

Investigating the Production Efficiency of Power Loom Industry in Pabna Sadar Upazila, Bangladesh

Md. Toriql Islam¹ and Farjana Quayum Keya²

¹Research Fellow, ²Associate Professor

Department of Economics, University of Rajshahi, Bangladesh

E-mail: keyafarjana34@gmail.com

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Abstract - The power loom industry is extremely important to our country's economy: employs a large number of people, helping to alleviate rural poverty, and it is a growing source of government revenue. The aim of this research is to identify the prospects and production efficiency of power loom industry in Pabna, Bangladesh. To assist the aim, this study has been based on primary data collected from 52 power loom units between October and November in 2019 with the help of a structured questionnaire and face-to-face interview method. In this study, an econometric model of Cobb-Douglas production has been employed to measure the factors affecting the sales revenue and the efficiency of production in power loom industry. The estimated results confirmed that main determinants of increasing the production efficiency and sales revenue of power loom industry are quality yarn, skilled labour, machine and electricity. The efficiency parameter is obtained 2.653.

Keywords: Power Loom, Production Efficiency, Elasticity, Returns to Scale, Robust Standard Error

I. INTRODUCTION

As Bangladesh is a populous country in the world, around 65% of the population in the country lives in rural areas who are mainly depend on agriculture. Due to lower per capita arable land, agriculture cannot always provide a sustainable livelihood to rural household. Therefore, with farming, rural households often finds scopes of non-farm activities for better livelihood. Since ancient times, the handloom industry has been Bangladesh's most important non-farm economic sector (Nipa 2016, BBS, 2005).

Handloom is considered as an important source of supplementary employment and income for small farmers (Islam et al. 1991). Bangladesh produced 'Muslin' which was famous in the world and it was completely handloom product mainly made in Narayanganj. But later on gradually 'Muslin' became abolished. The famous handloom products of Bangladesh are 'Jamdani, Banarase, Tangail Saree, Lungi' and few other products. A significant number of people are indirectly involved in this sector in the activities like marketing, transporting etc. In Bangladesh, the majority of small and cottage industry is based on the supply of agricultural products. Most emerging countries take various initiatives for rural development as part of their economic shift from an agrarian to an industrial society.

It is the country's second greatest source of rural income and employment, after agriculture (Ahmed, 1999). There are over 0.183 million handloom units (factories) and 0.505 million looms in the handloom sector. Around one million weavers labor in the industry, with around half of them being women (GoB, 2003). In terms of micro and macroeconomic impacts, the handloom sector provides significant benefits to Bangladesh's economy. It plays a critical role in the country's efforts to reduce poverty, increase employment, and boost household income and consumption (Islam and Hossain, 2015). Though, the industry has been on flourish, the units are also facing numerous reasons which pose significant threat to its further growth.

But now Handloom industry is replaced by Power loom industry. This sector has a bright future ahead of it. This industry is responsible for a large portion of the country's economic growth. More than 1.5 million people depend on it for their living, both directly and indirectly. Many developing countries are making rural nonfarm development a strategic focus as they transition from an agricultural to an industrial economy. It contributes significantly to the creation of local jobs and the integration of other industries. Weaving using power looms is one of Bangladesh's most important non-agricultural sources of income. After agriculture, it is the second greatest source of rural employment (Subrata, 2014). The knowledge and abilities required for this industry have evolved since their forebears. Loom products are well-known for being environmentally friendly. Furthermore, because they lack higher education, skill, experience, training, and well-managed capacity, the owners of power loom units are unable to reach the maximum possible production due to a failure to choose the ideal combination of inputs. As a result, the owners fail to reduce input utilization in order to achieve a given level of output. Their units are less profitable as a result of the failure of the least cost combination of output. Power loom production would become more viable and produce more employment and income in Bangladesh's rural economy if they were able to use efficient input combinations. As a result, it's critical to determine whether the sector is efficient and, if so, what variables lead to increased or decreased efficiency in the power loom industry. As a result, the production efficiency

of the power loom sector is investigated in this study. In this case, the improved econometric method of log-linear model of Cobb-Douglas production function is applied that has provided concrete evidence in favor of the available results.

Power looms are cost effective and much faster than handloom industry. While the production costs of handloom products are increasing due to increase in raw materials prices and labour charge etc; demand for the handloom products are decreasing due to machine made cheaper products. Since, now days, power loom industry is an emerging sector in Bangladesh, handsome research on this sector are very necessary. In Bangladesh, several research studies have been undertaken on the handloom industry Sobhan, (1989); Rahman, (2013); Chowdhury, (1989); Banarjee *et al.*, (2014); Islam and Hossain, (2012), (2015), (2018). These studies have been unable to reveal the production efficiency of power loom industry and the results from both of the research are not comprehensive and conclusive for power loom industries which necessities for further studies. This study, therefore, has as its overall objective to find the production efficiency and determinants which affect the production of power loom industry.

II. OBJECTIVES OF THE STUDY

The study's main goal is to attract attention to the existing improvements in the power loom sector in Pabna, Bangladesh. In light of this overarching goal, the study's specific aims are as follows.

1. To determine the current state of the power loom industry in Pabna, as well as its production efficiency.
2. To examine the influence of the power loom industry on Pabna's and the country's economic development, as well as to identify the industry's main challenges.
3. To calculate the power loom industry's production function, returns to scale, and factor intensity of power loom industry.

III. REVIEW OF THE RELEVANT LITERATURE

To search the existing production procedures and problem in power loom industry in Bangladesh and relationship between economic development and efficient production in power loom Industry a good number of studies have been conducted earlier in this field. Rahman, (2013) due to a number of internal and external causes functioning behind the scenes, Bangladesh's handloom industry has a brilliant past, a shaky present, and a hazy future.

Ahmed, (1999) it was discovered that over 80% of the inhabitants in this country are dependent on agriculture, either directly or indirectly. The loom business is Bangladesh's oldest, largest, and most important cottage industry. It is the second largest source of rural employment after agriculture, as it is our country's major handcraft sector. ADB, (2002) despite the fact that employment opportunities in this sector have been squeezed in recent years, it still employs almost 0.9 million weavers in rural

areas. Sobhan, (1989) says this sector has a bright future ahead of it as well as an illustrious past. Since 1972, handloom items have been steadily increasing in popularity in the export market, and Bangladeshi handloom products, with their distinct style and high quality, have carved out a position for themselves in international markets. Chowdhury, (1989) finds the absence of public plans and programs, the full improvement, growth, and structural adjustment has been achieved. Sobhan (1989) says that although the technical expertise of Bangladesh's weavers is second to none in the handloom-producing world, they are trailing behind in capturing current technologies due to a lack of infrastructure support from the government, according to his research. Subrata, (2014) finds out many people are employed by the loom industry, and the government receives a large amount of income tax from it. But the industry is beset with many obstacles. To run a successful business, it must be needed a cheap supply of raw materials, the security of the weavers, a reliable transportation system, and an interest-free financing from banks, stable political situation and above all a good attention of the government to nurture the industry and thus getting back the reputation of the industry worldwide. Ahmed, (1999) demonstrates that Bangladesh's oldest and most important cottage industry is currently on the verge of extinction due to a variety of issues and barriers. Our country's weavers do not have access to high-quality raw materials at the appropriate time and at the right price. Besides, ADB, (2002) examine weavers are hampered by outdated technology and a lack of working capital, both of which are required to sustain a steady flow of output.

Latif, (1997) was discovered that over a thousand weavers organizations existed at the time of independence, but that almost all of them are now dormant due to the government's lack of strategic vision to safeguard and nurture this industry. Elias *et al.*, (2012) investigate how the handloom sector is creating rural employment and income, relieving rural poverty, bringing income equity, substituting imports, and enhancing export possibilities. However, this industry is experiencing some issues, which are causing looms to stop working. As a result, it is critical to identify the current situation as well as the loom industry's future prospects in Bangladesh. Chowdhury (1981) conducted a cost-benefit analysis of weaving on handlooms, power looms, and mills. He estimated the financial and economic internal rates of return (IRR) of these three different production processes. He discovered that handloom is a more cost-effective method. Islam and Hossain (2014) works in Bangladesh's Kumarkhali Upazila, the contribution of factor costs to the gross return of the handloom weaving sector was investigated. Labor, yarn, and capital costs all contribute significantly to gross return, according to the study. As a result, the study showed that increasing the utilization of manpower, yarn, and capital expenditures can result in a higher gross return for handloom unit owners. Rahman (2013) assessed the handloom weaving industry's possibilities in Bangladesh's Pabna area. The research uncovered all of the internal and external aspects that

contribute to a better understanding of the current state of the Pabna district's handloom sector. The study discovered that the handloom units operating in Bangladesh's Pabna district have a lack of working capital, a high cost of raw materials, a lack of organizing capability, insufficient technology and efficiency, a lack of policy support, a huge knowledge gap, a lack of power supply, and a lack of credit facilities.

Most of the studies have however tried to explain the possibilities and problem in Handloom industry and its contribution to economic development from 1972. But no studies have yet examined the production efficiency in power loom industry, although, at present most of all Handloom is replaced by Power loom. As the production efficiency of power loom industry and development of this industry is correlated and very much important on economic development in Bangladesh. This study tries to examine this relationship with updated data (2018).

IV. METHODOLOGY AND DATA

A. Study Area and Data Collection

This research relies heavily on primary data gathered from power loom families. To carry out the study, Pabna district of Bangladesh is selected as study area because there are many power loom units in this area, it belongs second position after Tangaila in terms of number of looms in Bangladesh. Pabna district consists of 9 upazilas. Following

$$TSR_i = \beta_1 CC_{2i}^{\beta_2} LC_{3i}^{\beta_3} YC_{4i}^{\beta_4} DC_{5i}^{\beta_5} EC_{6i}^{\beta_6} OC_{7i}^{\beta_7} e^{u_i} \quad (i)$$

We get a log-linear model if we log-transform this model:

$$\ln TSR_i = \ln \beta_1 + \beta_2 \ln CC_{2i} + \beta_3 \ln LC_{3i} + \beta_4 \ln YC_{4i} + \beta_5 \ln DC_{5i} + \beta_6 \ln EC_{6i} + \beta_7 \ln OC_{7i} + u_i \quad (ii)$$

$$\ln TSR_i = \beta_0 + \beta_2 \ln CC_{2i} + \beta_3 \ln LC_{3i} + \beta_4 \ln YC_{4i} + \beta_5 \ln DC_{5i} + \beta_6 \ln EC_{6i} + \beta_7 \ln OC_{7i} + u_i \quad (iii)$$

Here, $\ln \beta_1 = \beta_0$ is the efficiency parameter (state of technology); U_i = stochastic disturbance term; e = base of natural logarithm (2.718).

$\ln TSR_i$ = total sales revenue of i^{th} loom unit per year in thousand taka,

$\ln CC_{2i}$ = cost of capital (interest on capital) per year in thousand taka,

$\ln LC_{3i}$ = cost of labour per year in thousand taka,

$\ln YC_{4i}$ = cost of yarn per year in thousand taka,

$\ln DC_{5i}$ = cost of dye per year in thousand taka,

$\ln EC_{6i}$ = cost of electricity per year in thousand taka,

$\ln OC_{7i}$ = other cost per year in thousand taka.

β_2 to β_7 are the (partial) elasticity of output with respect to input CC, LC, YC, DC, EC, OC respectively, that is, it calculates the percentage change in output as a result of a 1 percent change in one input while keeping the other input constant. The sum (β_2 to β_7) indicates the returns to scale, or the output reaction to a proportionate change in the inputs. If this sum is 1, there are constant returns to scale, which means that doubling the inputs doubles the output,

multi-stage random sampling technique, the study selects Pabna Sadar Upazila randomly from those Upazila. Then, one union (namely Goeshpur) is selected randomly from Pabna Sadar Upazila. In the next step, two villages are selected randomly. Finally, twenty six power loom units are selected randomly from each village. Consequently, a total of 52 power loom owners are selected for interviewing for the study. Data was gathered through face-to-face interviews utilizing a standardized questionnaire from October to November, 2019.

B. Econometric Model

One or more of the following specification errors are likely to occur when developing an empirical model: omission of a relevant variable(s), inclusion of an unnecessary variable(s), use of the incorrect functional form, measurement errors, incorrect specification of the stochastic error term, assumption that the error term is normally distributed. Considering these specification error we construct Cobb-Douglas production function for power loom industries. Equation using the ordinary least square (OLS) method, multiple regression analysis was utilized to investigate the relationship between inputs and outputs in the power loom sector. To evaluate the contribution of key variables for loom industry production, the Cobb Douglas production function is chosen to determine the input-output relationships of the most relevant variable. The Cobb-Douglas production function.

tripling the inputs triples the output, and so on. If the total is less than one, there are declining returns to scale, which means that doubling the inputs will only double the output by a factor of two. Finally, there are growing returns to scale if the sum is bigger than one; doubling the inputs will more than double the output.

V. RESULTS AND DISCUSSION

A. Result of Descriptive Statistics

Before we do anything, we should make sure that the practical problem we're dealing with is fully comprehended. In other words, in cross-section data analysis, like in all areas of statistics, the context of a particular topic is critical. The normality of the data is checked by the standard descriptive statistics. Table indicates that the variables under investigation have been discovered to be regularly distributed. Each variable's mean-to-median ratio is around one. In comparison to the mean, the standard deviation is also low, indicating a low coefficient of variation.

TABLE I DESCRIPTIVE STATISTICS

Variables	LNTSR	LNCC	LNLC	LYNC	LNDC	LNE C	LNOC
Mean	15.95182	10.90909	14.18599	15.27497	13.48729	11.84461	13.59008
Median	16.02334	10.83261	14.28468	15.40586	13.61044	11.97648	13.80500
Maximum	18.33904	13.81801	16.28021	17.68671	16.25960	13.99783	15.60727
Minimum	13.55597	8.699515	12.21404	12.57072	10.67360	10.08581	11.33657
Std. Dev.	0.804525	1.123623	0.689209	0.988481	1.196409	0.755715	0.876241
Skewness	-0.261989	0.217038	-0.297177	-0.651189	-0.176347	-0.162695	-0.825168
Kurtosis	4.549734	2.868881	4.414381	3.799065	3.036710	3.757155	3.539337
Jarque-Bera	5.798500	0.445497	5.099752	5.058500	0.272437	1.471517	6.531403
Probability	0.055065	0.800316	0.078091	0.079719	0.872652	0.479142	0.038170
Sum	829.4949	567.2725	737.6717	794.2985	701.3388	615.9198	706.6841
Sum Sq. Dev.	33.01025	64.38899	24.22544	49.83188	73.00114	29.12634	39.15772
Observations	52	52	52	52	52	52	52

Source: Author's own calculation. (The test is conducted with Eviews.10)

The difference in maximum and minimum values is also appropriate. Each variable has a low numeric skewness and is somewhat negatively skewed. Each variable's kurtosis is roughly 3, indicating that it is close to normal. The Jarque-Bera test statistics accept the null hypothesis of normal distribution for each variable at a level of significance of 5%, with the exception of the other cost (lnoc), which is significant at a level of significance of 5%. As a result, the analysis ensures that the distribution is normal.

B. Determinants of Sales Revenue: Multiple Regression Analysis

TABLE II RESULT OF THE COBB-DOUGLAS MODEL

Variables	Coefficient
Cost of capital (lnCC)	0.0240
	(0.0544)
Cost of labour (lnLC)	0.255***
	(0.0807)
Cost of yarn (lnYC)	0.521***
	(0.139)
Cost of dye (lnDC)	0.00748
	(0.0246)
Cost of electricity (lnEC)	0.200**
	(0.0905)
Other cost (lnOC)	-0.0747
	(0.0879)
Constant	2.653***
	(0.691)
Observations	52
R-squared	0.954
F(6,45)	93.63
(Prob>F)	0.0000

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's own calculation. (The test is conducted with STATA.14)

We estimate multiple regression equation (iii) by using least square method. The results are given in Table II. In our regression result, F test show the model's overall relevance, in which all coefficients are not equal to zero at the same time. At a 1% level of significance, the value of F (93.63) static is significant. The R-square value is 0.9540, which is quite high and represents 95% of the variation of the total sales revenue of power loom industry can be explained by explanatory variables.

From the results it is found that the cost of labour coefficient is 0.255, which is statistically significant. This suggests that a 1% increase in labour costs would result in a 0.255 percent rise in overall sales revenue if all other factors remained constant. Yarn is a significant input for power loom units to generate sales revenue. The yarn cost coefficient is 0.521, which is statistically significant. This means that a 1% rise in yarn cost would result in a 0.521 percent increase in sales income, assuming all other parameters remain equal.

The dye elasticity is 0.0075 means that a 1 percent increase in input dye, holding other input constant, led on an average to about 0.0075 percent increase in the sales revenue. Electricity input also highly affects output (lungi) of power loom industry and ultimately total sales revenue. The output elasticity of electricity is 0.200 which is statistically significant. This variable shows that, a 1 percent increase input electricity, holding other inputs constant, led in the research area, this resulted in an average rise of 0.200 percent in overall sales income in the power loom industry. The capital elasticity is 0.0240 and it is insignificant. Other inputs cost has negative impact on the total sales revenue of power loom units. The coefficient of other inputs is 0.0747, which suggests that a 1% rise in the cost of other inputs would result in a 0.0747 percent loss in sales income, assuming all other factors remain constant.

Therefore, it can be conceived that sales revenue of power loom owners are strongly determined by labour cost, yarn cost, and electricity cost. The efficiency parameter is 2.653, and at a 1% level of significance, it is statistically significant. For given values of all inputs, output will be increased by 2.653 percent and it shows the state of technology. The sum of all coefficients is 0.9333, indicating declining returns to scale: double the inputs in our model will only double the total sales revenue of power loom units by less than doubling the total sales revenue of power loom units.

VI. SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

The impacts of numerous inputs on power loom unit sales income, production efficiency, and impediments in the power loom industry were explored in this study. The projected result revealed that labor costs, yarn costs, and electricity costs all have a significant impact on power loom owners' sales revenue. The production efficiency factor is practically excellent (2.653), and it has the potential to improve if constraints to the power loom sector in Pabna Sadar Upazila are removed. In our research area, the power loom business has decreasing returns to scale of production. In our research, we discovered certain issues with the loom business in Bangladesh, such as scarcity of raw materials, insufficient capital, and inadequate government facilities. To run a successful loom firm, it must be needed a cheap supply of raw materials, additional electricity, a reliable transportation system, and a low-interest loan from a bank.

The yarn price should be kept at the desired level. The availability of high-quality yarn should be enhanced, and price variations should be kept under control. Electricity supply should be maximized, and the price per unit of electricity should be set to benefit the power loom business. The government should take some necessary steps, such as increasing SME loans from public, private, and non-governmental organizations (NGOs) to ensure credit facilities to power loom owners at a lower rate of interest; establishing a monitoring cell to ensure raw material availability and price control; making new and standard technologies available to reduce production costs; and providing training facilities for men and women to increase skilled labour.

VII. CONCLUSION

The size of sample of our study is only 52. Further study can be conducted with large sample size to predict more accurately and to know actual figure of power loom industry of Pabna districts. Another limitation of our study is correlation among explanatory variables. We find cost of yarn and other inputs cost are correlated in our study. As yarn is an important variable in power loom industry, we cannot omit this variable from model. Due to lower degree of multicollinearity among cost of yarn and other inputs cost we neglect the multicollinearity problem according to "do

nothing" principle. As a result, future research may use Rule-of-Thumb approaches to tackle multicollinearity issues, such as integrating cross sectional and time series data, dropping variable(s), variable transformation, and ridge regression.

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