Chapter - 3

Review of Literature and Approach to the Study

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3.1 Introduction:

Bangladesh came into being as an independent sovereign state on December 16, 1971. Soon after liberation the Government of Bangladesh nationalized the key industries e.g. Jute, Textile, Sugar, Insurance and Banking. The unexpected change of the government in August 15, 1975, the government declared the Revised Investment Policy in December 1975 and encourages further private investment through increasing some incentives including remittance. During the study period, i.e., from 1990-91 to 1999-2000 private sector Textile units have been found to the generating more investment fund than public sector textile units. During the year 1990-91 and 1999-2000 investments for private sector were 64.42 per cent and 97.48 per cent respectively. On the other hand, for the public sector the investment accounted for 35.58 per cent for the year 1990-91 and 2.52 per cent for 1999-2000. It reveals that the private sector investment is increasing and public sector investment is decreasing. The earlier studies on the subject matter state that productivity is likely to lead to increased profitability of the enterprise. If the private and public sector textile industry cannot increase productivity, they will be treated as a losing concern. In this regard, the study has examined whether there is any significant difference between public and private sector textile industry and if so, to what extent and to which regard.

The study also has made a comprehensive review of literature for finding out the research gap. In the course of review of literature, 35 research works and articles were found on textile units and productivity. Among them, a few were Ph.D. and M. Phil works. Vast majorities of them were articles written by
academicians and researchers on different aspects of textile units - a few were on the productivity of the textile units. No work has been found on the aspect of “Productivity performance: A comparative study of public and private sector Textile units in Bangladesh”. All this indicates a clear research gap, which the present study has identified.

3.2 Statement of the Problem:

Before Liberation some simple process industries like jute, textiles and sugar mills, two pulp and paper mills, a small urea fertilizer plant, a cement factory, a mini steel making plant with imbalances downstream rolling facilities for making plant mild steel bars, sheets and plates, a few pharmaceutical units with capacities for formulation, bottling and packaging and several minor dockyards and light engineering workshops comprised the industrial base of the country.¹ The liberation war had disrupted influence on the working of the economy and administration. The government of Bangladesh nationalized the key industries e.g. Jute, textile, sugar, insurance and banking after liberation. Moreover, it also took over abandoned units, which created a vast public enterprise sector in the country. The First Five Year Plan (1973-87) of the country adopted an inputs substitution strategy for industrialization with emphasis on domestic production of basic needs and investment goods. An investment ceiling was allowed within Tk. 2.5 million to Tk. 3.5 million for the new private industrial investment. All new foreign investment was permitted only in collaboration with government whose share in the equity would be at least 51 per cent.

The First Industrial Investment Policy (Announced in January 1973) assigned a major role to the public sector and hence restricted the role of the private sector in the industrial development of the country.² After only 18 months the new government policy showed a paradigm shift in favour of the private
sector through declaration of the New Industrial Policy of July 1974. In this policy, investment ceiling was raised from Tk 2.5 million to Tk. 3.5 million, tax holidays for less developed areas were extended from 5 to 7 years and foreign investors were allowed in collaboration with the government and local private entrepreneurs except in some selected industries. However, with the unexpected change of the government in August 15, 1975, the revised Investment Policy was announced in December 1975 which encouraged private investment through increasing some incentives including remittance.

Table 3.2.1

Total Investment in Manufacturing Sector

(In million Taka)

<table>
<thead>
<tr>
<th>Sector</th>
<th>90-91</th>
<th>91-92</th>
<th>92-93</th>
<th>93-94</th>
<th>94-95</th>
<th>95-96</th>
<th>96-97</th>
<th>97-98</th>
<th>98-99</th>
<th>99-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total investment</td>
<td>23415</td>
<td>22699</td>
<td>24319</td>
<td>25825</td>
<td>35199</td>
<td>34919</td>
<td>34513</td>
<td>35162</td>
<td>35439</td>
<td>36121</td>
</tr>
<tr>
<td>Public Sector investment</td>
<td>8331</td>
<td>3338</td>
<td>1240</td>
<td>2273</td>
<td>2227</td>
<td>1718</td>
<td>1082</td>
<td>1023</td>
<td>982</td>
<td>912</td>
</tr>
<tr>
<td>Private sector investment</td>
<td>15084</td>
<td>19361</td>
<td>23079</td>
<td>23552</td>
<td>32972</td>
<td>33201</td>
<td>33431</td>
<td>34139</td>
<td>34457</td>
<td>35209</td>
</tr>
<tr>
<td>Percentage share: Public Sector</td>
<td>35.58</td>
<td>14.71</td>
<td>5.10</td>
<td>8.80</td>
<td>6.33</td>
<td>4.92</td>
<td>3.14</td>
<td>3.2</td>
<td>2.77</td>
<td>2.52</td>
</tr>
<tr>
<td>Percentage Share: Private Sector</td>
<td>64.42</td>
<td>85.29</td>
<td>94.90</td>
<td>91.20</td>
<td>93.67</td>
<td>95.08</td>
<td>96.86</td>
<td>97.1</td>
<td>97.23</td>
<td>47.48</td>
</tr>
</tbody>
</table>

Source: Fifth Five Year Plan, Government of Bangladesh, Dhaka, 1997

* Projected

During the period 1978 a Two Year Plan (1978-80), Second Five Year Plan (1980-85), Third Five Year Plan (1985-90), Fourth Five Year Plan (1990-95), a Two Year Plan (1995-97) and Fifth Five Year Plan (1997-2002) were launched and implemented which in different degree encouraged private sector development. As a consequence, total investment in private sector
registered an accelerating growth. Whereas on the other hand, the public sector textile units, total investment declined marginally in the manufacturing sector for the period 1990-91 to 1999-2000. The statistics in this regard are presented in table-3.1.

From the above table it is clear that private sector textile units are generating more investment fund than public sector. The reason behind this can mainly be attributed to poor profit performance of public sector enterprises leading to external pressure for increased role of private sector. In this regard, it is asserted that declining productivity of public sector enterprises has significantly contributed towards poor profit performance, among other factors. As a result of this, the private investment was encouraged towards textile industry. Against this backdrop the present study is centered in comparative study of Private sector textile units productivity performance with the public sector textile industry.

The public sector textile units operate under the BTMC. But BTMC incurred net loss amounting to Tk. 55.38 crore in 1991-92 and this loss increased to Tk 134.33 crore in the year 1995-96, Tk. 49.24 crore in 1999-2000. As earlier stated productivity is likely to lead to increased profitability of the enterprise. If the BTMC can not increase productivity, they will be treated as losing concern. In this regard productivity performance of private sector textile industry will also be examined to see whether there is any significant difference between public and private sector industry and if so to what extent and to which regard.

3.3 Review of Literature:

So far importance of productivity measurement especially in the context of public and private sector textile industry in Bangladesh has been examined on
theoretical perspective. Now an attempt is made in the following paragraphs to find out research gap as regards productivity measurement of public and private sector textile units in Bangladesh from the review of existing literature on productivity measurement and works done on textile units.

In the first instance, the study came across a research work, which was conducted, by Sobhan, Rehman and Mahmood, Syed Akhter under the caption "The Economic Performance of Denationalized Industries in Bangladesh the case of the Jute and Cotton Textile Industries". The Authors examined first the status of those enterprises at the time of denationalization then went through financial performance of the enterprise subject to denationalization from the period 1980-81 to 1984-85. The authors concluded that there are no evidence that denationalization has ushered in a golden age for Jute & Cotton Textile Industries.

Abedin, M.M. Morshedul conducted a research on "Cost behaviour and profitability of the Rajshahi Cotton Textile Mills". The author found out that the profitability of Rajshahi Cotton Mills was affected by increasing cost of sales not representing the sales price, which is controlled by the corporation. As BTMC does not follow cost plus price, such a situation can not be avoided and that there is scope for cost control and cost reduction.

Arif, Anwarul Azim conducted a research on "Industry Management of some Selected Textile Mills in Chittagong". The author examined different aspects of management and especially material management. Items handled in stores, inventory movement, store control and inventory costs were examined and found flaws in these aspects.

Khan Mokbul Ahmed, examined the aspects of application of optimum methods in industrial planning to address the scenario of low level
productivity in the context of cotton textile enterprises in Bangladesh. In an article under the caption "Specialization and concentration in the cotton textile enterprises of Bangladesh: A Mathematical approach". The author examined theoretically the suitability of its application, gave a framework for its application and advocated its implementation in the context of textile enterprises of Bangladesh and hoped that it would ensure proper production planning leading to improved productivity and better performance. 

Islam, A.F.M. Mofizul wrote a number of articles on "Productivity covering different manufacturing enterprises in Bangladesh". In one of such articles titled "A Comparative Analysis of Productivity in Some Selected Handloom and Small Power Loom Industries of Bangladesh", the author evaluated productivity of such enterprises under three broad heads viz. loom yearn productivity, labour productivity and capital intensity. The author admitted the shortcomings of the findings due to coverage of small size of samples however observed that the finding of the study would provide some information, which may be helpful to the policy makers. The study found that loom yearn productivity in a semi-automatic loom is higher than handloom called pit-loom and that overall productivity of power loom is much higher than semi-automatic handloom. Considering different aspects, the author concluded that product diversification in handloom and power loom may be aimed at without creating serious disturbance of the economic and social fabric of the country along with solving different problems that were being faced by such enterprises.

Mahmud, Manjur Morshed wrote an article titled "Integrated Accounting System in the Textile Mills in Bangladesh". The author pointed out the advantages of the system, rationale for adopting the system of BTMC and examined the technique that was being in operation. The author critically
examined the utility and pointed out that cost control aspect has been adversely affected by the system which warrant attention.\textsuperscript{10}

In an article titled "Financial Analysis of Jute and Cotton Textile Industries in Bangladesh". Loqman, Muhammad evaluated the financial position of the Jute and textile enterprises under BJMC and BTMC for the period 1975-76 to 1979-80 with reference to liquidity, activity, profitability and solvency. The author in conclusion observed that financial position of the enterprises was unsatisfactory, affecting productivity and profitability quite adversely. However, no effort was found to have been made in this article as to judge productivity of the samples and the reference to productivity to be general observation.\textsuperscript{11}

Hoque, Md. Jahirul and Hossain A.T.M. wrote an article titled "Some Aspects of Material Management in the Public Sector Cotton Mills in Bangladesh", where organization, principles, proceedings of material purchase and planning were evaluated. The author also examined material control techniques. It was observed that organization for material management, planning and control were ineffective, which adversely affected profitability and operation of the enterprise.\textsuperscript{12}

Shaha, A.C. wrote an article titled "Capacity Utilization in the Cotton, Textile Mills of Bangladesh", and the author pointed out the importance of Textile Mills in the economy of Bangladesh. He traced out the factors affecting capacity utilization and identified them with the capacity utilization of the sample mills for the period 1982-83 to 1986-87. The article pointed out low capacity utilization to be a problem to the enterprise and that problem in procurement of raw materials, increased cost of imported materials defective pricing policy, unfair competition and some lack of infrastructure facilities had a bearing for a low capacity utilization of Textile Mills in Bangladesh.\textsuperscript{13}
Muniruzzaman, M. prepared an article titled "Inventory Management in Textile Mills in Bangladesh". The Author evaluated inventory Management, Practices of these spinning mills situated at Tangi, Dhaka. Alike other research works on this topic, the author found inventory management inefficient and such flows caused blockage of fund leading to increased cost and adverse affect on profit performance. The author suggested for steps leading to overcome the shortcomings and proposed for coordinating of efforts of relevant functional areas.\textsuperscript{14}

Shaha, A.C. evaluated financial management techniques used in Rajshahi Textile Mills and prepared an article under the caption, "Application of Financial Management Techniques in the Rajshahi Textile Mills: A case study". The author found that various types of budget are prepared by the mill like cash budget, inventory budget, production and sales budget and that capital budget is prepared by the corporation (BTMC).The author concluded that sophisticated financial management techniques are getting to be employed at plant level. The author advocated the case of modern financial management techniques, which may be of great help to the enterprise in particular, and the economy of Bangladesh in general.\textsuperscript{15}

Hossain, A.T.M. Tofazzel wrote an article titled, "Evaluation of Inventory Management in Cotton Textile Mills of Bangladesh". It was pointed out in the article that the flows in Inventory Management significantly adversely affected profitability position and that proper planning and remedial action need to taken urgently.\textsuperscript{16}

Loqman, Md. in an article captioned "Fanatical Analysis of the Accounting Data: A Study of Jute & Cotton industries in Bangladesh" found inefficient and inadequate use of accounting data for decision making and pointed out
that the financial position is unsatisfactory affecting profitability of the enterprises. He advocated proper and adequate use of information relevant to decision making, which may lead to favourable impact on the performance of the enterprises.\textsuperscript{17}

Islam (1990) identified some problems in his article, relating to marketing of textile products in the Bangladesh and offered some suggestions to solve it. The author emphatically expressed the opinion that if the problems were solved, the mills under BTMC would be able to market their products effectively and in turn be able to contribute to the welfare of the people of Bangladesh. The study is limited to only marketing of textile products among various functional areas of textile mills under BTMC.\textsuperscript{18}

Hossain and Chowdhury (1991) identified that there is deficiency of cash and with the size and percentages of cash to current assets are abnormally low in all the selected mills of BTMC except one. They identified the reason for the unhappy situation and these are: non implementation of the techniques to regularize cash flows, absence of adequate policy in determining the optimum cash balance and non-introduction of the techniques to maximize the availability of cash. They have suggested to prepare an effective cash planning and control and apply the different procedural techniques for obtaining the required volume of cash, reducing the volume of inventories and receivables (according to the prescribed norms of the BTMC) etc. In concluding remark, the author expected to have a broad based internal system for an effective control over cash but did not cover other important problem areas of financial management of BTMC mills.\textsuperscript{19}

Hossain (1985) found that, most of the selected mills of BTMC could not fulfill their financial obligations and operating at losses. He observed that, the percentage of the cash to working capital is very low, investment in
inventories is high and that negative profitability adversely affecting the liquidity position of the selected units. The author suggested some remedial measures to overcome the adverse situation. The other has discussed only the problems in management of working capital but did not touch upon the other important problem areas of textile industries in Bangladesh.20

Habibullah, M., conducted a research under the caption, "Some Aspects of Productivity in the Jute Industry of Pakistan". The author computed various types of productivity and identified the factors that affected productivity.21

Abdullah, Abu wrote an article on, "Some Practical Problems on Productivity in the Textile Industries of Bangladesh." The author examined the different types of problems of productivity in the textile industry of Bangladesh.22

Chowdhury, N, wrote an article in the textile sector. He examined comparative position of the large and small scale cotton wearing industry and published the article under the caption of "Comparative productivity efficiency of large scale and small scale cotton weaving industry in Bangladesh."23

Islam, Mafizul conducted Ph.D Research work under the title "Labour Productivity in the Manufacturing Industries: The Case of Cotton Textile Industry in Bangladesh". The researcher evaluated the productivity status of the cotton industry in Bangladesh.24

An unpublished Ph.D thesis titled "Management of Working Capital in Cotton Textile Industry of Bangladesh" was done by Hossain, A.T.M. Tofazzel. The research analyzed working capital management of 20 cotton mills under BTMC for the period 1972-80 to 1983-84. It was observed that aspects of inventory receivables and cash have a number of flows leading to stock
pilling, increased cost of carrying inventory, problems of liquidity which is significant and attributed to poor working capital management in the textile industry of Bangladesh.\textsuperscript{25}

From the above review of literature the study has attempted to find out the research gap in the following paragraphs:-

3.4 Research Gap:

So far importance of productivity measurement especially in the context of public and private sector textile industries in Bangladesh and comparison of productivity performance with the public and private sector textile units in Bangladesh has been examined in theoretical perspective. Now an attempt is made to find out research gap as to productivity performance: A comparative study of public and private sector textile units in Bangladesh from the review of exiting literature on productivity measurement and works done on textile units. The review clearly points out that no significant study has been undertaken on "Productivity performance: A comparative study of public and private sector textile units in Bangladesh. The article of Mondal and Ahmed was an important attempt to measure and analyze the changes in the trends of productivity of capital and labor in two selected industries of Bangladesh namely Jute and Cotton Textile during the period 1962-63 to 1977-78.\textsuperscript{26}

Some general articles on theoretical aspects of productivity were written by D. Bhattacharjee.\textsuperscript{27} He wrote another article titled, "Measurement of Productivity and Productivity Aspects of a Firm." He also wrote an another article titled, "The Rational of Productivity Measurements and Ways of Identifying Reserve of Industrial Productivity in Bangladesh.\textsuperscript{28} Another article of Bhattacharjee titled, "A Few Dimensions of Labour Productivity: An Overview of Concepts and Measurers" dealt extensively with the various
methods of measuring labour productivity. In a similar article, Bhattacharjee dealt with "Labour Productivity: Trends and their Effects on Output in Bangladesh.


Another study on “Productivity Through people in the Age of charging Technical Textile Industrial Experience on Bangladesh”, by Rahman, Habibur mainly examined the impact on technological change and innovative idea on Productivity enhancement in the sample mills.

Thus it is clearly evident that productivity performance of textile units till today has got little attention of the researches. In the course of review of literature, about 35 research works and articles were found on textile units. Among them a few were Ph.D and M. Phil works. Vast majorities of them were articles written by academicians and researchers on different aspects of textile units while a few were on the productivity of the textile units. All this indicates a clear research gap, which the study briefly elaborates below:
1) There is no research about the comparative study of textile industries of public and private units
2) The time span of a decade from 1990-91 -- 1999-2000 is yet another uncovered area.

The present study therefore has undertaken to deal with the aspect of “Productivity Performance: A Comparative Study of Public and Private Sector Textile Units in Bangladesh” during 1990-2000.

3.5. Scope of the Study:

3.5.1 Sample Size and the Study Period:

The study has covered overall and samples textile mills productivity performance of public and private sector textile units of Bangladesh. Five textile mills from each sector were selected for the purpose of productivity performance measurement. The mills were selected only from spinning and weaving sub-sector because public sector textile mills work under only spinning and weaving sub-sector. Thus the main objective of the study to make comparative analysis of public and private sector textile units has become logical and pragmatic. The sample was selected randomly keeping in mind the different areas of Bangladesh. The study has been conducted covering the period of ten years i.e., from 1990-91 to 1999-2000.

3.5.2 Brief Description of the Samples:

The study has covered Five Public Sector Textile Mills, and Five Private Sector Textile Mills. The sample has been taken randomly. Brief description of sample mills are given as follows.
3.5.2A Public Sector Textile Mills.

a) Sundarban Textile Mills (STM):

Sundarban Textile Mills is situated in the district of Satkhira of Bangladesh. The installed capacity of the mills is 24,960 spindles and 260 looms. The establishment of the mills was in 1980 and started commercial production from 1983. The mills are operating under the supervision of Bangladesh Textile Mills Corporation (BTMC).

b) Drawani Textile Mills (DTM):

Drawani Textile mill is situated in the district of Nilphamari of Bangladesh. The installed capacity of the mills is 25,056 spindles. The mills was established in the year 1977 and started commercial production from 1980. The mill is operating under the supervision of BTMC.

c) Rajshahi Textile Mill (RTM):

Rajshahi textile mill is situated in the district of Rajshahi of Bangladesh. The installed capacity of the mills is 25,056 spindles. It was established in the year 1975 and started commercial production from 1979. The mill was established under the direct supervision of BTMC.

d) Quaderia Textile Mill (QTM):

Quaderia textile mill is situated in the district of Gazipur, Bangladesh. The installed capacity of the mills is 19800 spindles. It was established in the year 1970 and started commercial operation from 1973. The mill was incorporated
under the public sector from 1972 and is presently under the supervision of BTMC.

e) Orient Textile Mill (OTM):

Orient textile mill is situated in the district of Dhaka, Bangladesh. The installed capacity of the mills is 12,400 spindles. It was established in the year 1964, which started commercial production from 1965. The mills was incorporated under the public sector from 1972 under presidential order ‘No’ BTMC.

3.5.2 B Private Sector Textile Units:

a) Dulamia Cotton Spinning Mills Ltd. (DCSM):

The company was incorporated in February, 1987 and started commercial production in mill No-1 with 14400 spindles from January 1990 and mill No-2 from April 1993. Principal activities of the mill are to import raw cotton and manufacture different count of yarn through the cotton spinning mills. It has been enlisted with DSE for public trading of its shares. The mill is situated in the district of Feni.

b) Eagle Star Textile Mills Ltd (ESTM):

The mill is situated in the district of Chittagong. The company was incorporated in April 1970 as a public limited company and started commercial production in 1972. It was nationalized by the then Government in 1972 and was returned to its original owner in 1985 under privatization policy. As a public limited company, it was listed with Dhaka Stock
Exchange (DSE) for trading its shares. It manufactures and markets cotton yarn, gray fabrics and terry towel.

c) Tallu Spinning Mills Ltd (TSM):

The mill was incorporated as a public Ltd company on July 20, 1985 and went into commercial production in July 1989. The mill is situated in the district of Chuadanga. The principal activities of the company are to import raw cotton and manufacture different count of yarns through the cotton spinning mills.

d) Ashraf Textile Mills Ltd. (ATM):

The company is engaged in the manufacture and sale of the cotton, polyester, viscose and yarns. It was situated in the district of Gazipur, at Tongi thana. The mill is enlisted with DSE from 1983.

e) Tamijuddin Textile Mills Ltd. (TTM):

The mill is situated in the district of Narayangonj and it is enlisted with DSE from 1992. The company operates as a textile spinning mills producing and selling cotton and polyester yarn in the local market.

3.6 Objectives of the Study:

The main objectives of this study are to measure and to compare productivity performance of the public sector textile industry working under BTMC with private sector textile industry in Bangladesh and to determine the impact of
productivity on performance of textile units along with the identification of the factors affecting productivity.

The study has been carried out with the following broad objectives:

a) To study the socio-economic background leading to the growth and development of public sector textile mills and policy reversal leading to the growth and development of private sector textile industry in Bangladesh.

b) To measure and to analyze the productivity performance of the public and private sector textile industry for the period from 1990-91 to 1999-2000.

c) To identify and to evaluate productivity performance of sample public and private sector textile units of Bangladesh.

d) To identify the factors affecting productivity of textile units of both public as well as private sector textile units.

e) To make a comparative study of the productivity performance of public and private sector textile units of Bangladesh.

f) To suggest and to recommend measures to increase productivity in the public as well as private sector textile industries in Bangladesh in the light of the productivity performance during the period 1990-2000.

3.7. Hypotheses Formulated For Testing:

The Researcher has formulated the following hypotheses:

Hypothesis 1

There is variation in industry average between public and private sector textile units in respect of fixed assets productivity in terms of sales, returns on capital employed and inventory turnover during the study period.
Hypothesis 2

There is variation between selected public and private sector textile units in respect of assets productivity during the study period.

Hypothesis 3

There is variation between selected public and private sector textile units as regards value added productivity during the study period.

Hypothesis 4

There is positive correlation of total productivity with labour productivity in terms of number of employees, fixed assets productivity in terms of value of production, value added productivity in terms of value of production in the case of public and private sector textile units of Bangladesh during the period under reference.

Hypothesis 5

There is variation in return on capital employed among the selected textile units in the case of public and private sector textile units during the period under reference.

3.8 Research Methodology:

Research Methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In such a context, the research methodology that has been used in the present study is to analyze the productivity performance in the main
functional areas like production, sales, cost, capacity utilization etc, with different productivity measurement tools and techniques.

3.8.1 Research Design:

The research design is the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data. In the present study the following research design has been adopted.

3.8.2 Selection of Sample:

The study is based on micro approach to the comparative study of productivity performance in the public and private sector textile units. These are different types of textile sub-sectors in textile units of Bangladesh such as:

i) Spinning
ii) Weaving
   a) Power Loom and Specialized Textiles.
   b) Handlooms
iii) Dyeing Printing and Finishing.
iv) Composite Textile Mills.
v) Knitting and Hosiery Units.
vi) Sericulture and Silk Industry.
vii) The Readymade Garment’s (RMG).

The study has, at the first stance, covered overall productivity performance of public and private sector textile units. For the comparative purpose, the study has selected only spinning and power loom and specialized textile (Weaving sub-sector) mills. Because public sector textile mills operate under spinning
and power and specialized (Weaving) sub-sector. Further in order to make the study logical and result oriented randomly five mills from public sector and five mills from private sector textile units have been selected.

3.8.3 Collection of Data:

The study’s main reliance was placed on secondary data. Published materials from various sources were collected and evaluated in the light of the objectives of the study. Relevant literature, research work and other available secondary data were studied intensively to grasp the concept of productivity, measurement process and other relevant aspects. This helped the development of relevant research design and construct theoretical framework of productivity measurement. In this context, the Researcher visited different libraries of India and Bangladesh also.

Secondary data were relevant to the variables of productivity measurement and operational aspects of the enterprises. They were output, materials, number of employees, wages and salaries, factory overhead, cost of production, total cost, sales, profit, capital, capacity utilization, Assets etc. These were collected from the Annual Reports of Sample Mills, Annual reports of BTMC, Annual Reports of BTMA, Textile Policy, Five Year Plan, Second Year plan and relevant materials published by Ministry of Textile of Bangladesh.

3.8.4 Data Compilation and Tabulation:

Data relevant to the measurement of productivity were collected from secondary sources. After completion of the field study for collection of data, some of the data were checked for reliability and consistency. This was done to ensure reliability of the measurement as far as possible. After collection of
the data and check made thereof, data were tabulated as per tabulation plan and processed both through computer and manually. Thereafter, informations were interpreted to write this thesis.

3.8.5 Statistical Tools and Techniques Used:

In the context of analysis, two distinct techniques viz., analytical and explanatory were followed which were based on the existing standard literature that could be made available on productivity measurement. For interpretation of data, various statistical tools were used according to the requirement and suitability. The statistical tools were, Simple Average, Standard Deviation, Coefficient of Variation, Exponential Growth Rate, Correlation, Multiple Regression Analysis, ANOVA (single and two factor) etc. Brief discussion about these statistical tools are given blow in the following paragraphs:

(a) Mean: The arithmetic mean (also called the mean) is most commonly used average or measure of central tendency. It is calculated from data and then dividing the total by the number of items involved.\(^{39}\)

(b) Sample Average: This refers to the mean for the entire group of subjects from all the samples in the experiment and average value of averages of selected components.\(^{40}\)

(c) Standard Deviation (S.D): The standard deviation (S.D) is a measure of the Variation in data that is used to determine the percentage of data values that reside within only specified distance from their mean.\(^{41}\)

(d) Coefficient of Variation (C.V): The coefficient of variation is a measure of relative variation. It expresses the standard deviation as a percentage of arithmetic mean.\(^{42}\)
(c) Exponential Growth Rate (EGR): The equation of the exponential curve is of the following form:

\[ y = ab^x \]

Putting the equation in logarithmic form, we get

\[ \log Y = \log a + X \log b \]

To obtain the value of constant ‘a’ and ‘b’ the two normal equations to be solved are:

\[ \sum \log Y = N \log a + \log b \sum x \]
\[ \sum (X \log Y) = \log a \sum x + \log b \sum x^2 \]

Where ‘a’ is the y intercept and ‘b’ the slope of the curve.

Under the growth function, growth rate is actually equal to \( \log b \), which implies that there is growth over the period provided \( \log b > 0 \). Antilog of \( \log b \) gives the value of ‘b’ and the growth rate in percentage form shall be equal to.

\[ \text{EGR} = \left\{ \frac{(\text{Antilog of Log b})}{100} - 100 \right\} \]

In the presence of ‘o’ or negative data in the series, the study has used percentage of slope as growth rate.

(f) Correlation: Correlation analysis deals with the association between two or more variables. The degree of relationship between the variables under consideration is measured through the correlation analysis. The measure of correlation called the correlation coefficient or correlation index summaries in figure the direction and degree of correlation. The correlation analysis refers to the techniques used in measuring the closeness of the relationship between the variables. Of the several mathematical method of measuring correlation, the Karl Pearson’s method, popularly known as Pearson’s coefficient of correlation is most widely used in practice. The Pearson’s coefficient of correlation is denoted by the symbol ‘r’. The formula for computing ‘r’ is:

\[ r = \frac{\sum xy}{N \delta x \delta y} \]
Here \( x = (x - \bar{x}) \)
\[ y = (y - \bar{y}) \]
\( \sigma_x \) = Standard Deviation of Series x
\( \sigma_y \) = Standard Deviation of y Series
N = Numbers of pairs of observations
r = The correlation coefficient

(g) Multiple Correlation: In multiple correlation it is assumed that the dependent variable is related to a number of independent variables and the degree of association between the dependent variable and number of independent variables is taken together.46

(h) Coefficient of Multiple Correlation: The most commonly used measure of correlation between two or more independent variables and a dependent series is known as the coefficient of multiple correlation.47 It is the degree of association between two or more variables. Variables that move in the same direction are said to be positively corrected whereas, negatively correlated variables move in opposite directions. The positive square R i.e. \( R^2 \) is known as the multiple correlation coefficients.

(i) Regression Analysis: Regression analysis attempts to establish the nature of the relationship between variables that is to study the functional relationship between the variable and thereby provide a mechanism for production or forecasting.48

j) Multiple Regressions: The study of collective effect of all the independent variables on a dependent variable is called Multiple Correlation. In other words, the statistical process by which several independent variables
One used to estimate the dependent variable is known as Multiple Regression. It describes the average relationship between the independent variables and dependent variables.  

k) R square: While fitting a regression equation, the interest lies to know how far the equation serves our purpose. Thus we want to confirm whether the equation is a good fit or not. $R^2$ tells what part of the total variation in $Y$ is explained by $X$ variables.  

l) Degree of Freedom: The number of values in a sample we can specify freely, once we know about that sample.  

m) P-Value: This refers to the largest significance value at which we would accept the null hypothesis. It enables us to test hypothesis without first specifying a value for $\alpha$ (Alfa).  

n) SS: A sum of squares describes the value obtained by first squaring difference of individual data values from their mean, then summing.  

o) MS: Mean squares is a sum of squares divided by the associated degree of freedom.  

p) Univariate Regression Analysis: The correlation analysis no doubt provides an insight into the relationship between the two variables, but it does not explain the causal analysis, which can be elucidated by univariate regression analysis. Univariate regression analysis is concerned with estimating the expected value of one variable on the basis of observed value of another variable. The regression equation of $Y$ (dependent variable) on $X$ (independent variable) can be expressed as follows:

$$Y = a + bx + e$$
Where ‘a’ and ‘b’ are constant parameters. The parameters ‘a’ determines the level of the fitted line and the parameter ‘b’ determines the slop of the line i.e., the change in Y per unit change in X. The symbol Y stands for the value Y computed form the relationship for a given X plus the error component.55

q) Step-Wise Regression Analysis: From the univariate regression analysis, the study has been able to determine the impact of a single variable. But in the studies of developmental variables, it is quite obvious that it is the different combinations of variables, which affect any phenomenon. In other words, a single variable in itself may not explain any phenomenon adequately until and unless it acts in the company of other variables.56 For this purpose, it is desirable to look for different combinations or multiple regression analysis to study how different variables explain variations in total productivity of textile units (private and public) of Bangladesh.

r) Hypothesis Testing: Hypothesis testing is a process of using sample data and statistical procedure to decide whether to reject or not to reject a hypothesis (statement) about population parameters value (or about its distribution characteristics)57

s) Null and Alternative Hypothesis: The word null means invalid or void. A null hypothesis states that there is no significance difference or relationship between two or more parameters. So, the null hypothesis is a statement of no difference or no change from a hypothesized value (or distribution) and is symbolized by $H_0$. Whenever we reject the null hypothesis, the conclusion is that we have accepted alternative hypothesis and alternative hypothesis is symbolized by $H_a$.58

t) Two-Tailed and One-Tailed Test of Hypothesis: A two-tailed test of hypothesis will reject the null hypothesis, if the sample statistic is
significantly higher than or lower than the hypothesized population parameter. Thus in a two-tailed test the rejection region is located in both the tails. If we are testing a hypothesis at 5% level of significance the size of the acceptance region on each side of the mean world were 0.475 and the size of the rejection region is 0.025. If we consult the table areas under the normal curve we find that an area of 0.475 corresponds to 1.96 standard errors on each side of null hypothesis, the hypothetical mean, and this equals the size of acceptance region. One tailed test, the rejection region will be located in only one tail which may be left or right depending upon the alternative hypothesis formulated.

u) T-Test: T-distribution is used in testing of hypothesis about the population mean to decide about the acceptance or rejection of $H_0$ vis-à-vis $H_a$. The calculated value of $t$ is compared with the value of $t$ for (n-1) degree of freedom and level of significance, the tabulated $t$-value gives the critical value of $t$. More clearly, if $t_{cal} > t_{tab}$ for (n-1) degree of freedom, reject $H_0$, otherwise accept it.

v) T-Test For Correlation Coefficient: If we are to test the hypothesis that the correlation coefficient is zero i.e., the variables in the population are not correlated. The study has applied the following test:

$$ t = \frac{r}{\sqrt{1-r^2}} x \sqrt{n-2} $$

Here ‘$t$’ is based on (n-2) degree of freedom. If the calculated value of $t$ exceeds to $t_{0.05}$ for (n-2), df, we say the value of $r$ is significant at 5% Level, $n$ indicates the number of pairs.
w) F- Test: The F-distribution measures the ratio of the variance between groups to the variance within groups. If calculated value of F exceeds this table value, this would reject the null hypothesis. If not, we would accept it. A ratio is used in the analysis of variance, among other tests, to compare the magnitude of two estimates of the population. Variances to determine the two estimates are approximately equal; in ANOVA, the ratio between column variance to within column variance is used.

\[ F = \frac{\text{Variance between the Samples}}{\text{Variance within the Samples}} \]

x) ANOVA (Single factor): A statistical technique which is used to test the equality of three or more sample means and thus to make inferences as to whether the samples come from populations having the same mean.

Table 3.8.5.1
ANOVA (Single factor) One Way Classification Model

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>SS(sum of squares)</th>
<th>V(Degree of freedom)</th>
<th>MS(Mean squares)</th>
<th>Variance Ratio of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>SSC</td>
<td>( V_1 = c-1 )</td>
<td>MSC = SSC/c-1</td>
<td>MSC/MSE</td>
</tr>
<tr>
<td>Within Samples</td>
<td>SSE</td>
<td>( V_2 = n-c )</td>
<td>MSE = SSE / (n-c)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>SST</td>
<td>n-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


SSC = Sum of squares between samples (Columns)
SST = Total sum of squares of variations
SSE = Sum of squares
MSC = Mean sum of squares between samples.
MSE = Mean sum of squares within samples.

y) ANOVA (Two-factor): When it is believed that two independent factors might have an effect on the response variable of interest, it is possible to design the test so that an analysis of variance can be used to test for the effects of the two factor simultaneously. Such a test is called two-factor analysis of variance. With the two-factor analysis of variance, we can test two sets of hypothesis with the same data at the same time.\(^5\) Computing two-factor analysis of variance, the study has used computer-based system called ANOVA: Two factor without replication and with Replication.

**Table 3.8.5.2**

ANOVA (Two-factor) Two Way Classification Models

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of squares</th>
<th>Degree of Freedom</th>
<th>Mean sum of squares</th>
<th>Ratio of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>SSC</td>
<td>(c-1)</td>
<td>MSC = SSC/(c-1)</td>
<td>MSC / MSE</td>
</tr>
<tr>
<td>Between Rows</td>
<td>SSR</td>
<td>(r-1)</td>
<td>MSR = SSR / (r-1)</td>
<td>MSR / MSE</td>
</tr>
<tr>
<td>Residual or Error</td>
<td>SSE</td>
<td>(c-1)(r-1)</td>
<td>MSE = SSE / (r-1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(c-1)</td>
</tr>
<tr>
<td>Total</td>
<td>SST</td>
<td>n-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


SSE = Sum of Squares Due to Error
MSE = Mean of Squares Due to Error.
SSR = Sum of Squares Within Row.

70
MSR = Mean of Squares Within Row.

\( (c-1) \) = Number of Degree of Freedom Between Columns.

\( (r-1) \) = Number of Degree of Freedom Between Rows.

\( (c-1)(r-1) \) = Number of Degree of Freedom for Residual.

\( z \) Intercept: A constant for any given straight line whose value represents the value of the Y when the X variable has a value of 0.

\( a = \bar{y} - \bar{a}x \)

\( za \) Slope: A constant for any given straight line whose value represents how much each unit change of the independent variable change the dependent variable

\[
b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}
\]

3.9. Productivity Measurement Approach Used in This Study:

From the foregoing review of the model of productivity measurement the following productivity measurement models have been found suitable for measuring the productivity performance of the textile units of Bangladesh.

1. Computation of Labour Productivity:

Labour being considered as the major input of the manufacturing industry is taken to be the most important element of productivity measurement Labour Productivity has been measured through the following methods.

a. Labour productivity in terms of number of Employees:

\[
\text{Labour productivity} = \frac{\text{Value of Production}}{\text{Number of Employees}}
\]
b. Labour productivity in terms of Manpower cost.

\[ LP = \frac{\text{Value of Production}}{\text{Manpower Cost}} \]

2. Computation of Assets Productivity:

Assets productivity has been computed through the following methods:

a) Fixed Assets productivity in terms of valued of production

\[ FAP = \frac{\text{Value of Production}}{\text{Fixed Assets}} \]

b) Fixed Assets productivity in terms of Sales:

\[ FAP = \frac{\text{Sales}}{\text{Fixed Assets}} \]

c) Current Assets productivity in terms of sales:

\[ CAP = \frac{\text{Sales}}{\text{Current Assets}} \]

d) Current Assets productivity in terms of value of production

\[ CAP = \frac{\text{Value of Production}}{\text{Current Assets}} \]

e) Working capital productivity = \( \frac{T}{M+C} \)

Where \( T = \text{Total Sales} \)

\( M = \text{Manpower cost} \)

\( C = \text{Capital cost (Depreciation)} \)

3. Value Added Productivity:
Traditionally Value Added Productivity is measured through ratio between outputs to input. But this method does not give due importance to other interested parties viz, labour, customers, government etc. Value added in the present case has been worked in the following manner:

Value Added = Manpower cost + Depreciation + VAT, Duty Taxes + Interest + Profit & loss after tax.

Net value added = Value Added - Depreciation.

Value Added = Net sales - Material Cost

Thus:

a) Value added productivity in terms of manpower cost = \( \frac{\text{Value Added}}{\text{Manpower Cost}} \)

b) Value added productivity in terms of fixed assets = \( \frac{\text{Value Added}}{\text{Net Fixed Assets}} \)

4. Surrogate Productivity:

The study has also calculated surrogate productivity. Surrogate productivity has been computed through the following methods:

a) Total Cost Productivity = \( \frac{\text{Value of Production}}{\text{Total Cost of Goods Sold}} \)

b) Profit Productivity = \( \frac{\text{Net Profit Before Tax}}{\text{Total Cost of Goods Sold}} \)

c) Value Added Productivity in terms of Current Assets = \( \frac{\text{Value Added}}{\text{Current Assets}} \)

d) Value Added Productivity in terms of Value of Production = \( \frac{\text{Value Added}}{\text{Materials Cost}} \)
5. Financial Productivity:

Some researchers also indicate some financial ratios as indicators of financial productivity. In this connection the financial productivity has been measured through the following methods.

1. Return on Fixed Assets = \( \frac{\text{Net Profit Before Tax}}{\text{Fixed Assets}} \)

2. Return on Capital Employed = \( \frac{\text{Net Profit Before Tax}}{\text{Capital Employed}} \)

3. Return on Equity Capital = \( \frac{\text{NPBT}}{\text{Equity}} \)

4. Current Ratio = \( \frac{\text{Current Assets}}{\text{Current Liabilities}} \)

5. Quick Ratio = \( \frac{\text{Quick Assets}}{\text{Current Liabilities}} \)

6. Inventory Turnover Ratio: \( \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}} \)

6. Total Productivity:

Total productivity has been computed by using the following methods:

\[
\text{Total productivity} = \frac{V}{M+Q+C}
\]
Where,

\[ V = \text{Value of production} \]
\[ M = \text{Manpower cost} \]
\[ Q = \text{Materials Input} \]
\[ C = \text{Capital Input} \]

### 3.10 Limitations of the Study:

Sometime a researcher may not reach the desired level of standard due to the lack of adequate data and relevant published materials. In this study, the researcher has mainly relied on the published data from public limited company only for the purpose of computation of overall productivity performance of private sector textile units of Bangladesh. However, the reliability of the data is authenticated and in no way affects the result of the study.

### 3.11 Conclusion:

This chapter has rendered detailed accounts with regard to review of literature on the subject matter, besides the statement of the problem. Research gap has been identified after having reviewed the subjective literature and based thereon scope and objectives of the study have been designed. The researcher has formulated the hypotheses to substantiate the objectives. Appropriated research methodology has been adopted preparing the framework in terms of research design i.e. random sample, Data collection, Tabulation and Test of hypotheses. This chapter also highlights the limitations of the study.

In the forth-coming chapter the Research scholar has made an attempt to present a detailed analytical discussion with regard to productivity performance of public sector textile units in Bangladesh. This chapter also presents a case study of some selected public sector textile units for an in-
depth analysis of productivity performance and thus to identify the factors affecting productivity performance in these units in particular and the public sector textile units as a whole in general during the period 1990-2000.

3.12. References:


42. Ibid.


45. Ibid , p- E-10-11.


50. Agarwal , B. L. op cit, p- 374.

51. Levin and Rubin, op cit, p -362.

52. Ibid, p-457.


54. Ibid , p- 504.
55. Amandeep, op cit, p-19.
56. Ibid, p-197.
57. Ingram and Marks, op cit., p-362.
60. Ibid, p-A-3.8
63. Levin and Rubin, op cit., p-568.
64. Ibid, P. 724.