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Export Trend of Ready Made Garments (RMG) Sector of Bangladesh

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Abstract

Ready-Made Garments (RMG) sector has greater importance than any other sector in Bangladesh in terms of growth, employment, foreign exchange earnings and Gross Domestic Product (GDP). The objective of this study is to determine the export trend of the RMG sector in Bangladesh by using different trend models. To serve the objectives of the study, time-series data of RMG sectors has been used for the period 1985-2018. Among several trend models, the Semi-log Parabolic Trend model is found to be the best-fitted model for determining the trend of RMG exports. From the empirical results of the study, it is observed that RMG exports have a significant upward trend for the period 1985-2018 with a growth rate of 8.76 % in 2018. The forecasted RMG export will be nearly 31712.82 million USD in the financial year 2022-23. The findings of the study will help the government, NGO's and policymakers to undertake necessary steps for the progress of this sector.

Keywords: Ready-made garments; Exports; Trend models; Semi-log parabolic.

1. Introduction

In terms of employment, production and foreign currency earnings, Ready Made Garment (RMG) is the leading sector of Bangladesh. At the same time, Bangladesh is the second-largest exporter of garment products in the world after China for the last three decades [1]. Ready-Made Garments (RMG) industry is deliberated as the strongest pillar of Bangladesh economy which holds almost 81 % of total export earnings in the budgetary year of 2013-14, whereas in 1976 the industry contributed only 0.001 % to the country's total export earnings, and then in 2005, its share increased to about 76 % [2,3]. In 2005, the value of Bangladesh's export garments was 6.9 billion dollars, which was around 2.5 percent of the total value ($ 266 billion) of exports. The foreign currency earnings and the expansion of RMG sector employment are increasing every year [4]. In FY 2017-18 RMG industry in Bangladesh contributes 83.5 % of the country's total export with 11.2 % share of GDP [5]. By exporting apparel products, now Bangladesh has become a flagship brand in the developed countries of the world, where around 62 % of total exports were exported in European countries and 18 % in the United States [6]. RMG industries is the only

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multi-billion-dollar manufacturing and export industry in Bangladesh that contributes to various sectors of Bangladesh's economy such as banking and insurance, shipping, contribution to a government fund, engineering sector etc. [3].

Most of the study on the RMG sector of Bangladesh showed descriptive analysis such as problems, prospects, challenges, competitiveness in the major international market, workers conditions such as wage level, working hour, health status and solution of the problem as well as the growth of RMG sector in Bangladesh [1,4,7,8]. Hasan *et al*. [3] applied a linear trend model to reveal the trend of RMG export and they also used a linear regression model to assess the relationship between RMG export and GDP. Rahman and Jiban [9] also used various trend model for finding the trend of foreign exchange earnings of garment sectors in Bangladesh. So far our knowledge a little number of studies has been performed to measure the export trend of RMG sectors in Bangladesh by using different trend models. The main objective of this study is to determine the export trend of the ready-made garment industry by using different trend models. Besides the main objective, this study was also conducted to get an overview of the present scenario of Ready-Made Garments including the no of factories, workers, RMG exports, percentage of RMG export to total export and total GDP.

2. Materials and Methods

To carry out the objective of the study yearly time series data of Ready-Made Garments (RMG) for the period 1985-2018 were collected from Statistical Year Book 2018 published by Bangladesh Bureau of Statistics (BBS) [10] and from Bangladesh Garments Manufacturing Export Association (BGMEA) [5]. Various trend models were applied to analyze the collected data.

2.1. *Methods of determining trend*

By secular trend or simply trend, we mean the general tendency of the data to increase or decrease during a long period of time. Trend analysis is a statistical technique that aims to predict the future pattern of the dataset based on past performance. In order to establish a trend pattern, annual data of RMG exports for the past 34 years (1985-2018) have been used. To find out the best-fitted model of RMG exports the following trend models have been considered.

i	Straight-line trend	$: Y_t = \beta_0 + \beta_1 t$	(1)
ii	Semi-log trend	$: \log Y_t = \beta_0 + \beta_1 t$	(2)
iii	Logarithmic trend	$: Y_t = \beta_0 + \beta_1 \ln t$	(3)
iv	Log linear trend	$: ln Y_t = \beta_0 + \beta_1 \ln t$	(4)
v	Parabolic/ quadratic trend	$: Y_t = \beta_0 + \beta_1 t + \beta_2 t^2$	(5)
vi	Semi-log Parabolic trend	$: \log Y_t = \beta_0 + \beta_1 t + \beta_2 t^2$	(6)

where, Y_t is the amount of RMG exports at time t (1985-2018).
These models are fitted separately to the annual data using regression analysis methodology.

2.2. *Model selection criteria*

From these fitted models, the most appropriate one is selected according to the following rule:

2.2.1. *R^2 criteria*

It is known that one of the measures of goodness of fit of a regression model is R^2, which, is defined as:

$$R^2 = \frac{\text{RSS}}{\text{TSS}} = 1 - \frac{\text{ESS}}{\text{TSS}} \ . \tag{7}$$

R^2 thus defined, necessity lies between 0 and 1. The closer it is to 1, the better is the fit. But there are limitations of using R^2. For example, it measures in-sample goodness of fit in the sense of how close an estimated *Y* value is to its actual value in the given sample and more importantly, an R^2 always increases when more explanatory variables are added to the model. Therefore, there is very tempting to play the game of "maximizing the R^2" by simply adding more variables to the model. Of course, adding more variables to the model may increase R^2, but it may also increase the variance of forecast error.

2.2.2. *Adjusted R^2 criteria*

Each additional explanatory variable added to the model increases R^2. Thus, since R^2 can be made larger simply by adding more predictor variables to the model, a modification of R^2 has been proposed. This adjusted R^2 does not automatically increase when new predictor variables are added to the model. In fact, the adjusted R^2 may actually decrease, because the decrease in SSE may be more than off-set by the corresponding decrease in the error degrees of freedom.

$$\bar{R}^2 = 1 - \frac{\text{ESS}/(n-k)}{\text{TSS}/(n-1)} \ . \tag{8}$$

Here, $\bar{R}^2 \le R^2$, showing how the adjusted R^2 penalizes for adding more regressors. For comparative purposes, therefore, $\bar{R}^2$ is a better measure than R^2.

2.2.3. *Akaike's information criterion (AIC)*

Akaike's information criterion, developed by Akaike [11] under the name of "an information criterion"(AIC) in 1971 and proposed it as a measure of the goodness of fit of an estimated statistical model.
The AIC is defined as

$$AIC = 2k - 2\log(L) \ , \tag{9}$$

where *k* is the number of parameters in the statistical model, and *L* is the maximized value of the likelihood function for the estimated model. Lower the value of AIC, better the model fit.

2.2.4. *Bayesian information criterion (BIC)*

The BIC is a criterion for model selection among a class of parametric models with a different number of parameters. When estimating model parameters using maximum likelihood estimation, it is possible to increase the likelihood by adding additional parameters, which may result in over-fitting. The BIC resolves this problem by introducing a penalty term for the number of parameters in the model. Several forms of BICs have been proposed in the literature. One typical BIC is defined as follows:

$$BIC = \log(\widehat{\sigma}^2_{MLE}) + \frac{mlog(T)}{T} \ . \tag{10}$$

"Eq. (10)" is very similar to "Eq. (9)" in that BIC is also composed of two parts with the same first item as in "Eq. (9)". The difference is in the penalty term. It is clear that BIC imposes a greater penalty for model complexity than AIC. Hence the use of BIC for model selection would result in a model whose number of parameters is no greater than that chosen by AIC.

3. Results and Discussion

3.1. *Basic descriptive analysis*

The present scenario of Ready-Made Garments including the no of factories, workers (in million), RMG exports, percentage of RMG export to total export and percentage of RMG export to total GDP are presented in Figs. 1-4.
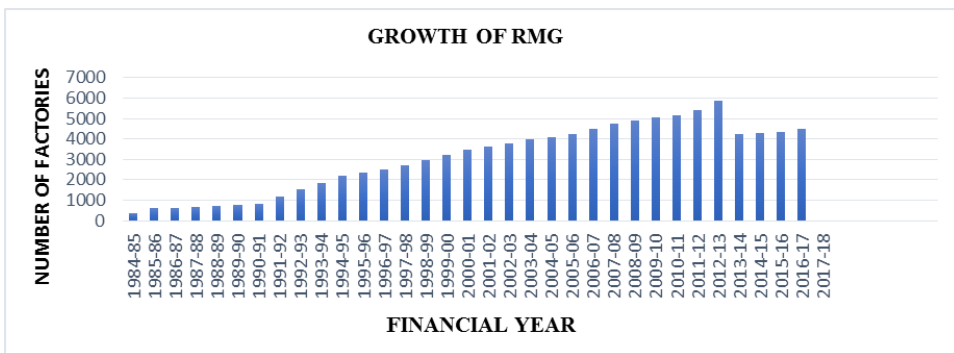

Fig. 1. Number of Factories in Ready Made Garments.

In Bangladesh, the Ready-Made Garments (RMG) sector started its journey in the late 1970s but continued exporting it in 1976. By at the end of 1982, there were only 47 garment manufacturing units. After 2 years that means in 1984-85, the number of garment factories increased to 587 which also showed in Fig. 1. But within the next 15 years, a breakthrough occurred when the number of garment factories was increased to 2900 in 1999. In 2017-18, the number of factories increased to around 4560 with 4 million workers and most of them are women [5,12-14].
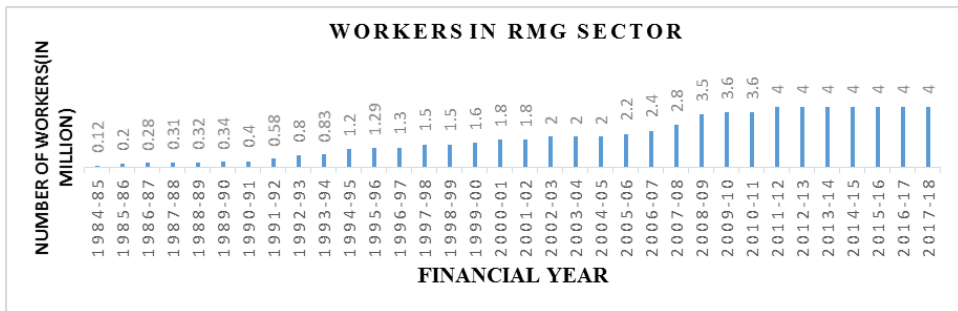
Fig. 2. Number of workers (in million) in RMG sector.

In 1980, the World Bank data revealed around 50,000 female garments workers in this sector [15]. In 1997-98, the number of working people in the garment sector increased to more than 1.5 million, which was about 70 % of the total female employment in the country's manufacturing sector. By 2001, the textile industry employed 3 million workers, of whom 90 % were women. In 2004, the garment sector holds the position of the largest employer of women in Bangladesh. By 2013, there were approximately 5,000 garment factories (Fig. 2), employing about 4 million people, most of them are women [16].
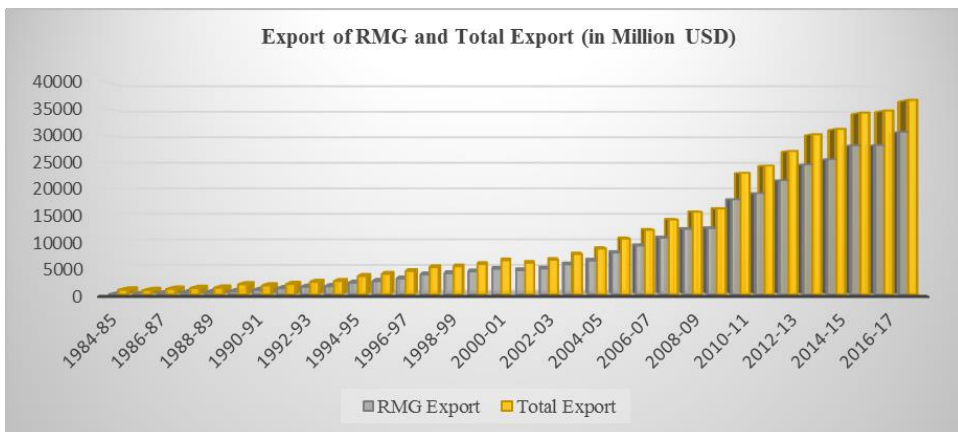

Fig. 3. Amount of RMG export and total export.

In 1980s RMG export increased from 116.2 million USD or 12 % of total export to 4020 million USD or 76 % of total export, which reached 10 billion USD (Fig. 3) by the end of the fiscal year 2007 [2]. According to Fig. 3 the last budgetary year (FY 2017-18), the apparel sector contributed 30.61 billion USD (83.49 %) of Bangladesh's total exports of 36.66 billion USD which also similar to the findings of Export Promotion Bureau [17].
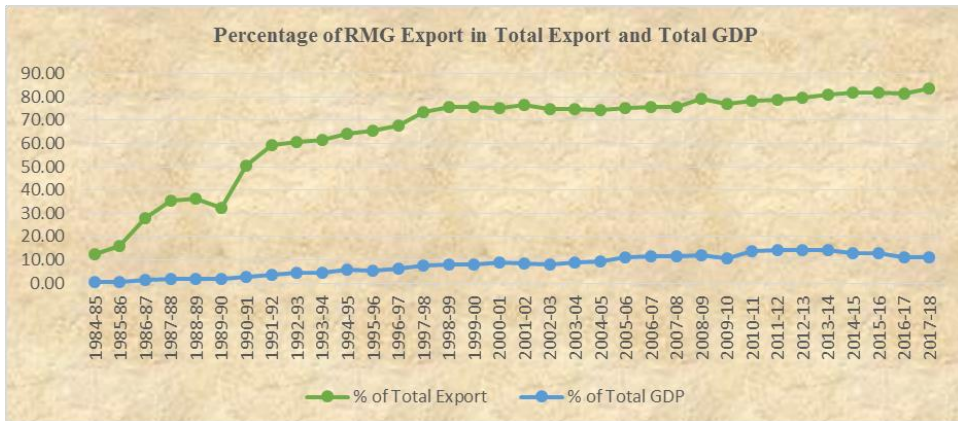
Fig. 4. RMG export as percentage of total export and total GDP.

The Bangladeshi RMG sector is one of the fastest-growing sectors in the Bangladeshi economy, which had 77 % of Bangladesh's total merchandise exports and 8 % of total GDP in 2002 (Fig. 4). In 2010, it became the country's most important industrial sector with about 15 billion US dollars exports; they represent 13 % of GDP and more than 75 % of total exports [18]. The RMG contributed almost 81 % of total export earnings and 14.17 % of total GDP in the fiscal year 2013-14 whereas in 1976 the industry contributed only 0.001 % to the country's total export [2]. Fig. 4 also illustrates that there exists a positive relation of RMG export with total export and total GDP. The more the RMG exports earning, the more will be the total export as well as economic growth. Islam [19] also reported similar findings that the RMG export earnings significantly improves the economic growth rate where Islam et al. [20] only showed a positive association between RMG export and total export.

3.2. *Trend analysis of RMG export*

By using regression analysis methodology, trend models of Ready-Made Garments (RMG) exports during the years 1985 to 2018 are shown in Table 1.

Those fitted trend models for RMG export showed that all estimated coefficients and F-values are significant at 5 % level. For the Semi-log Parabolic Trend model, the value of adjusted R^2 is highest (0.982) among those models, and the value of others model selection criteria such as AIC (-3.544), BIC (2.561) is comparatively lowest for this model. Fulfilling all the model selection criteria, the Semi-log Parabolic Trend model found to be the most appropriate trend model for determining the trend pattern of RMG exports though it presents some correlation in residual analysis and the residuals aren't normally distributed as well as doesn't seem to be constant over time (Fig. 5). A similar study was done by Rahman and Jiban [9], where they found that the semi-log trend model was the best-fitted model for the foreign exchange earnings on garment sectors in Bangladesh.

Table 1. Trend Models of RMG Export.

| Type of models	Estimated coefficients			F-value	R^2	$\overline{R}^2$	AIC	BIC
	β_0	β_1	β_2					
Linear	-6491.47*	877.73*		157.68	0.831	0.826	664.4	668.98
Logarithmic	-12018*	8017		34.42	0.52	0.503	700.08	704.66
Semi-log (growth)	5.57*	0.15*		602.98	0.95	0.948	30.56	35.14
Log linear	3.62*	1.78*		656.1	0.95	0.952	27.83	32.41
Quadratic (parabolic)	2453.81*	-613.16*	42.6*	829.84	0.982	0.98	590.94	597.05
Semi-log parabolic	4.88*	0.27*	-0.003*	873.9	0.983	0.982	-3.544	2.56

*significance at 5 % level
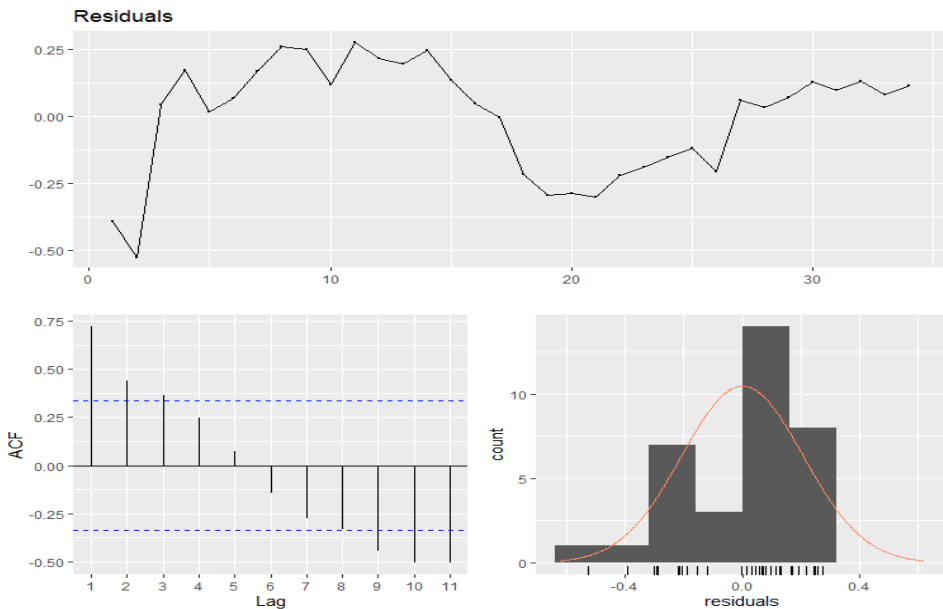
Fig. 5. Residual analysis of fitted Semi-log Parabolic Trend model for RMG Export.

The fitted Semi-log Parabolic Trend model for ready-made garments exports is

$$\log Y_t = 4.8813 + 0.2679\, t - 0.0033\, t^2 \ , \tag{11}$$

where Y_t is the amount of RMG exports (in the million taka) in Bangladesh and t is the time (in the year).

The overall calculation for Semi-log Parabolic Trend with its observed, estimated, and 5 years forecasted values of Ready-Made Garments exports are shown in Fig. 6. It is observed that the RMG exports show an upward trend during the study period. It is also observed that at the financial year 1984-85 the RMG export was only 116.2 million USD, but after 33 years at the financial year 2017-18, the RMG export is remarkable high and it

is 30614.8 million USD. The Semi-log Parabolic fitted line is almost adjacent to the observed line. It is found that in the financial year 2017-18 the fitted value is 27456.88 million USD which is slightly less than the observed value. Using Semi-log Parabolic Trend model the five years forecasted RMG export will be 31712.82 million USD at the financial year 2022-23.
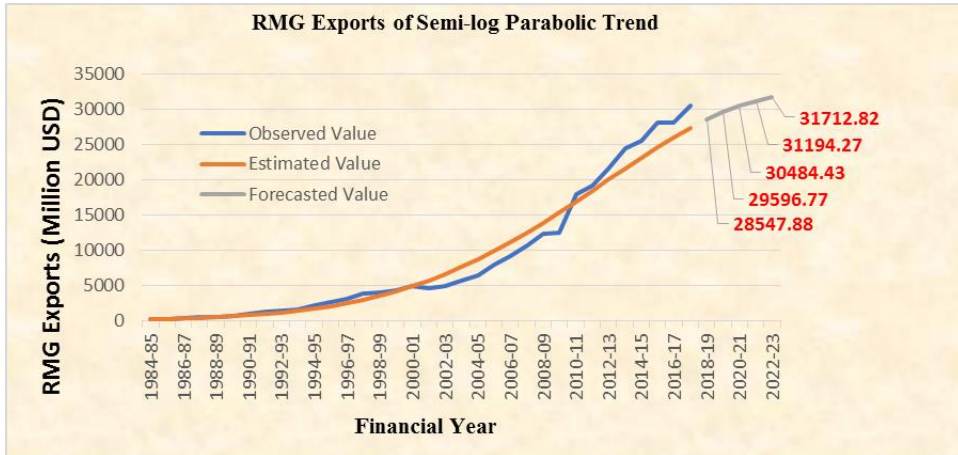

Fig. 6. The observed, estimated and 5 years forecasted value of RMG exports.

3.3. *Growth of RMG export*

A study has been conducted to find the trend of RMG export through the linear trend method of time series analysis by using eleven years (2004-2014) data, and they found that there is a slight difference between observed and estimated values [3]. By applying a linear trend method, another related study showed that there is an increasing trend of number of garments factory, number of workers and RMG exports [7]. Another study has also been done to know the trend of foreign visitors in Bangladesh during the period 1976-2008, where they found that the semi-log trend has been performed better with a growth rate of 5.97 percent per year [21]. The present study reported that the growth of RMG export at the year 2018, 2017 and 2016 is 0.0876 (8.76 %), 0.2 % and 10.21 % respectively which is also showed in Fig. 7. Islam *et al*. [20] also reported a 12.1 % growth rate of RMG export for the financial year 2016-17 which is slightly higher than our findings (10.21 % in 2016-17). The average growth of RMG export is 0.2005 for the years 1985 to 2018 which indicates that the average growth rate of Ready-Made Garments exports is 20.05 % followed by the previous year.
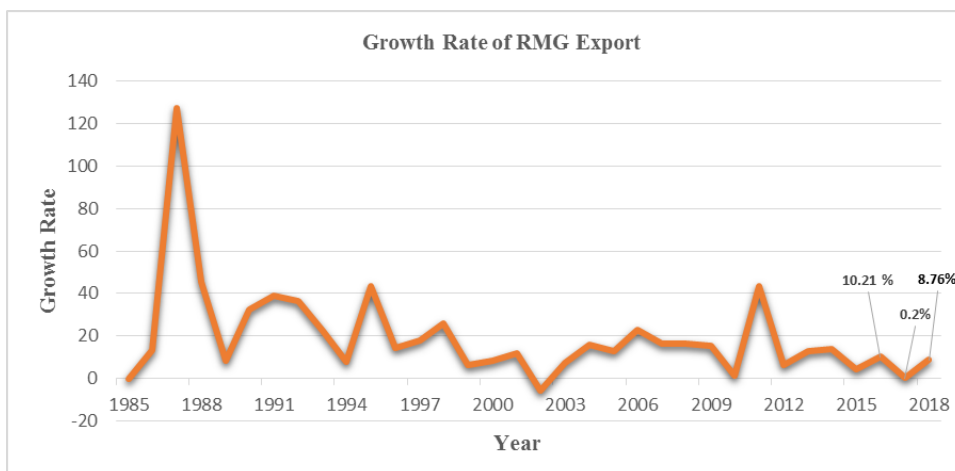
Fig. 7. The growth rate of RMG exports.

4. Conclusion

Time-series data on RMG for the period (1985-2018) have been used to determine the export trend of ready-made garment industry by using different trend models. By fitting several trend models, it is found that the Semi-log Parabolic Trend model is the most appropriate trend model for determining the trend pattern of RMG exports of Bangladesh. The result showed that RMG exports have a significant upward trend for the period 1985-2018, with an average growth rate of 20.05 %. From the empirical results, it also found that the forecasted RMG export will be 31712.82 million USD in the financial year 2022-23. Since RMG industry is termed as the strongest pillar of Bangladesh economy, the findings of the study will help the government and the regulators to get an idea about the future condition of the RMG sector. To be an upper-middle-income country within 2021, a high-income country within 2041 and to eliminate extreme poverty by 2030, Bangladesh now needs to focus on its economic growth where the largest portion mainly based on RMG. But there is a lack of research and practices in this sector especially about the socio-economic condition of garments workers, infrastructure development, perception of buyers (sentiment analysis, a data mining technique can be performed to know which specific product criteria buyers are looking for), what reason buyers changes suppliers each year etc. Therefore, it can be recommended that the Government, Semi-Government, and NGOs should take sufficient initiative to develop this sector for the sustainable economic development of Bangladesh.

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