labour during the pre-liberation period have to be looked for not only in rising wages alone but also elsewhere. In fact, there are good reasons to believe that the marked improvement in industrial conflict situation is also due to certain sweeping pieces of labour ligislation enacted in 1965 which effectively banned the workers' right to organise strike for collective bargaining. One of the decrees enacted in the year also weakened the trade unions by legitimatising individualistic modes of grievance settlement [6].

A wage-based explanation for the observed magnitude of industrial conflict is most appropriate for the post-liberation period. Real wages fell very rapidly in this period as a result of severe inflation in food prices. Real wage in the large-scale industries of Bangladesh in 1975 was half, even less than that of the corresponding 1971-72 wage [34]. The situation obviously aggravated in the following years. This has, to a great extent, given rise to a chronic problem of worsening climate in terms of industrial conflict which has in turn affected the productivity of labour.

Utilisation of Capital Resource :

Capital productivity, power & fuel productivity and capital intensity are used as the efficiency indicator with respect to the capital resource. Regression of labour productivity on these three variables would be of much value in explaining the productivity of labour. But since presence of strong multicollinearity among these three independent variables is very likely we have instead estimated correlation coefficients of labour productivity and capital productivity, and of labour productivity and power & fuel productivity, and finally regressed productivity of labour on capital intensity.

Table-4(4) below shows the indices of labour productivity and the productivities of capital and of power & fuel. Labour productivity

Table-4(4)

Labour productivity, capital productivity and power & fuel productivity indices in cotton textile industry in Bangladesh, 1962 - 1982

Base: 1962-63=100

Period	Year	Labour Productivity	Capital Productivity	Power & Fuel Productivity
Pre-liberation Period	1962-63	100.00	100.00	100.00
	1963-64	93.25	102.32	52.63
	1964-65	126.43	31.76	70.71
	1965-66	147.33	93.71	62.54
	1966-67	113.80	98.58	61.85
	1967-68	108.18	101.	50.68
	1968-69	123.11	109.01	59.13
	1969-70	185.59	117.77	65.53
	1970-71	127.68	93.47	65.53
	1971-72	88.29	63.34	29.76
	1972-73	136.65	93.99	33.17
Post-liberation Period	1973-74	67.63	99.56	33.48
	1974-75	67.04	98.92	35.38
	1975-76	62.92	96.27	30.45
	1976-77	62.33	79.53	29.49
	1977-78	59.11	82.23	23.90
	1978-79	62.79	94.75	29.24
	1979-80	45.52	93.53	28.77
	1980-81	52.65	86.97	27.65
	1981-82	61.54	92.11	26.60

Source : Computed from data presented in Appendix Table-B(3) and Appendix Table-B(4).

and capital productivity, as expected, shows positive correlations during both the periods under study, but the results are not statistically significant (pre-liberation period : $r^2=0.0169$, $t=0.3469$ and post-liberation period: $r^2=0.1225$, $t=0.0099$). During the pre-liberation period, the relationship between the labour productivity and power & fuel productivity has been found to be negative having not statistically significant result ($r^2=0.0042$, $t=1.1727$), while that during the post-liberation period has been found to be positive having significant result at 5% level ($r^2=0.25$, $t=1.77$).

Table-4(5) below shows the indices of labour productivity and the capital intensity. The estimated regression equations stand as follows :

$$\text{Log } L_{1962-71} = \underset{}{1.696} + \underset{(0.012)}{0.0031}\, K \qquad R^2 = 0.2574 \qquad : \text{Pre-liberation period}$$

$$\text{Log } L_{1973-82} = 0.532 + \underset{(0.001)}{0.0004}\, K \qquad R^2 = 0.1721 \qquad : \text{Post-liberation period}$$

Values within parentheses are standard errors of the coefficients. The equation for the pre-liberation period has a higher R^2 ; the coefficient of capital intensity in this equation shows that one per cent increase in capital-labour ratio could increase labour productivity by 0.31 per cent. During the pre-liberation period, the government had adopted a number of measures as regards industrialisation. These include a grossly over-valued exhange rate, the maintenance of very low or negative real interest rates, a regime of import allocation administered by elitist bureaucrats [24], easy availability of credit [82], a link between approved installed capacity and automatic entitlement to intermediate imports on official exchange rates [90] etc. All these coupled with foreign aid and foreign exchange availability, due to Korean boom, had led to a rapid expansion of capacity resulting in growth of capital intensity during the pre-liberation period.

During the post-liberation period, capital intensity was lower than the pre-liberation period. The capital stock was lower due to the ravages of the liberation war. The high level of labour hoarding due to political pressure also had the effect of lowering capital intensity during the post-liberation period.

Table-4(5)

Labour productivity and capital intensity indices in cotton textile industry of Bangladesh, 1962-1982

Base: 1962-63=100

Period	Year	Labour productivity	Capital intensity
Pre-liberation Period	1962-63	100.00	100.00
	1963-64	93.25	91.13
	1964-65	126.43	151.66
	1965-66	147.33	157.21
	1966-67	113.80	115.44
	1967-68	108.18	106.91
	1968-69	123.11	112.93
	1969-70	185.59	157.58
	1970-71	127.68	136.59
	1971-72	88.29	107.81
	1972-73	136.65	145.39
Post-liberation Period	1973-74	67.63	67.93
	1974-75	67.04	67.77
	1975-76	62.92	65.36
	1976-77	62.33	78.38
	1977-78	59.11	71.89
	1978-79	52.79	55.71
	1979-80	45.52	48.67
	1980-81	52.65	60.53
	1981-82	61.54	66.81

Source : Computed from data presented in Appendix Table-B(3) Appendix Table-B(4).

Summary :

The foregoing discussion shows that the labour productivity in the pre-liberation period fares well compared to that in the post-liberation period. Better utilisation of labour and capital resources in the pre-liberation period is found to have contributed to the comparatively better performance of labour productivity. The poor performances of labour productivity in the post-liberation period are due to, among other things, overmanning, migration of skilled labour and to some extent industrial disputes consequent upon falling real wages.

CHAPTER V

PLANT LEVEL ANALYSIS OF LABOUR PRODUCTIVITY

5.1 Determinants of Labour Productivity :

For explanation of labour productivity at the plant level (on the basis of sample data of 13 firms), we considered six explanatory variables and ran step-wise regressions. All are not shown except the following one as the variables are not found significant. Below are presented the results that conformed well with the economic and statistical criteria :

$$L = \text{Constant} + \underset{(0.1641)}{1.2472\, x_6} - \underset{(0.382)}{1.0981\, x_3} - \underset{(0.006)}{0.0231\, x_1}$$

$$R^2 = 0.8025$$

The three independent variables; size of the enterprise (x_6), ratio of manhours lost to actual hours worked (x_3) and man-capital equipment ratio (x_1) together explain 80.25 per cent of the variation in productivity of labour at the plant level. The co-efficient of independent variables x_6, x_3, x_1 are significant at the 99.9 per cent level. The variable with the highest explanatory power is x_3 which alone explains 63.21 per cent of the variation in productivity of labour. When x_3 is run together with x_1, the two variables explain 74.15 per cent of the variation in productivity. Whereas when these are considered along with x_6 (production variation due to enterprise size) the explanatory power of the model increased by 2.28 per cent to 80.25 per cent.

5.2 Inter-Firm Variations of Labour Productivity :

Table-5(1) shows variability in the productivity of labour across the firms. Taking the productivity of labour of all sample enterprises as 1, it has been found that the enterprise of Category 'C' shows the highest level of productivity which is 1.27. The corresponding figures for enterprise 'B' and enterprise 'A' are respectively 1.10 and 0.75.

Table-5(1)

Labour productivity comparison among the three categories of firms of sample enterprises, 1981-82

Enterprise Code	Level of labour productivity
A	0.75
B	1.10
C	1.27
Average	1.00

Source : Calculated from Appendix Table-C(1)

The productivity level of enterprise 'C' is, therefore, 14.55 per cent higher than the enterprise 'B' and 69.16 percent higher than the enterprise 'A'. The enterprise 'C' again, claims that its productivity level is 27 percent higher than the average productivity of the sample enterprises as a whole.

5.3 Factors of Inter-firm Variations of Labour Productivity :

Inter-firm variations of labour productivity are caused by a variety of factors. On the basis of availability of data, we have been able to investigate more extensively about a few of them. They are discussed below :

Employment Structure and Labour Productivity :

Employment structure in relation to labour productivity has been considered, employment structure being defined as ratios of labour to 'non-production workers' and also all employees. Table-5(2) below shows the ratios of labour to non-production workers and all employees of the three categories of firms under study for the year 1981-82. It is needless to mention that the ratio(s) respresenting employment structure that corresponds to the highest labour productivity can be considered to be "better" at least from the comparative point of view.

Table-5(2)

Variations of employment structure in the three categories of sample enterprises, 1981-82

Enterprise Code	Productivity of labour	Ratio of labour to non-production workers	Ratio of labour to all employees
A	0.75	0.83	0.94
B	1.10	1.08	1.01
C	1.27	1.32	1.05
Average :	1.00	1.00	1.00

Source : Calculated from Appendix Table-C(2)

Taking all these ratios of the sample values as 1, it can be seen that the enterprise 'C' comes up to be the most productive with the employment structure ratios which are also the highest. Next in order of productivity as well as employment structure ratios is enterprise group B. Enterprise group A turns out to be the one with the lowest productivity value accompanied by lowest ratios of employment structure.

So far as the employment structure is concerned, the enterprise 'C' can be said to have the best combinations of human resources as it relates to the highest productivity in comparison to all other enterprises. Thus with ceteris paribus assumption, it transpires that the enterprise groups 'A' and 'B' suffer from over-manning in terms of non-production workers like administrative & professional staff and others. That is to say, sub-optimal employment structures, in part, explain rather lower productivity situations of enterprise groups A & B.

Manning in Relation to Capital Equipment :

Productivity of an enterprise to a considerable extent, depends on how optimally the human input is used per capital equipment. In view of this, labour productivity in relation to employment structure measured by man-capital equipment ratio will provide some insight into the causes of inter-firm variations of productivity. Table-5(3) below shows the employment-capital ratio of the sample enterprises

Table-5(3)

Employment-capital input ratio in the three categories of sample firms, 1981-82

Enterprise Code	Labour Productivity	Employment-Capital Ratio
A	0.75	1.14
B	1.10	1.04
C	1.27	0.74
Average :	1.00	1.00

Source : Calculated from Appendix Table-C(3)

under study for the year 1981-82. Taking the ratio of the total sample enterprises as 1, it has been found that the corresponding figures for 'A' 'B' and 'C' are 1.14, 1.04 and 0.74 respectively, which stand in inverse relation with the labour productivity of 0.75, 1.10 and 1.27. Thus the higher manning rate causes lower productivity of labour.

From our above two findings we can not, however, draw a strong conclusion that the enterprises 'A' and 'B' suffering from over-manning and the quality of labour force is more effectively used in the enterprise 'C' without comparing the technology differentials of the enterprises.

Differential Technology :

If a firm has a high level of labour productivity compared to another, it does not always mean that the quality of labour force is more effectively used in the particular firm. The differential technology may have a significant relationship with the level of labour productivity. In our present analysis, technology change is measured by the factors like power and fuel productivity, capital productivity and capital intensity. All these three measures are provided in Table-5(4) below.

Table-5(4)

Relationship between the labour productivity and improved technology

(Taking all sample value as 1)

Enterprise Code	Labour productivity	Power & fuel productivity	Capital productivity	Capital intensity
A	0.75	0.63	0.84	0.85
B	1.10	1.48	1.15	0.92
C	1.27	1.16	0.99	1.23
Average :	1.00	1.00	1.00	1.00

Sources : Calculated from Appendix Tables C(4) & C(5)

Power & Fuel Productivity :

In terms of power & fuel productivity, it may be that higher the power & fuel productivity, higher is the productivity of labour. It is observed in the Table-5(4) that the power & fuel productivity for 'B' is highest, while the enterprise 'A' shows the lowest level of labour productivity.

Capital Productivity :

Higher level of labour productivity may be the impact of the higher level of capital productivity. This proposition also contradicts our results. The enterprise 'B' shows the highest level of capital productivity, while the enterprise 'C' claims the highest level of labour productivity. Power & fuel productivity and capital productivity, however, show the similar situation.

Capital Intensity :

Capital intensity is an important factor that determines the level of labour productivity. The proposition is that higher the capital intensity, higher is the level of labour productivity. This proposition holds true in our results.

Results of the capital-labour ratio indicate that the improved technology causes inter-firm variations of labour productivity to a considerable extent. So far as the employment structure is concerned, the enterprise group having highest productivity level can be said to have the best combinations of human resources. It has also been observed that higher manning rate causes lower productivity of labour.

Production Management :

Production management is a broad term encompassing a number of activities. We have, however, considered a few of them like preventive maintenance, organisational health, capacity utilisation, minimisation of wastage, production planning & control and research & development (R&D). There may be disagreements as regards the items to be included in what has been called 'production management'. However, this does not give rise to any problem in the present context inasmuch as labour productivity is viewed separately in relation to each of the above mentioned items.

Preventive Maintenance :

Since machine breakdowns stop production, make men and machines idle, cause loss of production and put orders behind schedule, preventive maintenance enters as an important aspect of production management to keep the delivery schedule in line in order to boost up production and productivity. The enterprises being examined are all reported to have preventive maintenance system. The maintenance systems are found to be similar in the case of all enterprises. Since it is worthwhile to get an idea of the system, it is summarised below :

> "Generally one or two machines of each section are opened up, cleaned and checked everyday. This programme is done in such a way that every machine is opened up, cleaned and checked every fortnight or month. Maintenance records are maintained in registers and on graphs. The graphs are generally kept hanging on the walls of the respective sections."

Although maintenance systems are similar, facilities of maintenance differ among the firms. Out of the 13 mills surveyed, the preventive maintenance system of enterprises in group 'C' is drawn up in detail and the programmes and recording are scientific. The enterprises of group B regards its system as inadequate whereas enterprise group A responds that their maintenance system can not be termed as a formal one. The enterprise C has some technical literature of machines available, while in cases of A and B they are not available. These maintenance facilities seems to be in accord with the respective productivity performances of the different categories of enterprises. For further evidences of this aspect it is required to see the productivity performances in relation to the share of man-hours lost due to machinery defect (other than shortage of spares) and maintenance to total man-hours lost. Table-5(5) below shows the share of man-hours lost due to machinery defect and maintenance to total man-hours lost during 1981-82 and its relationship with the productivity of labour. The table shows that the enterprise A has the highest ratio of man-hours lost due to machinery defect and maintenance while enterprises B and C respectively portrays lower ratios of manhours lost on this account with a descending trend. It is revealed by the survey that skill concentration, capable of detecting machinery and providing remedial measures, are the highest in enterprise C followed by B and A.

Table-5(5)

Productivity level and share of man-hours lost due to machinery defect and maintenance to total man-hours lost of the sample enterprises, 1981-82

(Taking total samples as 1)

Enterprise Code	Productivity of labour	Share of man-hours lost due to machinery defect & maintenance to total manhours lost
A	0.75	1.40
B	1.10	0.85
C	1.27	0.48
Total Sample:	1.00	1.00

Source : Calculated from Appendix Table-C(6)

Organisational Health :

Lack of organisational health leads to dissatisfaction on the part of the employees and this in turn causes absenteeism, strikes and lock-outs, etc. The share of manhours lost due to strikes and lock-outs of the different enterprise groups and their corresponding labour productivities are listed in Table-5(6).

Table-5(6)

Productivity of labour and the share of manhours lost due to absenteeism, strikes and lock-outs to total manhours lost in the sample enterprises, 1981-82

(Taking sample result as 1)

Enterprise Code	Productivity of labour	Share of man-hours lost due to absenteeism, strikes and lock-outs to total manhours lost
A	0.75	0.95
B	1.10	1.06
C	1.27	0.99
Average :	1.00	1.00

Source : Calculated from Appendix Table-C(6)

The figures in the table are not in full conformity with the 'priori' notion of the relationship between labour productivity and organisational health. For instance, enterprises A show lower productivity and lower ratio of manhours lost than the corresponding figures of enterprises B and C which seems contradictory. However it should be noted that our analysis is based on **'ceteris** peribus' assumption and we have seen earlier that other forces are at work to depress the productivity of enterprise A. The influence of other forces may be strong enough to outweigh the favourable effect (compared to those of other enterprises) of lower ratio representing man-hours lost.

Capacity Utilisation :

Having discussed preventive maintenance and organisational health for explaining differential labour productivity, considerations of capacity utilisation for the sample purpose appear superflous on the reasoning that the preventive maintenance as well as organisational health affect capacity utilisation. But capacity utilisation depends on a host of factors like availability of raw materials, marketing facilities, etc. besides preventive maintenance and organisational health. Therefore, examination of labour productivity in relation to capacity utilisation would be complementary rather than superflous to our study. Table-5(7) contains the relevant informations.

Table-5(7)

Relationship between the labour productivity and capacity utilisation of the sample firms, 1981-82

(Taking total sample value as 1)

Enterprise Code	Productivity of Labour	Capacity Utilisation
A	0.75	0.94
B	1.10	0.97
C	1.27	1.12
Average :	1.00	1.00

Source : Compiled from Col.(2) of Appendix Table-C(7)

The table reads that the order of capacity utilisation is the same as the order of labour productivity. This can be conceived of as the net result on productivity of factors like preventive maintenance, organisational health and others which are not explicitly examined in this study.

Wastage of Raw Materials :

The relevance of wastage of raw materials to labour productivity stems from the fact that it creates an environment for low productivity. Wastage may occur in different stages of production and some of the reasons of wastage are noted below :

a) Quality of input material
b) Technique used in spinning
c) Skill of the operator
d) Maintenance of machines
e) environmental conditions, viz. humidity and temparature
f) Quality of supervision

It was not possible to trace the extent of wastage due to each of the above mentioned reason. Hence total wastage was the choice - the exact variable being the ratio of wastage of enterprises A, B and C to the total wastage of all the enterprise. The results are contained in Table-5(8).

Table-5(8)

Productivity of labour and wastage share of the sample enterprises, 1981-82

(Taking total sample value as 1)

Enterprise Code	Productivity of Labour	Wastage Ratio
A	0.75	1.04
B	1.10	1.13
C	1.27	0.65
Total Sample :	1.00	1.00

Source : Calculated from Col.(1) of Appendix Table-C(7)

It can be seen from the figures of the table that variation of wastage ratio does explain variation of labour productivity but with some qualifications. Productivity ratios of B and C are in accord with their respective wastage ratios. But A here, as it was in the case of organisational health, is a divergent case. A relatively lower productivity ratio is seen against relatively lower wastage ratio. This may not imply that in case of A enterprises productivity and wastage go together. Nor does it damage the inverse relationship between productivity and wastage. More than one explanations can be offered. The foremost one on which we may fall back is the 'ceteris paribus' assumption again. Other negative factors might have been too depressive in their effects on labour productivity in the case of A enterprises. On statistical count, only three enterprise groupings provide too small a sample to come up with a definitive trend.

Production Planning and Control :

Production planning and control technique is a vital aspect of production management since it helps maximise the utilisation of the factors of production. In order to examine its relevance to the differential labour productivity across the firms, our questionnaire was directed to information pertaining to whether the individual enterprises prepared production plans; the questionnaire also sought answers as to how the plans were prepared and how frequently they were prepared, besides these information as to how the production control mechanism worked and how the production planning technique was learnt were looked for. Not very meaningful informations could be obtained on production planning and control to explain differential labour productivity. This is because all the firms were reported to be following more or less the same planning technique. Inter-firm variations as regards other aspects of production planning & control were reported to be absent. Under these circumstances production planning and control is of little relevance to the differential labour productivity.

Research and Development (R&D) :

An attempt was also made to see the significance of R&D on differential labour productivity. Questionnaire was framed to assess the magnitude, nature, etc. of R&D. The firms under investigation were reported not to have expenditure on this account.

5.4 Summary :

Plant level analysis is carried out at two different levels. The first level involves explanation of labour productivity at the aggregate level of 13 sample mills. It is found that the size of the enterprise, ratio of manhours lost to actual hours worked and man-capital equipment ratio - these three variables explain 80 per cent of labour productivity. Productivity study at the the inter-firm level involves analysis of differential labour productivity ; variations in labour productivity is found to be associated with differential employment structure in relation to labour, manning relative to capital equipment, capital intensity, preventive maintenance and capacity utilisation. Organisational health and wastage ratio also influence labour productivity but these results are not conclusive.

CHAPTER VI

PROCESS-BY-PROCESS LEVEL ANALYSIS OF LABOUR PRODUCTIVITY

This chapter attempts to analyse productivity of labour at each stage of production process. The study is based on all the 9 spinning mills in our sample. The focus of analysis is on production process levels with data for 1981-82.

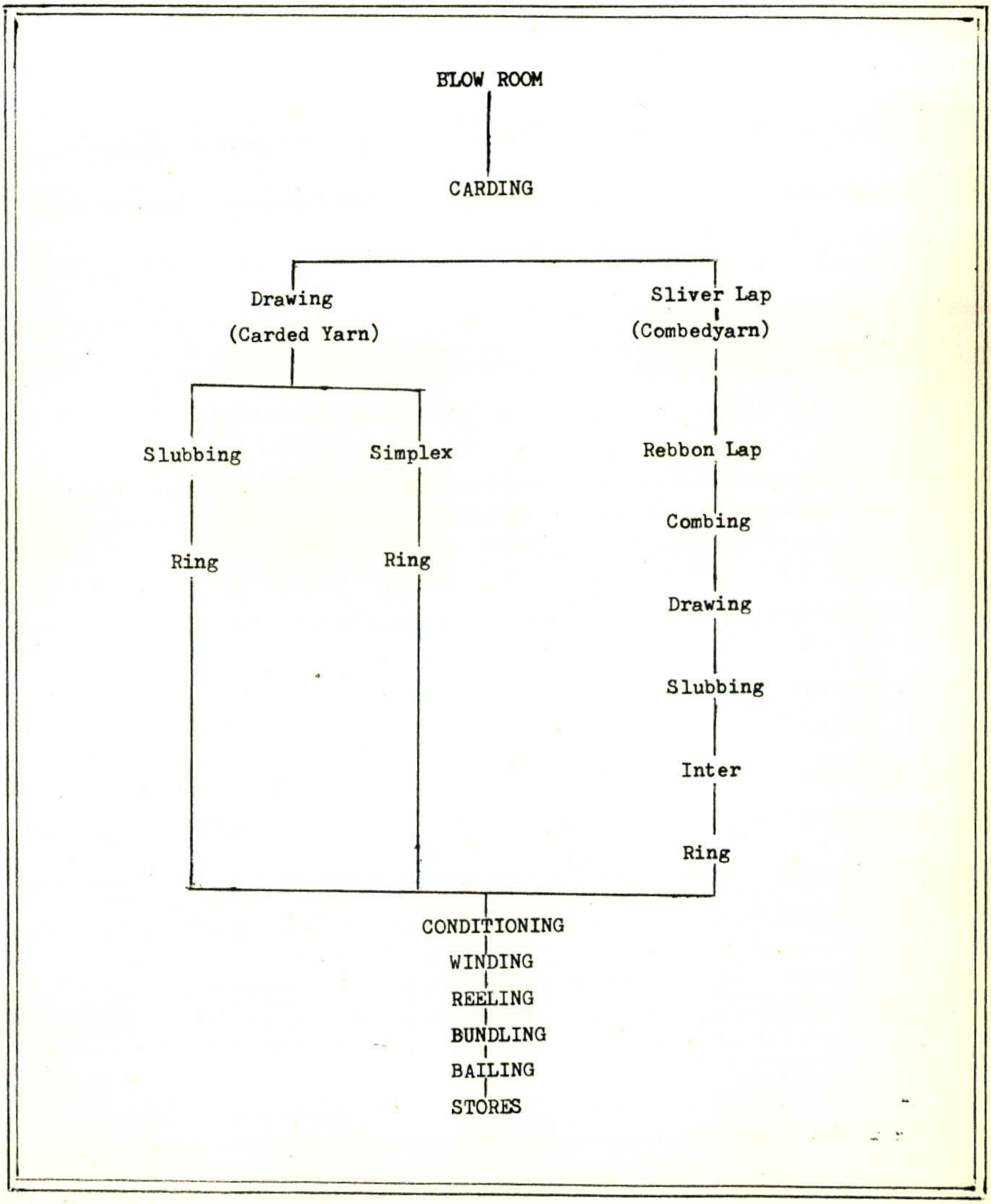
6.1 Production Process: A Brief Description:

We set out here to analyse factors affecting labour productivity at the production process levels. Before we do so, it is instructive to briefly discuss the production process involved. For the production of yarn, the basic raw materials obtained is a mass of entangled fibre - entangled because it is required to be highly compressed to facilitate transportation. This cotton contains natural and other impurities including fibres of different lengths and qualities.

It is, therefore, required to clean and mix the fibres and then straightened. Thus the first step in manufacture is to clean and mix the fibres. These are then generally straightened. Thereafter, the fibres are drawn out (attenuated) to form a sliver. The fibres are then further attenuated and twisted (to impart strength) to produce rovings which are finally twisted into yarn. The following 'Flow Chart' will be helpful in getting into the process.

This flow-chart is a fairly detailed description of the production process. The processes can be thought of as parts of two broad processes-preparing the cotton for spinning and spinning the cotton

FLOW PROCESS CHART (SPINNING)



into yarn. These two processes are seen to be composed of five stages:

Stage-1 : Opening & Cleaning
Stage-2 : Carding
Stage-3 : Drawing
Stage-4 : Roving
Stage-5 : Spinning

The stages/processes of production are dealt with in some detail and factors affecting labour productivity examined.

6.2 Productivity Measurement and Regression Analysis:

In measuring productivity we attempted to use the standard output estimates prepared by management. On the basis of experience, management has made estimates of what should be normal output at each stage of production process. These estimates were made by adjusting the International Standards according to the conditions of their own mills. The actual production of each stage was converted into percentages of the standards fixed for them and this was taken as their productivity level.

The primary purpose of our study here is to analyse what factors affect productivity of labour at each level of production process. We have made use of linear multiple regression analysis to find out which variables are important in explaining the variations in the level of productivity at each level of production process. The strength of relationship is measured by the co-efficient of correlation R. The regression equation takes the form:

$$P_L=a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7$$

Where P_L = Productivity of labour expressed as output produced in physical terms divided by total manhours worked.

x_1 = Absenteeism measured in terms of total manhours absence divided by the total manhours worked.

x_2 = Shortage of back process expressed as the ratio of the total production hours lost due to shortage of backprocess to the total production hours worked.

x_3 = Mechanical defect measured in terms of production hours lost due to defect in the machine divided by the total production hours worked.

x_4 = Electrical defect measured in terms of production hours lost due to electrical defects divided by the total production hours worked.

x_5 = Power failure expressed as total manhours lost due to electricity failure divided by total manhours worked.

x_6 = Strike/gate meeting expressed as total manhours lost due to strike and gate meeting divided by the total man hours worked.

x_7 = Religious affairs expressed as total manhours lost for worship and other religious functions divided by the actual manhours worked.

6.3 Results and Explanations:

6.3.1 Total Process Level:

The average level of labour productivity at the total process level of 9 spinning mills under observation came to 31.97% below its standard level and the variation between the stages was found to be substantial. Not all the variables were found significant at the total process level. In terms of significance, our multiple regression equation was as follows:

$$P_L = 54.16 - 1.4368x_1 - 0.0328x_2 - 1.9077x_5$$

$$\qquad\quad (0.1614) \quad (0.007) \quad (0.318)$$

$$R^2 = 0.7797$$

The figures in parengheses are the standard errors of the regression co-efficients. The three independent variables together (absenteeism, shortage of back process and power failure) explain 77.97% of the variation in labour productivity at the total process level. The co-efficients of independent variables x_1, x_2 and x_5 are significant at the 99.5% level. The variable with the highest explanatory power is x_1 (absenteeism) which alone explains 63.02% of the variation in labour productivity. When x_1 is run together with x_2, the two independent variables explain 75.15% of the variation in productivity of labour. The two variables x_1 and x_2 are not correlated between themselves, which is important, for if they were, our result would have been spurious. When these two variables are run along with x_5 which shows production interruption due to electricity failure, the explanatory power is increased by 2.82%.

6.3.2 Process-by-Process Level:

Stage 1 : Opening & Cleaning:

The object of the opening and cleaning process is to blend cotton so as to get a uniform raw material, clean it (i.e., remove leaf, dirt and trash), open up the fibres, since these have been compressed in bales, and deliver a cleaned, uniform product in a suitable form to the next stage.

Opening and cleaning takes place in the blow room and involves a range of four or five machines. These comprise an opener, mixing and cleaning machines and a scutcher. The opening involves *inter alia* beating the cotton in such a way that loosened extraneous matter is disposed of through a suitably located grid. The cleaning machines make use of combing and beating (and in some cases, differential air speeds) further to purify the cotton which emerges in lap form. It is then fed to the scutcher which basically comprises a rapidly revolving, multi-bladed beater mounted over a rid. The cotton passes under this beater, is still further loosened by suction, and is delivered as a continuous flat sheet (or lap) of uniform thickness which is made into a large roll to be fed to the carding machines. The line normally works without human intervention except for the possibility of feeding in cotton at one end and removing the finished product (lap) at the other. At the end of the range the choice is at the delivery end of the last machine, the scutcher. Laps can be doffed manually or automatically. The output of single opening line with two deliveries, scutcher of chute is about 1200 lbs an hour of cleaned cotton. After allowing for about 5 per cent waste in the transition from raw cotton to cleaned cotton, the raw cotton requirement is about 1250 lbs an hour which is about 50 bales a day.

One storage hand or baleman would operate the bale and collect the waste. At the feeding stage, it is reasonable to allow for 2 feeders but use of a bale plucker would cut this requirement to one. Moreover, according to the makers of the equipment, 2 men on one shift are sufficient, as the plucking line can be left unattended all night. At the delivery end of the blow room one doffer can attend to both scutchers.

The opening and cleaning stage shows an average of 29.74% lower productivity of labour in our sample mills. The result of the regression equation was as follows:

$$P_L=69.91-0.7589x_1-0.01266x_2-3.2246x_5$$
$$\qquad (0.2632)\ (0.000808)\ (0.70529)$$

$$R^2=0.7596$$

The three variables (absenteeism, shortage of back process and power failure) explain 75.96% of the variation in productivity of labour in this stage. Power failure alone explained 67.04% of the variation of labour productivity and, together with absenteeism, the value of R^2 came to 73.72%. Both power failure and absenteeism are significant at the 99.5% level, while the shortage of back process was much lower in significance. This means that the shortage of processing raw cotton, though significant, was not very important as a factor in explaining labour productivity in this stage.

Stage-2: Carding:

The function of carding machine is to remove most of the remaining impurities from the cotton as well as relatively short fibres left in from the previous stage. It also breaks up any hard tufts which survives the earlier opening and cleaning operations.

At this stage a basic objective is the formation of sliver from the lap.

The core of the modern carding machine comprises a composite fabric in which are anchored densely-packed fine-pointed wires the pointed ends of which are bent over. This material covers a large horizontal cylinder in the machine as well as a smaller cylinder on the one side of the machine. Another small cylinder on the other side of the machine has cut teeth. The lap from the scutching machine is fed to this toothed roller (the licker-in) which rotates rapidly. Its teeth pierce the lap and carry it forward, attenuating the cotton in the process, to meet the large cylinder where it is taken off with more attenuation - by the wire points. The cotton spread film-like on the cylinder is passed under moving wire points on "flats" above the large cylinder. As a result, the cotton is combed and straightened as it moves forward to meet the other (card-clothed) small roller which removes it from the cylinder. The lapped cotton is then collected by roller and narrowed to a thick sliver which is coiled into tall narrow cans.

The mills under study posses high production card and the collection of the sliver from the card cylinder is done by rollers instead of vibrating comb. The current high production card gives an output of about 70lb. an hour so that 16 cards would be sufficient to process the required volume of cleaned cotton when associated with ring spinning.

It has been observed that productivity of labour is as low as 50.37% at this stage. The regression equation gave the following result.

$$P_L = 47.936 - 1.1128x_1 - 0.01864x_2 - 0.9732x_5$$

$$(0.2984) \quad (0.0014) \quad (0.2323)$$

$R^2 = 0.7621$

The three variables are all significant at 99.5% level and explain 76.21% of the variation in labour productivity. The single largest contribution to the explanation of labour productivity in this stage was made by power failure, which alone explained 66.40% of the variation in labour productivity. Absenteeism together with power failure explained 70.64% of the variation.

Stage-3 : Drawing:

The draw frame draws several slivers from the card and attenuates them to the dimensions of one thus increasing the uniformity of the product. The draw frame uses pairs of rollers in line and suitably spaced so that the differential speeds of the rollers attenuate the fibres without causing them to break.

The regression equation for this stage in our sample mills stood as follows:

$$P_L = 48.47 - 1.252x_1 - 2.3268x_3 - 1.602x_5$$

$$(0.337) \quad (0.6766) \quad (0.2585)$$

$$R^2 = 0.7309$$

All the three variables, namely, absenteeism, mechanical defect and power failure are significant at the 99.5% level. The equation gives 73.09% explanation of the variation of labour productivity at this stage. Mechanical defect alone explains 7.5% of the variation of labour productivity.

Stage-4: Roving:

The object of the roving frame is to further attenuate. The actual draft being about 7 - an even the sliver, which at this stage is order to give strength requires some twist, and to wind it into robbins suitable for spinning. Use is again made of rollers.

With an output of 1.6 lb an hour and a requirement of 1026 lb an hour, about 640 high speed roving spindles are needed - 7 frames with an average of 96 spindles. It requires a 2 operatives as has been specified by the suppliers. In addition to the above staffing two supervisors and two labourers are needed for general supervision and coordination of the previous stages.

At this stage, two variables namely mechanical defect and electrical defect add significantly to the explanation of the variation in labour productivity. The explanatory power of the equation came to 82.18% as is evident from the regression equation given below:

$$P_L = 41.1544 - \underset{(0.1955)}{1.1853x_1} - \underset{(0.00565)}{0.0212x_2} - \underset{(2.5076)}{7.61817x_3} - \underset{(2.3076)}{10.5826x_4} - \underset{(0.3477)}{1.349x_5}$$

$$R^2 = 0.8218$$

A substantial proportion of the low productivity of labour in this stage is explained by the defects associated with mechanical and electrical matters.

Stage-5 : Spinning

Two types of spinning are generally used : ring spinning and opened or break spinning.

In ring spinning bobbins of roving are placed on the upper part of the ring frame. The roving - a sliver of the thickness of coarse string is led downwards through drafting rollers on to a vertical spindle which rotates a very high speed. There is a light ring round the spindle which is fitted with a traveller and the roving coming from the drafting rollers is threaded through a small yarn guide vertically over the spindle through the traveller of the spindle. The traveller imparts a slight drag to the roving and this has a tensioning effect as the roving is being guided round the spindle. This effect facilitates the twisting and winding operation.

In ring spinning then the roving is further attenuated by roller drafting to the fineness of the yarn required, usually a draft of 22 to 24, and at the same time further twist is inserted to give the yarn the necessary strength. The amount of twist is measured by the number of turns per inch in the yarn and the finer the yarn the smaller the number of fibres per unit of cross section area and the greater the amount of twist required. The usual relation is for the number of turns per inch to be four times the square root of the yarn count. The number four is called the twist factor and is higher if a shorter staple (cheaper) cotton is used. The amount of twist is regulated by drawing off the yarn at the right rate in relation to spindle speed. In general the spindle is run at its maximum speed of up to 15,000 rpm but at low count this means that the roving emerges from the rollers at a higher rate so that breakages are difficult to attend to and slower spindle speeds may be needed while operations are acquiring the necessary skill in piecing up. The ultimate limit to spindle speed is set by the centrifugal force on the traveller so that narrower diameter rings permit high speeds than wide diameters. This method of operating means, however, more frequent doffing.

A speed of about 12,500 rpm for a basic 1½"-2" diameter ring has been used in the mills under study. At this speed with a twist factor of four, output per rotor would be 0.063 lb an hour and 16,000 spindles would be required to obtain the assumed output (0.063 x 16,000 = 1,000 lbs). Six spinners and five doffers would be required i.e. 2700 spindles per spinner and 3200 per doffer. In addition to workers engaged directly in spinning provision should be made for supervision and maintenance in the ring spinning room as follows: 1 supervisor, 2 mechanics, 2 cleaners/oilers and 2 sorters/carriers.

In this spinning stage the productivity of labour came to at 49.7% lower than its standard level. The following regression equation was obtained to explain the variation of Labour productivity at spinning stage.

$$P_L=30.9997-1.0127x_1-2.3965x_2-23.2467x_3-28.3982x_4-1.6758x_5$$

$$(0.1792) \quad (0.4583) \quad (3.9915) \quad (3.8712) \quad (0.2895)$$

$R^2 = 0.8482$

At this stage, all the five variables run in our regression are highly significant. The explanatory power of the equation came to 84.82%.Mechanical defect along with electrical defect explain about 10% of the variation of labour productivity. Absenteeism and shortage of back process explain 34.9% variation.

6.4 Summary:

Productivity levels at different stages as has been observed are relatively low. Three variables in particular, namely, absenteeism , power failure and shortage of back process explain the variation of the productivity of labour significantly. There is scope to improve the level of productivity by appropriate measures particularly by reducing absenteeism and electricity failure and maintaining inter-stage input-output balance through proper assessment of input fed and output let at each stage of production process.

CHAPTER VII

SUMMARY AND CONCLUSION

7.1 Summary of the Study :

The study involves measurement and analysis of labour productivity in the cotton textile industry of Bangladesh. The study is carried out at three levels, i.e. aggregate level, plant level and process-by-process level.

The aggregate level covers a 20-years period with its two sub-periods, viz., the pre-liberation and the post-liberation periods, and analyses inter-temporal variations of labour productivity. It has been observed that the labour productivity in the pre-liberation period though shows a relatively better picture in comparison to the post-liberation period, the productivity performance of overall period is anything but satisfactory. The declining trend of labour productivity of the post-liberation period is found to have given rise to such a picture of the overall situation. The comparatively better performance of labour productivity in the pre-liberation period, though not statistically significant at the conventional level, is found to be associated with a more rightful stock of human as well as capital resources than in the post-liberation period. Productivity in the post-liberation period is constrained due to overmanning, migration of skilled labour and industrial conflicts.

At the plant level, a cross-section study of a sample of 13 mills under nationalised management is studied where the three variables, namely, man-capital equipment ratio, ratio of manhours lost to actual hours worked and size of the enterprises are found to explain 80 per cent of the variation in labour productivity. As expected, firm-size is found to have favourable impact while the other two variables unfavourable impact on labour productivity. The wide variation in labour productivity among three categories of firms, viz., the firms established between 1950 & 1960, and those between 1961 & 1970, and 1971 & 1980 is of significance. Systematic association between labour productivity and the variables like employment structure, capital intensity, preventive maintenance and capacity utilisation are found to exist. Organisational health and wastage ratio are also found to be related to variation in labour productivity. However, the relationship of these two variables with labour productivity were not found to be as definitive.

Coming to the question of the process-by-process level of labour productivity. It is seen that productivity at different stages are relatively low compared to their standard levels. Low productivity at the different stages are attributable to a number of reasons. Besides others, some of these are related to management problems and some are technical in nature. Absenteeism, lack of preventive maintenance, power failure, short of back process and 'electrical defects etc. are found be important factors of low productivity.

7.2 Policy Implication :

The results obtaied in this study suggest two types of policy implications : one, pertaining to the techno-managerial aspect which is the concern of the factory management and the other relating to the overall industrial invironment which is the domain of the higher authority like the government. As regards the former, the following aspects are noted.

Overmanning & Employment Structure :

The existing overmanning which creates an imbalance of employment structure can not be solved overnight. However, this is supposedly reduced to a considerable extent by introducing floor level training to excess hands and by inter-mill adjustments. BTMC may take this initiative.

Raw Material Testing :

Better quality output and least wastage depend on 'micronaire value and strength' of the raw cotton. It is, therefore, required to be tested the micronaire value and pressly strength correctly before sending it to the mills. BTMC should control the selection of raw materials at the point of entry into the country when imported. Re-checking should be done by the mill before sending it to the process of production.

Quality Control :

The standard of quality control personnel of the mill level would have to be raised. The gusting quality control personnels would require more in depth practical training in control methods and utilisation of them.

Inter-stage Input-Output Consistencies :

Inter-stage input-output balance should be maintained by proper assessment of input fed and output let at each stage of production process through a carefully supervision on back process, machine defect and labour utilisation.

Operator Training :

We have found that the operators lack the appreciation of why particular tasks have to be carried out in a systematic way. We would suggest that in view of the labour problems that do occur in the mills, it would be worthwhile to train operator instructions for each area of processing. This ensures that each operator knows in detail the work he has to perform and more to the point the reason he has to do it. Management has the satisfaction of knowing that each operator has the same working procedures. Systems like these require monitoring by the instructor.

Maintenance :

The type of equipment which runs at relatively high production speeds requires correct methods of fitting bearings and shafts etc. In particular where settings have to be made it requires a certain amount of training imparted to the maintenance personnel to ensure that machines are in correct mechanical and technical working condition.

Machinery Rationalisation :

If the BTMC is to remain as a combined group of mills, it would seem feasible to select what is considered the most appropriate make of machine for each area of appreciation, taking into consideration prior and follow-up machineries. The reason we suggest this is that it is well-known that spares cost today is a formidable part of the operating cost throughout the life expectancy of the machinery. As we have been informed that in many mills new machines have been idle because of lack of correct spares, whilst in other mills wrong types of spares have lain idle for many years. A centralised system of machinery and spares could solve the problem and reduce spare parts expenditure to a considerable extent.

Factory Conditions :

Most factories under study what have been observed that they are running without air-controlling of any type. For these mills we would recommend that as a temporary measure extract fans be placed in strategic place in particular in spinning areas to extract the hot air build up. Air will return as per plenum system. Besides, lighting should be clear in spinning areas, there should have cool drinking water facilities and readily assessable and clean toilet facilities. To obtain the best output from the labour it is essential that he has the best available working conditions.

Removal of Absenteeism :

Absenteeism is a serious factor affecting productivity of labour. The workers are pushed into the industrial area because of poverty and lack of employment in the non-agricultural season. Being piece-rated workers, they avail themselves of the opportunity to do some other works outside as and when they find these suitable. Thus it is difficult to remove absenteeism overnight. However, increasing rate could be pulled down by providing incentives through recognition by the top management, increased wages and awards for recognised work.

Regarding creation or maintenance of a congenial industrial atmosphere, we note two points which are related to the skill and the infra-structural aspects respectively. It is mentioned that the post-liberation period has been marked by an acute and unprecedented shortage of skilled manpower - the shortage occuring at the management as well as operating levels. The factory studied at the level of production process does not exhibit paucity of skilled manpower. However, the skill reported in the study is in terms of degree of the personnels, not their ability to do their job satisfactorily. It is felt that the training programme directed at skill expansion should be of more relevance if greater emphasis is laid on the applied side of the programme. The point of reference is the Textile College of Technology in Dhaka which caters for the skill requirements of the industry. More attention should be given as regards development of teaching staff, courses and syllabi, laboratory facilities and in particular testing equipments. In the area where the qualified teacher is lacking tremendously, the persons could be drawn from abroad for the purpose of effective training.

Vital to growth and productivity is Research and Development (R&D). Productivity movement in industrialised countries and also in many Asian countries has been accompanied with the establishment of National Productivity Organisations. Since R&D involves substantial sum and individual enterprises can hardly afford this activity, it rests on the government to establish the missing link.

- o -

B I B L I O G R A P H Y

Books, Reports & Articles

1. Abramovitz , M.,

   'Resource and Output Trends in the United States Since 1870', American Economic Association, May 1956.

2. Ahmad, Q.K. and Chowdhury, A.,

   'Productivity Trends in the Manufacturing Sector of Bangladesh: A Case Study of Selected Industries', The Bangladesh Economic Review, Vol.I, No.2, April 1973.

3. Ahmad,Q.K.,

   'What has been Hapenning to Productivity in Manufacturing Sector of Bangladesh : A Case Study of Selected Industries', Bangladesh Institute of Development Studies.

4. Ahmad, Q.K.,

   'The Jute Manufacturing Industry of Bangladesh 1947-74', Ph.D. Thesis, University of London, 1976.

5. Ahmad, Q.H. and Rahman, A.,

   'Absorption and Diffusion of Imported Technology in Cotton Textile Manufacturing in Bangladesh', Dacca : Institute of Business Administration, University of Dacca : 1979.

6. Ahmad, K.,

   Labour Movement in East Pakistan, Dacca : Progati Publisher, 1969.

7. Alamgir, M. and Rahman, A.,

   'Savings in Bangladesh, 1959/60 - 1969/70', Research Monograph No. 2, Dacca : Bangladesh Institute of Development Studies, 1974.

8. Alamgir, M.,

   Bangladesh : A Case Below Poverty Level Equilibrium Trap, Dacca : Bangladesh Institute of Development Studies, 1976.

9. Allen, R.G.D.,

   Mathematical Analysis for Economists, Macmillan, 1971.

10. Amjad, R.,

    'Private Industrial Investment in Pakistan, 1960-70', Unpublished Ph.D. Thesis, Cambridge : Cambridge University, 1977.

11. Asian Productivity Organisation,

    Development Strategies for 1980's, Tokyo, 1981

12. Arrow, K., Chenery, H.B. and Minhas, B.S.,

    'Capital-Labour Substitution and Economic Efficiency', Review of Economics and Statistics, August 1961.

13. Aukrust, O.,

    'Investment and Economic Growth', Productivity Measurement Review, February 1959.

14. Bangladesh Bureau of Statistics,

    Detailed Report on Census of Manufacturing Industry for 1976-77 in Bangladesh.

15. Bangladesh Bureau of Statistics,

    Statistical Pocket Book of Bangladesh, Various issues.

16. Bangladesh Bureau of Statistics,

    Statistical Year Book of Bangladesh, Various issues.

17. Bangladesh Bureau of Statistics,

    Summary Tables of Census of Manufacturing Industries, Various issues.

18. Bangladesh Bureau of Statistics,

    Census of Manufacturing Industries (Final Tables) 1969-70.

19. Bangladesh Bureau of Statistics,

    Statistical Digest of Bangladesh, Various issues.

20. Bangladesh Textile Mills Corporation,

    Annual Report, Various issues.

21. Barna, T.,

    'Note on Productivity of Labour : Its concepts and Measurement', Bulletin of the Oxford University of Institute of Statistics, Vol.8.

22. Beacham, A. and Williams, L.J.,

Economics of Industrial Organisations, London : Sir Isaac Pitman and Sons, 1961.

23. Beri, G.C.,

Measurement of Production and Productivity in Indian Industry, London : Asia Publishing House, 1972.

24. Braibanti, R.,

Research on the Bureaucracy of Pakistan, Durham : Duke University Press, 1966.

25. Brown, M.,

On the Theory and Measurement of Technical Change, Cambridge : Cambridge University Press, 1966.

26. Bruton, H.,

'Productivity Growth in Latin America', American Economic Review, Vol.LVII, December 1967.

27. Bureau of Labour Statistics,

'The Manning and Measures of Productivity, Department of Labour, 1971.

28. Central Statistical Office, Government of Pakistan,

Census of Manufacturing Industries (CMI), Various Issues.

29. Central Statistical Office, Government of Pakistan,

Twenty Years of Pakistan in Statistics, 1947-67, Karachi, 1968

30. Chowdhury, MAU.,

'Measurement of Sources of Growth : Bangladesh Manufacturing, 1954-65' Unpublished Ph.D. Thesis, University of Birmingham, 1973.

31. Chowdhury, N.,

'Industrial Conflict in Bangladesh, 1947-75 : A Preliminary Analysis' The Bangladesh Development Studies, Vol.V, No.2, April 1977.

32. Chowdhury, N.,

'Growth and Structural Change in Large-Scale Cotton Textile Industry in Bangladesh, 1947-76', The Bangladesh Development Studies, Vol.V, October 1977.

34. Chowdhury, N.,

'Real Wages in nationalised Sector of Bangladesh' Paper presented to Second Annual Conference of the Bangladesh Economic Association, 1976.

35. Chowdhury, N.,

'Comparative Productive Efficiency of Large-Scale and Small-Scale Cotton Weaving Industry in Bangladesh, 1976-77', Dacca : Bangladesh Institute of Development Studies, September 1978.

36. Cobb, C.W. and Douglas, P.H.,

'A Theory of Production', American Economic Review, Supplement, March, 1928.

37. Clembount, S.,

'The Ratio Method of Productivity Measurement', The Economic Journal, 1963.

38. Correa, H.,

'Sources of Economic Growth in Latin America', Southern Economic Journal, Vol.XXXVIII, July 1970.

39. Crandal, N.P. and Wooton, L.M.,

'Development Strategies for Organisational Productivity', California Management Review, VolXXI, No.2, 1970.

40. Das, R.K.,

Production in India : A Comparative Study in National Productivity, Calcutta : Visva Bharati Book Shop, 1924.

41. Davis, H.S.,

'Productivity Accounting', W.S.F.C., Pennsylvania University, Research Studies No.37.

42. Dension, E.F.,

'Measurement of Labour Input : Some Questions Definition and Adequacy of Data', Output, Input and Productivity Measurement Study, N.B.E.R., 1961.

43. Dension, E.F.,

Why Growth Rates Differ : Post-War Experience in Nine Western Countries, Washington : Brocking Institution, 1967.

44. Domar, E.E.,

'On Total Productivity and All That', Journal of Political Economy, December 1962.

45. Dunlop, J.T.,

The Economics of Wage Dispute Settlement in Law and Contemporary Problems, New York : MacMillan, 1947.

46. Durand, D.,

'Some Thoughts on Marginal Productivity With Special Reference to Professor Douglas' Analysis', Journal of Political Economy, Vol.XIV, 1937.

47. ECE :

Structural Changes and Analysis of Labour Productivity in the ECE Market Economies and Some Implications of Future Economic Growth, Geneva, 1982.

48. Fabricant, F.,

Basic Facts on Productivity Change, New York : National Bureau of Economic Research, 1959.

49. Gaathon, A.L.,

Economic Productivity in Israel, Praeger Publishers, 1971.

50. Gavrilov, R.,

'Measurement of Labour Productivity in the Industry of the USSR' Voproci Economiki, No.3, 1976.

51. Ghose, B.,

The Changing Profile of India's Industrial Economy, Calcutta : The World Press, 1974.

52. Goel, V.K. et al.,

Productivity Trends in Iron and Steel Industry in India, Delhi : National Productivity Council, 1974.

53. Government of the People's Republic of Bangladesh,

The First Five Year Plan, 1973 - 1978, Dacca : Planning Commission, 1973.

54. Government of Pakistan, Ministry of Industries,

Report of the Textile Industry Commission 1960, Karachi : Government of Pakistan Press, 1960.

55. Government of Pakistan,

A Survey of the Cotton Textile Industry of Pakistan, Karachi : Industrial Development Bank of Pakistan, 1965.

56. Government of Pakistan,

The Cotton Textile Industry in East Pakistan, Karachi : Pakistan Industrial Credit and Investment Corporation, 1969.

57. Government of Pakistan, Planning Commission,

The First Five Year Plan, Karachi : Government of Pakistan Press, 1957.

58. Government of Pakistan, Planning Commission,

The Second Five Year Plan, Karachi : Government of Pakistan Press, 1960.

59. Government of Pakistan, Planning Commission,

The Third Five Year Plan, Islamabad : Government of Pakistan Press, 1965.

60. Gouvenneur, J.,

Productivity and Factor Proportions in Less Developed Countries : The Case of Industrial Firms in the Longs, Oxford : Clarendon Press, 1971.

61. Habibullah, M.,

Some Aspects of Productivity in the Jute Industry of Pakistan, Dacca : Bureau of Economic Research (Dacca University), 1967.

62. Holmes, R.A.,

'Economic Growth in Canada', The Western Economic Journal, No. 4 & 5 1965.

63. Hossain, M.,

'Productivity and Profitability in Bangladesh Rural Industries', The Bangladesh Development Studies, Vol.XII, 1984.

64. Hossain, M. and Rahman, A.,

'A Study on the Relative Efficiency of Handlooms and Small Powerlooms Versus Larger Mills', Dacca : Bangladesh Institute of Development Studies, 1980.

65. Islam, N.,

'Foreign Assistance and Economic Development : The Case of Pakistan', Economic Journal, June 1972.

66. Itin, L.L. and Logutkin, B.M.,

Economics of Socialist Industry, Moscow : V.S., 1980

67. Kazachenok, A.G.,

Economical Statistic, Minsk, V.S., 1976

68. Khan, A.R.,

'What Has Been Happening to Real Wages in Pakistan ?' The Pakistan Development Review, Vol VII, No.3, Autumn 1967.

69. Kendrick, J.W.,

Productivity Trends in the United States, Princeton : Princeton University Press, 1961.

70. Kendrick, J.W. and Sato, R.,

'Factor Prices and Economic Growth', American Economic Review, December 1963.

71. Kendrick, J.W.,

'Productivity Trends : Capital and Labour', Review of Economic Statistics, August 1956.

72. Kennedy, C. and Thirlwall, A.P.

'Surveys in Applied Economies Technical Progress', The Economic Journal, March 1972.

73. Khurana, S.K.,

'Industrial Relations in the Private and Public Sector Industry in India : Comparative Analysis', Indian Journal of Industrial Relations, Vol7, No.3, 1973.

74. Kindleberger, C.P.,

Economic Development, (2nd ed.), Magraw Hill, 1965.

75. Krishana, K.L.,
'Total Factor Productivity : Concept and Measurement', National Productivity Council Productivity Journal, Vol.10, No.4, 1977

76. Labour Bureau, Government of India,
Report on Trends in Utilisation of Labour and Other Inputs in Selected Industries, 1966

77. Larkin, J.A.,
Work Study : Theory and Practice, Maidenhead : McGraw Hill Publishing Company, 1969.

78. Lenin, B.M.,
Economics of the USSR Industry, V.S., 1977

79. Lewis, S.R.,
Pakistan : Industrialisation and Trade Policies, London : Oxford University Press, 1970.

80. Lewis S.R. and Hossain, S.M.,
Relative Price Changes and Industrialisation in Pakistan, 1951-64, Karachi : Pakistan Institute of Development Economics, 1967.

81. Lewis, S.R. and Soligo, R.,
'Growth and Structural Change in Pakistan Manufacturing Industry', The Pakistan Development Review, Vol.V, No.1, Spring 1965.

82. Mandol, A.H. and Ahmed, S.,
'Factor Proportions and Factor Productivity Changes in Jute and Cotton Textile Manufacturing Industries in Bangladesh, 1962/63 to 1977-78', The Bangladesh Development Studies, Vol.XII, No.3, 1984.

83. Massel, B.F.,
'Capital Formation and Technological Change in U.S. Manufacturing', Review of Economics and Statistics, May 1960.

84. Muslim, A.Z.,
Market Report of the Cotton Textile Industry in East Pakistan, Dacca : East Pakistan Industrial Development Corporation, 1969.

85. Nayudamma, Y.,
Factors which Hinder or Help Productivity Improvement in the Asian Region, Tokyo : Asian Productivity Organisation, 1980.

86. Nelson, R.R.,

'Aggregate Production Functions and Medium Range Growth Projection', American Economic Review, September 1969.

87. Niitamo, O.,

'The Development of Productivity in Finish Industry, 1925-52', Productivity Measurement Review, November 1958.

88. Nikitin, P.,

Fundamentals of Political Economy, Moscow : Progress Publishers.

89. O' Mally, P.J.,

The Structure and Performance of Irish Industry, 1953-63', Dublin, 1967.

90. Pal, M.L.,

'The Determinants of the Domestic Prices of Imports', The Pakistan Development Review, Winter 1964.

91. Pratten, C.F.,

Economies of Scale in Manufacturing Industry, Cambridge : Cambridge University Press, 1971.

92. Reddaway, W.B. and Smith, A.D.,

'Progress in British Manufacturing Industries in the Period 1948-54' Economic Journal, March 1960.

93. Revanker, N.S.,

'Capital-Labour Substitution, Technical Change and Economic Growth: The U.S.Experience,1929-1953', Metro-Economica, May-August 1971.

94. Revenker, N.S.,.

'A Class of Variable Elasticities of Substitution Production Functions', Econometrica, Vol39, No.1, 1971.

95. Rostas, L.M.,

'Alternative Productivity Concepts in Productivity Measurement', European Productivity Agency (OEEC), Vol1, 1956.

96. Satter, WES.,

Productivity and Technical Change, Cambridge : Cambridge University Press, 1960.

97. Scitovsky, T.,

Welfare and Competition, Homewood, Irwin, 1951.

98. Sibson, R.E.,

Increasing Employee Productivity, New York : Ama com. 1976.

99. Sinha, J.N. and Sawney, P.K.,

Wages and Productivity Trends in Selected Indian Industries, Delhi : Vicas Publications, 1970.

100. Sobhan, R.,

'Nationalised Industries in Bangladesh : Background and Problems', in Robindon, E.A.G. and Keith, G. (eds): The Economic Development of Bangladesh Within a Socialist Framework, London and Basingstoke: MacMillan Press Ltd., 1974.

101. Solow, R.M.,

'Technical Change and Aggregate Production Function', Review of Economics and Statistics, August 1957.

102. Sreenivasan, K.,

Productivity and Social Environment, Bombay : Asia Publishing House, 1964.

103. Stern, B.,

'Labour Productivity in the Boot and Shoe Industry, Bureau of Labour Statistics, 1939.

104. Tinbergen, J.,

'On the Theory of Trend Movement', in Klaasen, L.H. Koyck, L.M. and Witteveen, H.J. (eds), Selected Papers, North Holland, 1959.

105. Udalov, M.,

'Improving Methods of Computation of Indicators of the Output and Labour Productivity', Vestiniki Statistiki, No.9, 1974.

106. UNIDO :

Profile of Manufacturing Establishments, New York : United Nations, 1967-71.

107. US Bureau of Labour Statistics,

'Mechanisation and Productivity of Labour in the Cigar Manufacturing Industry', Bulletin No.660, September 1938.

108. Van de Van, A.H.,

'A Framework of Organisational Assessment', The Academy of Management Review, Vol.1.

109. White, L.J.,

Industrial Concentration and Economic Power in Pakistan, Princeton: Princeton University Press, 1975.

110. White L.J.,

'Pakistan's Industrial Families: The Causes, Extent and the Consequences of Their Economic Power', Journal of Development Studies, April-July 1974.

APPENDICES

Appendix-A(1)

Conversion Method of Loom into Spindle Equivalence

Let L and B be the total number of looms and spindles of a mill respectively. Suppose Y_{54} be the total output of cloth in yards in terms of 54 picks produced by looms, while C_{32} be the total output of yarns in terms of 32's produced by the spindles.

By applying 'ratio rule of arithmatic' we get :

$$\frac{\text{No. of looms}}{\text{No.of spindles}} = \frac{\text{Output of cloth in yards}}{\text{Output of yarn in lbs.}}$$

$$= \frac{Y_{54} \text{ yards of cloth}}{C_{32} \text{ lbs of yarn}}$$

$$= \frac{Y_{54} \times 0.2 \text{ lbs of yarn}}{C_{32} \text{ lbs of yarn}}$$

$$= \frac{Y_{54} \times 0.2}{C_{32}} \qquad [\because \text{ 1 yrd of cloth} \simeq 0.2 \text{ lb of yarn})$$

By cancelling the 'unit' from both the numerator and denominator, we have got an absolute number. Now by cross-multiplication, we get,

$$L = (S \times Y_{54} \times 0.2) \div C_{32}$$

Since the absolute number is multiplied by the number of spindle(S), we get the number of looms (L) in terms of spindle equivalence.

Appendix Table-A(2)

Locations and Years of Establishment of BTMC Mills, as of 1981-82

Names of Mills	Locations	Years of Establishment
1. Ahmed Bawany Textile	Dhaka	1957
2. Amin Textile	Chittagong	1957
3. Bengal Textile	Jessore	1962
4. Bangladesh Textile	Narayanganj	1959
5. Barisal Textile	Barisal	1978
6. Chisty Textile	Comilla	1966
7. Chittaranjan Cotton	Narayanganj	1936
8. Dhaka Cotton	Dhaka	1940
9. Dost Textile	Feni	1964
10. Darwany Textile	Nilphamari	1980
11. Dinajpur Textile	Dinajpur	1979
12. Eagle Star Textile	Khulna	1972
13. Fine Cotton	Tongi	1961
14. Khulna Textile	Khulna	1932
15. Kokil Textile	Brahmanbaria	1965
16. Kohinoor Spinning	Dhaka	1978
17. Kishoregonj Textile	Kishoregonj	1977
18. Luxmi Narayan Cotton	Narayanganj	1932
19. Monno Textile	Tongi	1961
20. Meghna Textile	Tongi	1962
21. National Cotton	Chittagong	1939
22. Olympia Textile	Tongi	1954
23. Orient Textile	Dhaka	1964
24. Pahartali Textile	Chittagong	1954
25. Quaderia Textile	Tongi	1963
26. R.R. Textile	Chittagong	1965
27. Rajshahi Textile	Rajshahi	1979
28. Satrang Textile	Tongi	1965
29. Sharmin Textile	Narayanganj	1963
30. Tangail textile	Tangail	1963
31. Zeenat Textile	Tongi	1954

Source : Bangladesh Textile Mills Corporation

Appendix Table-A(3)

Installed Capacity, Output and Employment of BTMC Mills, as of 1981-82

Name of Mills	Capacity		Output		Employ -ment
	Spindles	Looms	Yarns (lacs lbs)	Looms (lacs yrds)	
1. Ahmed Bawany Textile	38,567	324	34.68	47.75	2,501
2. Amin Textilq	18,400	-	24.14	-	809
3. Bengal Textile	12,400	-	20.75	-	906
4. Bangladesh Textile	18,000	210	15.13	19.65	1,399
5. Barisal Textile	25,056	-	23.05	-	1,015
6. Chisty Textile	15,120	-	15.27	-	789
7. Chittaranjan Cotton	19,802	395	23.43	54.35	1,746
8. Dhaka Cotton	14,200	206	16.20	35.39	1,291
9. Dost Textile	12,800	-	15.14	-	592
10. Darwany textile	24,625	-	29.96	-	850
11. Dinajpur Textile	25,056	-	21.37	-	887
12. Eagle Star Textile	20,736	-	10.12	-	210
13. Fine Cotton	12,400	-	17.28	-	375
14. Khulna Textile	12,448	97	18.14	22.13	1,057
15. Kokil Textile	12,800	-	16.29	-	917
16. Kohinoor Spinning	25,056	-	30.33	-	1,043
17. Kishoreganj Textile	25,172	-	23.07	-	955
18. Luxmi Narayan Textile	15,172	310	18.00	44.73	1,518
19. Monno Textile	28,240	-	22.26	-	955
20. Meghna Textile	15,120	176	15.40	23.26	969
21. National Cotton	15,880	218	12.67	16.39	1,007
22. Olympia Textile	32,736	404	30.06	40.77	2,440
23. Orient Textile	12,400	-	15.11	-	619
24. Pahartali Textile	30,400	-	31.81	-	1,942
25. Quaderia Textile	15,200	-	18.02	-	685
26. R.R. Textile	27,024	-	40.35	-	1,177
27. Rajshahi Textile	5,056	-	19.71	-	1,032
28. Satrang Textile	12,000	-	14.64	-	571
29. Sharmin Textile	12,400	168	13.69	19.01	1,154
30. Tangail Textile	24,900	-	17.07	-	878
31. Zeenat Textile	25,200	350	22.25	44.41	1,787

Source : Bangladesh Textile Mills Corporation
Note : '-' means 'not applicable'

Appendix Table-A(4)

Installed Capacity, Output and Employment in Sample Mills, as of 1981-82

Name of Mills	Capacity		Output		Employ -ment
	Spindles	Looms	Yarns (lacs lbs)	Looms (lacks yrds)	
1. Ahmed Bawany Textile	38,567	324	34.68	47.75	2,501
2. Bengal Textile	12,400	-	20.75	-	906
3. Bangladesh Textile	18,000	210	15.13	19.65	1,399
4. Chisty Textile	15,120	-	15.27	-	789
5. Darwany Textile	24,625	-	29.96	-	850
6. Fine Cotton	12,400	-	17.28	-	375
7. Kohinoor Spinning	25,056	-	30.33	-	1,043
8. Keshoreganj Textile	34,056	-	23.07	-	955
9. Meghna Textile	15,120	176	15.40	23.26	969
10. Orient Textile	12,400	-	15.11	-	619
11. Pahartali Textile	30,400	-	31.81	-	1,942
12. R.R. Textile	27,024	-	40.35	-	1,177
13. Sharmin Textile	12,400	168	13.69	19.01	1,154
TOTAL :	2,68,568	878	302.83	109.67	14,679

Source : Bangladesh Textile Mills Corporation

Note : '-' means 'not applicable'

Appendix Table-A(5)

Categorisation of BTMC Mills Established after 1950 and their Capacity, Output and Employment, as of 1981-82

Category of Mills	No.of Mills	Capacity		Output		Employ -ment
		Spindles	Looms	Yarns (lacs lbs)	cloth (lacs yrds)	
Category A: 1951-1960	6	1,63,303	1,288	158.07	152.58	10,878
Category B: 1961-1970	13	2,12,804	344	241.27	42.27	10,587
Category C: 1971-1980	7	1,50,641	-	157.61	-	5,992
TOTAL :	26	5,26,748	1,632	556.95	194.85	27,457

Sources : BTMC Mills Established after 1950 are identified from 'Appendix Table-A(2)'

Compiled data for such Mills from 'Appendix Table-A(3)

Notes : '-' means having no composite mills, looms and cloth figures are nil.

Appendix Table-A(6)

Categorisations of Sample Mills and their Installed Capacity, Output and Employment, as of 1981-82

Category of Mills	No.of Mills	Capacity		Output		Employment
		Spindles	Looms	Yarn (lac lbs)	Cloth (lac yrds)	
Category A: 1951-1960	3	86,967	534	81.62	67.40	5,842
Category B: 1961-1970	7	1,06,864	344	137.86	42.27	5,989
Category C: 1971-1980	3	74,737	-	83.36	-	2,848
TOTAL :	13	2,68,568	878	302.83	109.67	14,679

Sources : Years of mills are identified from'Appendix Table-A(2)

Sample mills are identified and data are compiled from 'Appenddix Table-A(4)

Note : '-' means looms and cloth figures are nil as there is no composite mill in this category

Appendix Table-B(1)

Output Growth in Cotton Textile Industry in Bangladesh During 1962-1982

Period	Year	Yarn (lac lb)	Cloth (lac yrd)	Cloth into Yarn Equivalence (lac lb)	Total Output (lac lb)
(1)	(2)	(3)	(4)	(5) = (4)x0.2	(6)=(3)+(5)
Pre-liberation Period	1962-63	542.09	551.30	110.26	652.35
	1963-64	637.69	482.82	96.56	734.25
	1964-65	638.80	487.73	97.55	736.35
	1965-66	730.01	400.21	80.04	810.05
	1966-67	743.45	550.16	110.03	853.48
	1967-68	774.71	520.26	104.05	878.76
	1968-69	956.88	608.52	121.71	1078.59
	1969-70	1056.61	591.49	118.30	1174.91
	1970-71	817.00	527.00	105.40	922.40
	1971-72	456.00	234.00	46.80	502.80
	1972-73	808.00	548.00	116.80	924.80
Post-liberation Period	1973-74	913.00	793.00	158.60	1071.60
	1974-75	913.02	846.26	169.25	1082.27
	1975-76	880.73	744.75	148.95	1029.68
	1976-77	824.22	681.24	136.25	960.47
	1977-78	897.66	825.52	165.10	1062.76
	1978-79	965.79	850.12	170.02	1135.81
	1979-80	952.82	885.81	177.16	1129.98
	1980-81	1019.51	859.72	171.94	1191.45
	1981-82	952.89	724.97	144.99	1097.88

Sources : [16,19,20,28,29]

Notes : Columns (3) and (4) from above sources
Columns (5) and (6) own calculation

Appendix Table-B(2)

Growth of Capital Input in Cotton Textile Industry of Bangladesh, 1962 - 1982

Period	Year	Spindles ('000)	Looms ('000)	Conversion of Looms into spindle equiva -lence ('000)	Total Capital Input('000)
	(1)	(2)	(3)	(4)	(5)=(2)+(4)
Pre-liberation Period	1962-63	399	4	81	480
	1963-64	459	4	69	528
	1964-65	564	5	86	650
	1965-66	573	3	63	636
	1966-67	555	4	82	637
	1967-68	563	4	76	639
	1968-69	646	4	82	728
	1969-70	660	3	74	734
	1970-71	643	4	83	726
	1971-72	530	3	54	584
	1972-73	633	4	91	724
Post-liberation Period	1973-74	675	5	117	792
	1974-75	679	5	126	805
	1975-76	673	5	114	787
	1976-77	765	4	126	891
	1977-78	803	5	148	951
	1978-79	750	5	132	882
	1979-80	750	5	139	889
	1980-81	863	5	145	1008
	1981-82	761	5	116	877

Sources : Cols.(2) & (3) [16,19,20,28,29]

Cols.(4) & (5) - 'Own calculations'.

Appendix Table-B(3)

Employee Indices in Cotton Textile Industry of Bangladesh, 1962 - 1982

Period	Year	Employee		
		Labour (.82)*	Non-production Worker (.18)*	All employee (1.00)*
		(1)	(2)	(3)
Pre-liberation Period	1962-63	100.00	100.00	100.00
	1963-64	120.70	113.62	119.43
	1964-65	89.28	79.83	87.58
	1965-66	84.28	77.54	83.07
	1966-67	114.96	155.48	122.25
	1967-68	124.52	164.08	131.64
	1968-69	134.30	178.53	142.61
	1969-70	97.04	58.31	90.07
	1970-71	110.73	42.56	98.46
	1971-72	112.86	49.97	101.54
	1972-73	103.74	48.96	93.88
Post-liberation Period	1973-74	242.89	144.22	225.13
	1974-75	247.45	122.95	225.04
	1975-76	250.85	263.52	253.13
	1976-77	236.19	337.91	184.50
	1977-78	275.59	184.70	259.23
	1978-79	329.82	210.60	308.36
	1979-80	380.55	133.22	336.03
	1980-81	346.91	221.52	324.34
	1981-82	273.49	342.93	285.99

Sources : Computed from the data provided by 'Bangladesh Bureau of Statistics'

Note : * Respective weights associated with inputs.

Appendix Table-B(4)

Output, Capital Input and Power & Fuel Input Indices in the Cotton Textile Industry of Bangladesh, 1962-82

(Base: 1962-63=100)

Period	Year	Output	Capital Input	Power & Fuel Input
		(1)	(2)	(3)
Pre-liberation Period	1962-63	100.00	100.00	100.00
	1963-64	112.55	110.00	213.83
	1964-65	112.88	135.42	159.64
	1965-66	124.17	132.50	198.53
	1966-67	130.83	132.71	211.52
	1967-68	134.71	133.12	265.79
	1968-69	165.34	151.67	279.61
	1969-70	180.10	152.92	274.83
	1970-71	141.38	151.25	215.74
	1971-72	77.07	121.67	258.95
	1972-73	141.76	150.83	427.40
Post-liberation Period	1973-74	164.27	165.00	490.62
	1974-75	165.90	167.71	468.90
	1975-76	157.84	163.96	518.35
	1976-77	147.23	185.12	499.23
	1977-78	162.91	198.12	681.63
	1978-79	174.11	183.75	595.52
	1979-80	173.22	185.21	602.56
	1980-81	182.64	210.00	660.57
	1981-82	168.30	182.71	632.58

Sources : Col.(1) - Calculated from Col.(6) of Appendix Table-B(1)
Col.(2) - Calculated from col.(5) of Appendix Table-B(2)
Col.(3) - Computed from the data given in [14,15,16,17,18]

Appendix Table-B(5)

Productivities of Labour, Non-Production Workers and All Employees in Cotton Textile Industry of Bangladesh, 1962 - 1982

(Base: 1962-1963=100)

Period	Year	Labour	Non-production Worker	All Employee
Pre-liberation Period	1962-63	100.00	100.00	100.00
	1963-64	93.25	99.06	94.24
	1964-65	126.43	141.40	128.89
	1965-66	147.33	160.14	149.48
	1966-67	113.80	84.15	107.02
	1967-68	108.18	82.10	102.33
	1968-69	123.11	92.61	115.94
	1969-70	185.59	308.87	199.95
	1970-71	127.68	332.19	143.59
	1971-72	88.29	154.23	75.90
	1972-73	136.65	289.54	151.00
Post-liberation Period	1973-74	67.63	113.90	72.97
	1974-75	67.04	134.93	73.72
	1975-76	62.92	59.90	62.35
	1976-77	62.33	43.57	51.75
	1977-78	59.11	88.20	62.84
	1978-79	52.79	82.67	56.46
	1979-80	45.52	130.02	51.55
	1980-81	52.65	84.44	56.31
	1981-82	61.54	49.07	58.85

Source : Computed from data presented in Appendix Table-B(3) and Appendix Table-B(4)

Appendix Table-B(6)

Industrial Disputes and Loss of Man-days in Bangladesh Cotton Textile Industry During Pre- & Post-Liberation Periods under Study

Period	Year	No.of Disputes	No.of Workers Involved	No.of Man-days Lost
Pre-liberation Period	1962-63	15	15,873	527,393
	1963-64	20	18,171	355,532
	1964-65	11	3,989	94,771
	1965-66	6	4,551	16,536
	1966-67	6	3,824	23,245
	1967-68	5	15,567	26,108
	1968-69	12	10,760	430,717
Post-liberation Period	1975-76	5	14,517	25,618
	1976-77	22	76,675	81,715
	1977-78	89	113,209	6,62,332
	1978-79	96	114,248	6,47,629
	1979-80	104	164,032	11,60,436
	1980-81	80	117,031	11,98,460
	1981-82	85	21,788	2,38,658

Source : Government of Bangladesh, Directorate of Labour

Note : Data for the Years 1969-70 to 1974-75 are not available.

Appendix Table-B(7)

Duration of Dispute, Dispute Coverage Ratio, Time Loss Ratio and Composite Measure for Industrial Dispute Stopping Work in Cotton Textile Industry of Bangladesh

Period	Year	Duration of Dispute	Dispute Coverage Ratio	Time Loss Ratio	Composite Conflict Measure
Pre-liberation Period	1962-63	33.23	1058.20	35159.53	40355.75
	1963-64	19.57	908.55	17776.60	22513.98
	1964-65	23.76	362,64	8615.56	10862.87
	1965-66	3.63	758.50	2756.00	4034.81
	1966-67	6.08	637.33	3874.17	5295.73
	1967-68	1.68	3113.40	5221.60	9112.46
	1968-69	40.03	896.67	35893.08	44633.87
Post-liberation Period	1975-76	1.76	2903.40	512.36	3182.50
	1976-77	1.07	3485.23	3714.32	7599.88
	1977-78	5.85	1272.01	7441.93	10206.60
	1978-79	5.84	1190.08	6954.47	9539.78
	1979-80	7.07	1577.23	11158.04	15010.53
	1980-81	10.24	1462.89	14980.75	19577.99
	1981-82	10.86	256.33	2784.21	3637.29

Source : Computed from Appendix Table-B(6)

Note : Data for the Years 1969-70 to 1974-75 are not available.

Appendix Table-C(1)

Actual Hours Worked by the Labour, Output and Labour Productivity of Different Categories of Sample Mills, 1981

Category of Mills	Actual Hours worked by the Labour (Manhours)	Output (lac lbs)	Labour Productivity (lbs/hrs)
	(1)	(2)	(3)
Category A	88,68,225	95.10	1.07
Category B	92,49,998	146.31	1.58
Category C	46,13,782	83.36	1.81
TOTAL :	2,27,32,005	324.77	1.43

Sources : Col.(1) - Calculated from the data provided by the 'Office of the Sample Mills'.

Col.(2) - Calculated from Col.(3) & Col.(4) of Appendix Table-A(6).

Appendix Table-C(2)

Employment Structure of three Categories of Sample Firms, 1981-82

Category of Mills	Labour	Non-production Worker	All employees	Col.(1) as a ratio of Col.(2)	Col.(3) as a ratio of Col.(3)
	(1)	(2)	(3)=(1)+(2)	(4)=(1)÷(2)	(5)=(1)÷(3)
Category A	4,462	1,380	5,842	3.23	0.76
Category B	4,843	1,146	5,989	4.22	0.81
Category C	2,385	463	2,848	5.15	0.84
TOTAL :	11,690	2,989	14,679	3.91	0.80

Source : Cols(1), (2) and (3) - 'Office of the Sample Mills'.
Cols.(4) and (5) - Own calculation

Appendix Table-C(3)

Man-capital Equipment Ratio in the three Categories of Sample Firms, 1981-82

Category of Mills	Employment	Capital Equipment	Man-Capital Ratio
Category A	5,842	1,01,330	0.058
Category B	5,989	1,13,417	0.053
Category C	2,848	74,737	0.038
Total Sample :	14,679	2,89,484	0.051

Source : Cols. (1) & (2) - from Appendix Table-A(6)

Note : Capital Equipment is calculated from Cols.(2) & (3) of the above source by using the method provided in Chapter III.

Appendix Table-C(4)

Power and Fuel Productivity of the three Categories of the Sample Enterprises

Category of Mills	Output (lac lbs)	Power and Fuel (lac kwh)	Power and Fuel Productivity
Category A	95.10	176.84	0.54
Category B	146.31	115.59	1.26
Category C	83.36	88.41	0.94
Total Sample :	324.77	380.84	0.85

Sources : Col.(1) - from Appendix Table-C(1)
Col.(2) - Office of the Sample Enterprises
Col.(3) - Own calculations.

Note : Fuel is converted into 'electricity power unit' by using the method provided in Chapter III.

Appendix Table-C(5)

Capital Productivity and Capital Intensity of the three Categories of Sample Firms, 1981-82

Category of Mills	Capital Productivity	Capital Intensity
	(1)	(2)
Category A	93.85	0.011
Category B	129.00	0.012
Category C	111.54	0.016
Total Sample :	112.19	0.013

Source : Calculated from Appendix Table-C(1) and Appendix Table-C(3)

Appendix Table-C(6)

Reasons for and Extent of Manhours Loss of the three Categories of Sample Firms, 1981-82

Reasons	Manhours Lost (in lac hrs)			Total
	Enterprise A	Enterprise B	Enterprise C	
	(1)	(2)	(3)	(4)
1. Shortage of Spare Parts	4.50	3.27	1.79	9.56
2. Machinery defects/maintenance	3.53	1.96	0.61	6.10
3. Power failure	1.17	1.43	0.60	3.20
4. Electrical defect	1.12	1.14	0.70	2.96
5. Shortage of raw cotton	8.87	9.17	5.02	23.06
6. Shortage of back process	1.68	1.76	1.50	4.94
7. Count change	0.52	0.78	0.28	1.58
8. Absenteeism	5.05	5.14	2.71	12.87
9. Strike/gate Meeting /lockout	0.07	0.09	0.02	0.18
10. Religious affairs	1.60	1.08	1.03	3.71
TOTAL :	28.08	25.82	14.26	68.16

Source : Compiled from data provided by the Office of the Sample Mills

Appendix Table-C(7)

Wastage Rate and Capacity Utilisation of the three Categories of Sample Firms, 1981-82

Category of Mills	Wastage Rate (%)	Capacity Utilisation(%)
	(1)	(2)
Category A	15.13	66.06
Category B	16.43	68.12
Category C	9.37	78.86
Total Sample :	14.50	70.12

Source : Compiled from data provided by the Sample Firms.

Note : Total sample value provides weighted average.