International Journal of Management, Economics and Commerce
International, Peer Reviewed journal
E-ISSN: **2584-2609**

TOBACCO PRODUCTION AND ITS SOCIO-ECONOMIC IMPACT ON FARM HOUSEHOLDS IN BANGLADESH: A REGIONAL STUDY

Saikat Pande, Rimon Kumar, Jannat Sharmin Moon

Lecturer, Department of Economics, Dhaka International University
saikatpande.eco@yahoo.com

Department of Economics, Islamic University Kushtia, Bangladesh
rimoneco84@gmail.com

Department of Economics, Sheikh Hasina University Netrokona, Bangladesh
moonecon.12@shu.edu.bd

Abstract

Tobacco cultivation has increased in Bangladesh over the past few decades, raising significant concerns due to its economic, environmental, and health impacts on farm households. This study explored the socioeconomic aspects of farmers' lives associated with tobacco production, calculated its costs and benefits, identified determinants of net revenue, and suggested potential improvements for related issues. Primary data were collected using a random sampling technique involving interviews with 420 tobacco farmers through structured questionnaires and face-to-face interactions. The financial analysis of tobacco production in Bangladesh employed cost-benefit and multiple linear regression techniques, while the economic analysis utilized descriptive and inferential statistics. The descriptive statistics reveal that net returns average TK 30,466, with significant variation in production costs, particularly in land use, labor, and processing, highlighting the economic complexities of tobacco farming. The results of the regression analysis show that land use and labor costs significantly impact net returns in tobacco farming. Land costs reduce profits, while labor and processing costs increase them, explaining 76% of the variation in net returns. The analysis indicates a net return of TK 32,050 per bigha, with a profit of TK 71.22 per kilogram of tobacco produced. A majority of respondents believe that tobacco farming reduces soil fertility (49.29%) and requires significant fertilizer (76.19%), while a significant number view it as a lucrative opportunity (85.71%) supported by company encouragement (79.37%). Furthermore, 75.47% perceive tobacco farming as a health risk, with nearly half acknowledging its negative environmental impacts (49.29%). Although tobacco production offers higher profitability, it poses severe health and environmental risks. To mitigate these effects, tobacco companies should pay attention to this fact and provide healthcare subsidies to farmers so that they can contribute positively to the national economy. Thus, farmers will benefit, and our country's economy will improve with production as well.

Keywords: *Tobacco cultivation, Economic impact, Environmental impact, Net revenue, Cost-Benefit Technique*

1. INTRODUCTION

Bangladesh's economy is primarily based on agriculture, the country's most promising and potential sector due to its favorable geographical location, natural environment, and labor-intensive economy (Khatun & Islam, 2019). Agriculture contributes about 20% to the country's GDP and employs around 40% of the working population. It is crucial for achieving macroeconomic prosperity by eliminating unemployment, reducing poverty, ensuring food security, and promoting sustainable development (BBS, 2020; Hossain & Rahman, 2013). While paddy, wheat, jute, pulses, oilseeds, sugar cane, and tea are some of the most widely grown crops in the country, tobacco cultivation has emerged as a lucrative cash crop. Despite concerns about tobacco's health and environmental impacts, Bangladesh is one of the world's leading tobacco-consuming nations, and its production is the largest employment-generating farming sector, providing 0.5% of agricultural employment in the country (Barkat et al., 2012). Additionally, Prasad (2007) evaluated that tobacco is one of the significant cash crops and the return of tobacco production is more attractive than any other crop cultivation. According to The Food and Agriculture Organization Corporate Statistical Database, Bangladesh produces 1.3% of the world's tobacco output. It ranks 12th in the amount produced and 14th in the area under tobacco cultivation, with tobacco grown on around 46,472 hectares of land, yielding 87,628 tons of leaf annually (FAO, 2018).

In the mid-1960s, tobacco cultivation was introduced to Bangladesh, and it was cultivated on land in the Teesta sediment intended for crops in the Rangpur region. Still, its production and cultivation continued to increase after the liberation war in 1971 (Hossain & Rahman, 2013). Tobacco is the third-highest industrial product in Bangladesh after Food Production and Beverages (BBS, 2017). So, there is a vast demand for tobacco products in the market, and the biggest reason for tobacco production is its economic benefit (Hossain & Rahman, 2013). According to Gilmore's (2005) study, tobacco cultivation makes a transformative and radical

change in the Soviet Union's industry.

According to the 2017 GAT survey conducted in Bangladesh, 35.3% of all adults (those aged 15 and over) use tobacco products, with men using it at a rate of 36.2% and women using it at a rate of 0.8%. Twenty-six percent of people use smokeless tobacco (16.2% of men and 24.8% of women). 20.6% of people use smokeless tobacco (16.2% of men and 24.8% of women). Among Bangladesh's impoverished, bidis are cheap, handmade cigarettes that are used by 5.0% of all people and 25.0% of adult smokers. Another GAT poll from 2013 found that 6.9% of youth (13–15 years old) used tobacco in any form (9.2% of males and 2.8% of girls). The current tobacco use rate is 2.9% (boys 4.0%, females 1.1%), and about 5.9% of boys and 2.0% of girls utilize smokeless tobacco products in Bangladesh. As a result, the use of tobacco products among individuals of all ages in Bangladesh is growing, and this rate is fast expanding globally (Nargis et al., 2015). For instance, (Magati, 2019) evaluated that tobacco production offers tobacco farmers high wages and rewarding work that motivates them to be extensively involved in this sector and contribute to the national economy.

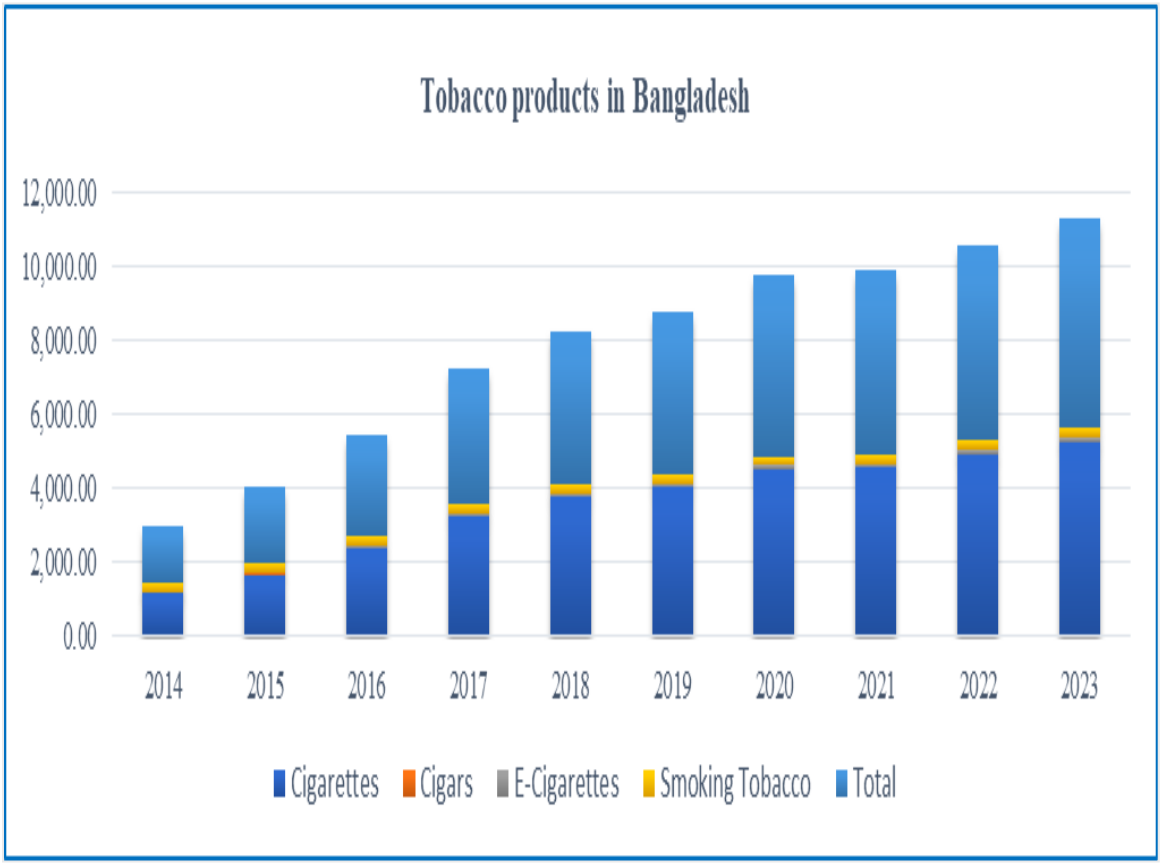

Figure 1. Tobacco products in Bangladesh ($ in millions) *(Source: Statista, 2022)*

In recent years, from 2014 to 2023, there has been an uptick in the growth of tobacco, which has resulted in the invasion of land that is appropriate for the cultivation of food crops (Hossain & Rahman, 2013). Consequently, the number of tobacco products in our country has been expanded arbitrarily and abruptly. According to the Statista Report 2022 (Figure 1), various forms of tobacco products, like cigarettes, E-cigarettes, and smoking tobacco, are developing rapidly in Bangladesh between 2014 and 2023. This report indicates that the total value of tobacco products in 2014 was $1,490 million. However, this number steadily increased briefly and is projected to reach approximately $5637 million by 2023. Figure 2 shows tobacco production in Bangladesh from 2014 to 2023 revealing a pattern of fluctuations, with no consistent growth or decline over the decade. Production saw a significant rise from 84,922 metric tons in 2014 to 94,221 metric tons in 2015, indicating a strong increase. However, this peak was followed by a drop in 2016 to 87,606 metric tons, before slightly recovering to 91,573 metric tons in 2017. From 2020 to 2022, tobacco production showed improvement, increasing steadily from 85,852 metric tons in 2020 to 92,327.72 metric tons in 2022. However, this upward trend was not sustained, as production fell again in 2023 to 86,583.17 metric tons. By way of example, Ochola and Kosura (2017) also highlighted the fluctuations in tobacco production and possible alternative crop cultivation in Kenya. These fluctuations in tobacco production could be indicative of several underlying factors, such as changes in agricultural practices, varying market demand, shifts in government policies, or environmental factors.

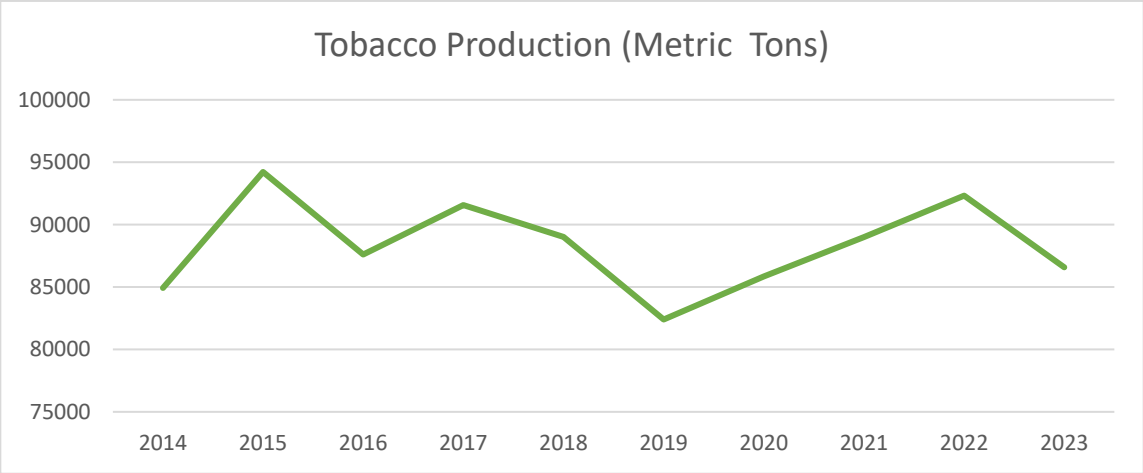

Figure 2. Tobacco Production in Bangladesh (Tons)
Source: Yearbook of Agricultural Statistics from 2014-2023(BBS)

However, the cultivation of tobacco crops spread to many additional regions of Bangladesh, including the Chittagong Hill Tracts (CHT), Rangpur, Jessore, and Kushtia, after the liberation war (Hossain & Rahman, 2013). In addition, the pioneer of the tobacco industry in Bangladesh was the British American Tobacco Company, and they first built the industry in the Rangpur district (Hassan et al., 2015). As a consequence, tobacco production in the country has increased dramatically. When the Bangladesh Agricultural Research Institute (BARI) undertook various research projects on tobacco, farmers in different areas were enthusiastic about tobacco cultivation, which was gaining popularity among them. Rahman & Parvin (2017) investigated that though there is some unethical nature of tobacco farming other, surrounding factors motivate farmers positively in tobacco cultivation. The Bangladesh Bank compiled a study on the situation and prospects were put together by the Bangladesh Bank. This report found that the total tobacco production was 55.000 and 82.00 tons in 2010 and 2019, respectively. The highest tobacco cultivation of 94.000 tons in 2018. Bangladesh's average tobacco production was 82.7 tons from June 2010 to 2019 (Talukder et al., 2020).

Table 1. District Wise Tobacco Production in Bangladesh (*Tons)

Region	**Quantity (*Tons)**
Rangpur	24,300
Kushtia	18,350
Rajshahi	6,000
Pabna	4,000
Magura	2,500
Thakurgaon	2,000
Chuadanga	1,800
Dinajpur	1,400
Meherpur	1,000
Others	3,895

Source: Food and Agriculture Organization (FAO), 2021

Later, through various foreign companies and foreign investment, many tobacco companies were formed in Bangladesh, and under their persuasion, tobacco cultivation started gaining popularity in different districts of the country (Genilo & Sharif, 2015). According to FAO statistics for 2021, Rangpur is the most tobacco-producing district, with 24,300 tons produced during the 2020–2021 fiscal year, followed by 18,350 tons produced in the Kushtia region, 6,000 tons in Rajshahi, 4,000 tons in Pabna, and other districts (Table 1). Among all the districts of Bangladesh, Kushtia district is currently the most popular for tobacco cultivation, mainly due to its land location, tobacco-friendly farming system, and high marginal income from tobacco production (Hossain & Rahman, 2013). That is why tobacco is now the most promising cash crop of agricultural output. The people of Kushtia have successfully cultivated tobacco and become economically prosperous (Rahman et al., 2020). Tobacco cultivation can do more for the sake of our country's development.

Nonetheless, Bangladesh's Ministry of Agriculture is cognizant of the negative consequences of tobacco production. Like, Sahadewo et al. (2020) surveyed Indonesia and found that tobacco production is not profitable for the significant farmers, and

they suffer from poverty and many related problems. Although these effects differ from nation to nation, tobacco growing has several negative repercussions on the environment and tobacco growers (Kutub et al., 2015). This study finds that food-cultivable land rapidly decreases due to increased tobacco cultivation. As a result, Tobacco farming has put more pressure on the environment, energy, and fuel sectors in emerging and poor countries worldwide. In addition, tobacco users were 19% more likely to develop tobacco-related cancer and 57% more likely to develop a tobacco-related illness, such as ischemic heart disease, stroke, COPD, or lung cancer, than non-users. In 2018, the economic cost of tobacco use in Bangladesh was BDT 305.6 billion (Faruque et al., 2019). Another study conducted by the World Health Organization (WHO) depicts that individuals' socioeconomic position was shown to be negatively correlated with tobacco use and the burden of associated diseases. Some studies like (Sansone, 2014) also highlighted the socio-economic repercussions of tobacco cultivation in the health sector. World Health Organization (WHO) research concluded that tobacco regulation would benefit the country, particularly people experiencing poverty (WHO, 2023).

Under the circumstances described above, this study aimed to examine tobacco production's socioeconomic analysis of tobacco production in the Kushtia district. In such a case, the question arises about how economically beneficial tobacco production is to the farmer, what effect this production has on people's health, food production, and the environment and the challenges associated with tobacco production and propose potential improvement solutions.

2. LITERATURE REVIEW

Tobacco farming is regarded as one of the world's most labor-intensive forms of agriculture and provides lucrative work and revenue for tobacco farmers (Magati, 2019). For this reason, farmers are extensively involved in this sector to improve their lifestyles and contribute to the national economy (Hassan et al., 2015). Several studies have been undertaken locally, nationally, and internationally in tobacco cultivation. The literature discusses the socio-economic impacts, health hazards, and environmental issues associated with tobacco cultivation in different regions, such as Bangladesh, India, Indonesia, Kenya, and the former Soviet Union. The studies revealed that tobacco cultivation is often financially beneficial for farmers, but it poses significant health risks and environmental problems.

Sahadewo et al. (2020) surveyed Indonesia and found that most tobacco farmers were middle-aged males and older than the general population. However, almost three-quarters of tobacco farmers were gaining less than half of their earnings from tobacco farming, and the evidence suggests that tobacco production is not profitable for the significant farmers, and they suffer from poverty. Rahman et al. (2020) surveyed 100 tobacco farmers in the Kushtia area with high growth rates to determine tobacco cultivation factors. This paper illuminates' aspects of Bangladeshi tobacco cultivation. A logistic regression model was employed to determine the strongest tobacco cultivation predictors. Land availability, market demand, and farmer education were major tobacco-growing predictors. Farmers with more land and a higher demand for tobacco were more likely to grow it. Lower-educated farmers were likelier to grow tobacco, showing that education may reduce tobacco cultivation. Rahman and Parvin (2017) investigated the ethics and economics of tobacco farming in rural Bangladesh. The study revealed that while many tobacco farmers acknowledged the unethical nature of tobacco farming, they were unwilling to abandon their cultivation. The study also found that fertilizer, pesticides, seeds, labor, company incentives, and land position positively affected tobacco cultivation. Ochola and Kosura (2017) studied tobacco production and possible alternatives in Kenya. They found that tobacco brought the lowest profit per acre compared to other commercial crops, such as passion fruit, watermelon, pineapples, and peppers. The study also revealed that farmers were willing to leave tobacco cultivation and search for other crop production methods that could offer better opportunities for credit to purchase farm inputs and technical assistance. Karim et al. (2016) conducted a study in Kushtia, Bangladesh, and found that tobacco cultivation is economically beneficial but harmful to farmers' health and the environment. The study showed that most farmers were illiterate and involved in tobacco farming, and a significant percentage of them suffered from health problems related to tobacco cultivation. Ali et al. (2015) identified tobacco farming in Bangladesh and its environmental impact. The study was based on primary and secondary data. The study was in the Nilphamari district of Bangladesh. According to the study on tobacco, production is gradually increasing daily. The leading causes of tobacco production were high benefits, ready cash, the tobacco market, and high demand and incentives. Tobacco farming caused substantial environmental damage to the soil and made the ground barren. It also pollutes the air when it is processed and manufactured. The government, however, entirely focused on it and made recommendations, as well as 8.3 of the Article 5.3 Guidelines for government state delegations to the FCTC COP and other related meetings. Genilo and Sharif (2015) studied the tobacco industry's governance and responsibility discourses in Bangladesh. According to the results, the four famous tobacco companies increased their share in the capital market, expanded their needs, and prepared for long-term business capability in the future. Findings also revealed that tobacco companies do not criticize their work and always try to show positive images of their aspects and processes. Set up mission criteria and philosophies that explicitly emphasize the need for economic growth and social development. Hassan et al. (2015) have examined the profitability of tobacco cultivation in the Rangpur district in the socio-economic context of Bangladesh. In this research, 65 farmers were selected using a random sampling method. The study states that most farmers used Virginia types of tobacco and sold it from home. The main problems they faced were lower product prices, price oscillation, a shortage of capital, untenable seeds, a lack of knowledge, higher input costs, etc. Nargis et al. (2015)

investigated the prevalence and patterns of tobacco use in Bangladesh from 2009 to 2012. The study found that overall tobacco usage fell from 42.4% to 36.3% during this period. Exclusive cigarette smoking increased while bidding decreased, and smoking both cigarettes and bidding also fell. Smokeless tobacco usage also decreased, and both smokeless tobacco usage and smoking fell during this period. Sansone (2014) conducted a study on the perceived risk of tobacco products among adult tobacco users in Bangladesh and India. According to the Study in Bangladesh, smokers' perception of the probability of smoking affecting lung cancer was about the same as in India. Almost 30%–45% of smokers were affected by gut lung cancer compared to non-smokers. Hossain and Rahman (2013) found that students were involved in tobacco production in Kushtia District, Bangladesh, and many illiterate people were also involved. A significant percentage of respondents believed that tobacco production pollutes the environment and that the cultivation of tobacco leads to soil infertility. However, despite these concerns, many farmers cultivate tobacco because it is more profitable than other crops. In summary, the literature shows that tobacco cultivation can be economically beneficial for farmers but poses significant health risks and environmental problems. Alternative crops could offer better financial returns and reduce the harmful impact of tobacco cultivation on farmers' health and the environment. The studies also revealed that education and awareness programs are necessary to reduce the prevalence of tobacco use in the population. In India, Prasad (2007) evaluated tobacco cultivation and alternative crops and found that while tobacco is an important cash crop, it is not the only crop that can bring good returns. The study suggested that sugar cane, onion, maize, vegetables, and soybeans under rain-fed conditions could be alternative crops to tobacco, and the cost-benefit ratio of tobacco and alternative crops strongly suggests that the returns are not unattractive for other crops. Gilmore (2005) discussed tobacco and transition to understand the impact of transition on tobacco use and control in the former Soviet Union. This study found that huge investments were made in ten countries and selected regions by the TTC between 1992 and 2000. The collapse of the Soviet Union in 1991 and its transfer from a social economy to capital precipitated considerable changes in the tobacco and industry regions. They introduced the most rapid and unregulated entry of multinational and transnational tobacco companies and the privatization of the tobacco industries. This research experiment examined the Soviet Union's transformation and smoking behavior among the people in the region and the change system in internal tobacco industry documents.

Tobacco production has become a valuable topic for research because of this sector's contribution to generating employment in developing countries like Bangladesh (Hossain & Rahman, 2013). Tobacco cultivation impacts two crucial sectors in every country: the economy and society. Most of the research has only discussed tobacco cultivation and its economic sides (Sahadewo et al., 2020; Rahman et al., 2020; Rahman & Parvin, 2017; Ali et al., 2015; Genilo & Sharif, 2015; Hassan et al., 2015). Furthermore, some research has also highlighted the socioeconomic consequences of tobacco cultivation, particularly in the health sector (Hossain & Rahman, 2013; Karim et al., 2016; Sansone, 2014). However, no studies will discuss tobacco production's economic and social impact on farm households in rural areas of Bangladesh. The district-level study did not discuss the cost-benefit analysis directly affecting tobacco production. For this, we selected the different areas under the Kushtia district to show tobacco production's economic and socioeconomic impacts on the farm household. However, Kushtia is suitable for this study because of the rapidly growing tobacco cultivation. As a result, field research is required to determine the difficulties in tobacco production and to bring opportunities to Kushtia and Bangladesh. The text includes references whenever necessary.

3. MATERIALS AND METHODS

3.1. Data Collection Method

The Kushtia district has been chosen for the study, and this study was carried out in three upazila in that district, namely Mirpur, Daulatpur, and Bheramara. The data were collected through an interview schedule involving 420 respondents from six villages under the three unions from each upazila interested in tobacco production in this village. The study is based on primary data collected using a structured questionnaire. The study's foundation is primary data gathered through the use of a standardized questionnaire. The survey was conducted from January to April 2023. The analysis is separated into two major areas: descriptive statistics and inferential statistics.

Descriptive statistics is used to organize, summarise, and describe data and measure the connection between two or more variables in the study area. It is also used to analyze the frequency, means, standard deviation, etc. Inferential statistics are used to evaluate socio-economic and demographic factors and generalize the results of tobacco farmers in the study area. It is also concerned with an estimation of parameters and a test of hypotheses **(Investopedia,** 2023).

3.2 Sampling Technique and Sample Size

The sampling technique and the sample size are shown in Figure 2. Using purposive sampling techniques, the district and upazila are selected first, followed by Upazilas, using the lottery method three unions and six villages are selected as the study area. Thus, from the three Upazilas, three unions, and six villages, Finally, 420 tobacco farmers were surveyed by taking 70 farmers randomly from each village based on the village-specific paddy farmer list.

When the population is unknown, the sample size is approximately 384 (Cochran, 1977; Israel, 1992; Krejcie & Morgan, 1970). However, in this study, the selected sample size is 420 to follow the chosen method in Figure 3. The data was collected via a standardized questionnaire administered to the tobacco farmer during the face-to-face interview. The survey was conducted from May to July 2023. There were both open-ended and closed-ended data collection questions.

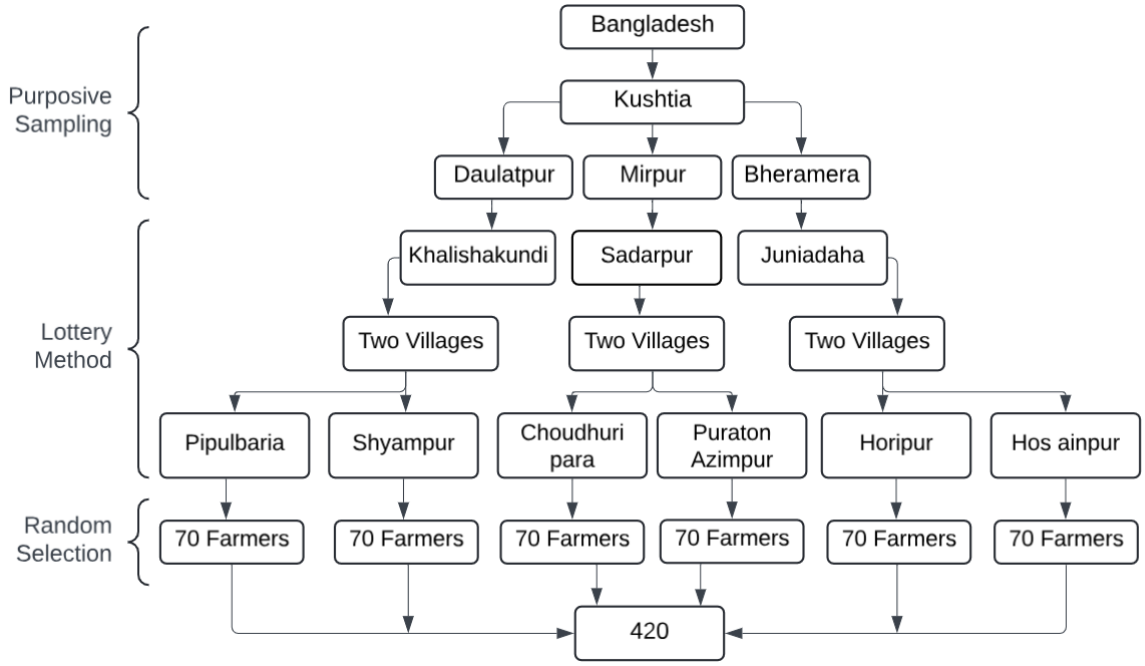

Figure 3: Sampling Framework

3.3 Net Return of Tobacco Farmers

The gross return minus the total production cost determines the net return. The gross return can be computed by multiplying an estimate of the total output by the average price during the harvesting season. It complied with the sum of the amounts of the product (Khan et al., 2005). An equation is used to estimate gross profit.

$GR = \sum QP$

Where,

GR = Gross return (Tk/bigha)

Q = Volume of product (kg/bigha)

P = Average price Product (Tk/kg)

Net return is computed by subtracting the total cost of production from the gross return, where the total production cost is the sum of all variable and fixed costs. (Hassan et al., 2015). In the current research, this equation is used to calculate the net return on tobacco production.

$\Pi = GR - TC\ (TVC + TFC)$

Where,

Π = Net return

GR= Gross return (Total production * per unit price)

TC = Total cost of production

TVC= Total variable cost

TFC = Total fixed cost

3.4 Cobb-Douglas Production Function of the Model and Regression Analysis

The Cobb-Douglas production function model estimates the effects of variables on the net return of betel leaf. For this reason, we consider the Cobb-Douglas type of production function in this study. The study's main objective is to assess whether or not there is a linear relationship between the dependent variable (Net Return) and the independent variables. Regression analysis is one of the most commonly used methods because it provides for the investigation of function relations among variables.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + U_i \quad (1)$$

Taking log on both sides of the Cobb-Douglas production function, it was changed into the following logarithmic form and rewritten as an equation for use with the ordinary least squares (OLS) method:

$$\ln Y = \ln \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + \beta_7 \ln x_7 + \beta_8 \ln x_8 + u_i \quad (2)$$

Where,

lny =Net Return, β_0 = Intercept term, $\beta_{1,2}$……. β_8 = Coefficient, x_1 = Age, x_2 = Education, x_3 = Land use cost, $x4$ = Labor cost, x_5 = Power tiller cost, x_6 = Fertilizer Cost, x_7 = Irrigation cost, x_8 = Processing cost, ui = Stochastic disturbance term

4. RESULTS AND DISCUSSION

4.1 Results from Descriptive Statistics of the Variables

Descriptive statistics show the variables used for estimate and related sample data, such as the respondents' maximum and minimum values, mean, and standard deviation for sociodemographic variables (age, education), as well as economic variables (land use, labor, power tiller, fertilizer, irrigation, and processing cost) in this study.

Table 2. Descriptive Statistics of the Variables

Variable	Minimum	Maximum	Mean	Standard Deviation
Net return	3090	103350	30466	22158.17
Age (Years)	26	71	47.78	9.72
Years of Schooling	0	17	8.65	4.59
Land use cost (TK.)	200	34000	4380.87	3980.15
Labor cost (TK.)	350	10000	1481.33	1160.66
Power tiller cost (TK.)	250	7200	2557	2067.30
Fertilizer cost (TK.)	200	8000	1288.80	961.92
Irrigation cost (TK.)	0	4000	1002	675.76
Processing cost (TK.)	450	34250	6477.47	4875.82

Source: Authors' Estimation, 2023

Table 2 shows that the average net return value is TK.30466, with a maximum net return of TK.103350 and a minimum net return of TK.3090. The average age of the farmers is 47.78, with a lowest age of 26 and a highest age of 71. The average years of schooling of the farmers are 8.65, which means most of the farmers are educated.

According to the table, the average value of land use cost is TK 4380.87, with the minimum and maximum land use costs of TK 200 and TK 34000, respectively. The average labor cost is TK.1481.33, with the minimum and total labor costs of TK.350 and TK.10000, respectively. The average fertilizer and irrigation costs are TK 1288.80 and TK 1002, respectively. Lastly, the mean value of processing costs is TK.6477.47, with the minimum and maximum costs of TK.450 and TK.34250, respectively. The standard deviation of the net return is TK 22158.17. The standard deviations of age, education, land use cost, labor cost, power tiller cost, fertilizer cost, irrigation cost, and processing cost are TK.9.72, TK.4.59, TK.3980.15, TK.1160.66, TK.2067.30, TK.961.92, TK.675.76, and TK.4875.82, respectively.

4.3 Production Cost and Return of Tobacco Production

Production costs may include different types of costs, like labor, raw materials, manufacturing supplies, and general overhead costs (Investopedia, 2023). This variety of production costs is utilized on average so that the number of Product units returned during a given period in our study, the utilization of the per-bigha tobacco production cost, and its return are analyzed in this section (Table 3).

Table 3. Per Bigha Average Cost and Return of Tobacco Production

Cost Item	Unit	Quantity	Price per unit (TK.)	Total value (TK.)
Labor		5	350	1750
Seed	kg	160	20	3200
Fertilizer Cost				
Urea	kg	50	20	1000
MOP	kg	50	17	850
Gypsum	kg	25	26	650
Zn	kg	2.5	200	500
MG	kg	25	120	3000
Boron	kg	2.5	240	600
Pesticide and Weedicide	kg			3000
Direct Operating Costs				
Irrigation	Number	3	250	750
Herbicide	Number	3	350	1050
Power tiller	Number	6	600	3600
Land use	Bigha	1		6000
Processing Cost	Bigha	1		5000
Total, Gross, and Net Return				
Total cost				30950

Production per bigha	kg	450	140	63000
Gross return				63000
Net Return (Gross return – total cost)				32050
Cost per kg				68.78
Profit per kg				71.22

Source: Authors' Estimation, 2023

4.5 Estimation of Coefficient of Multiple Linear Regression Model of Factor Affecting the Net Return of Tobacco Production

The net return of tobacco output and inputs is examined here using the Multiple Regression model. This study uses different factors to explain tobacco production. All the factors that influence this are various and affect the net return of tobacco production in the research region.

Table 4. Estimation of Coefficient of Multiple Linear Regression Model of Factor Affecting the Net Return of Tobacco Production

Variable	Coefficient	St. Error	t	P-value	Tolerance	VIF
Intercept	-1.38	1.563	-0.888	0.37		
ln Age	0.285	0.284	1.003	0.31	0.901	1.11
ln Education	0.082	0.089	0.0992	0.36	0.740	1.352
ln Land use cost	-0.42	0.206	-.206	0.044**	0.150	6.52
ln Labor cost	0.385	0.189	2.039	0.046**	0.300	3.336
ln Power tiller cost	0.214	0.176	1.213	0.230	0.185	5.413
ln Fertilizer cost	-0.12	0.119	-1.085	0.28	0.52	1.92
ln Irrigation cost	-0.04	0.038	-1.134	0.261	0.830	1.205
ln Processing cost	1.17	0.252	4.634	0.000*	0.111	9.004
R^2	0.76					
Adjusted R^2	0.73					
Durbin-Watson D-Statistic	1.646					

Source: Authors' Estimation, 2023 (*1% level of significance, **5% level of significance)

The calculated result indicates that both the land-use and labor costs of production are highly high at p 0.05, with coefficients of -0.424 and 0.385, respectively. This suggests that if the land usage cost of manufacturing rises by TK, the net return falls by TK0.424. In contrast, if labor expenses grow by TK.1, the net return on output increases by TK.0.385. The results also demonstrate that the processing cost of production is positive and significant at P 0.01, with a coefficient of TK 1.17. The data show that when processing costs rise to TK.1, the net return on output rises by TK.1.17. Although the other factors positively influence the net return from tobacco production, this effect is not statistically significant in our model. Furthermore, the age and education of farmers and the cost of power tillers have all had a favorable influence on the net return from tobacco cultivation. However, fertilizer and irrigation expenditures have a detrimental impact on tobacco yield in this scenario.

The value of R^2 is 0.76, indicating that about 76 percent of that variation of the net returnees identified through the model's explanatory variables as a rule of thumb, the residuals are not associated if the Durbin-Watson statistic is around 2, and the permissible range is 1.5 to 2.50. (Alam et al., 2013). In this study, the Durbin-Watson statistic is 1.646. So, there is no autocorrelation problem. Table 4 shows three VIF values are less than 10 (Gujrati, 2003). Thus, the study's empirical findings do not suffer from the multicollinearity problem.

4.6 Respondents' Attitude on Tobacco Cultivation

Table 5. The attitude of Respondents about Tobacco Cultivation

Respondent's Opinion	Yes	No	No Comment
Tobacco farming reduces soil fertility	223	138	59
Tobacco farming requires a significant amount of fertilizer	276	102	42
Chance of a Handsome Amount at a Time	356	25	39
Tobacco Cultivation is Courageous by Company	310	78	32

Source: Authors' Estimation, 2023

Respondents provided varied insights into tobacco farming's effects in Bangladesh. Most believe it reduces soil fertility and requires substantial fertilizer input. Financially, a strong majority see tobacco cultivation as a lucrative income opportunity, suggesting it holds economic appeal for many farmers. Additionally, a large portion of respondents feel that companies encourage

tobacco farming, indicating external influences that support this practice. These perspectives highlight the economic incentives tied to tobacco farming despite environmental concerns.

4.7 Tobacco Farmer Response to the Environmental Impact of Tobacco

Table 6. Tobacco farmer opinion on the environmental impact of tobacco cultivation

	Category	Frequency	Percentage	Cumulative Frequency
Tobacco cultivation negatively impacts the environment	Yes	207	49.29	49.29
	No	162	38.57	87.86
	May be	51	12.14	100

Source: Authors' Estimation, 2023

The analysis of responses from 420 participants reveals several critical insights into the environmental consequences of tobacco cultivation. A significant 63.64% of respondents reported that tobacco cultivation contributes to environmental pollution, while 67.27% indicated it leads to a drastic reduction in soil fertility. Additionally, the study found that tobacco cultivation demands 65.45% more fertilizer than other crops, highlighting its intensive agricultural requirements. Ali et al. (2015) also identified that tobacco farming caused substantial environmental damage to the soil and made the ground barren.

4.8 Tobacco Farmer Response to the Health Impact of Tobacco

Table 7. Tobacco farmer opinion on the health impact of tobacco cultivation

	Category	Frequency	Percentage	Cumulative Frequency
Tobacco farming poses a health risk	Yes	317	75.47	75.47
	No	37	8.81	84.28
	May be	66	15.72	100

Source: Authors' Estimation, 2023

Health risks associated with tobacco farming are a major concern, with 75.45% of tobacco farmers highlighting its adverse effect on health. They reported health issues include cancers (especially lung and skin cancer), skin diseases, respiratory problems, and complications arising from tobacco processing and pesticide exposure as well. Supporting these findings, a study from Brazil by Lopes-Ferreira et al. (2022) discussed the severe impact of pesticides on human health among tobacco farmers, identifying various diseases linked to tobacco cultivation *(Lopes-Ferreira et al. 2022).*

Additionally, the pesticide used in tobacco farming significantly contributes to skin diseases and other health problems, worsening the overall health conditions of agricultural workers. Khan et al. (2008) also noted the detrimental effects of pesticide residues on biochemical markets in tobacco farmers in Pakistan.

4.9 Tobacco Farmer Response to the Economic Impact of Tobacco

Table 8. Tobacco farmer opinion on the economic impact of tobacco cultivation

	Category	Frequency	Percentage	Cumulative Frequency
Tobacco farming is more financially profitable	Yes	293	69.76	69.76
	No	77	18.34	88.10
	May be	50	11.90	100

Source: Authors' Estimation, 2023

Despite its environmental (Ali et al., (2015) and health drawbacks (Karim et al., 2016), tobacco cultivation appears to be economically more advantageous for many farmers. A significant 69.76 percent of participants stated that it is more financially profitable than other crops, making it a lucrative option for those who are involved. Furthermore, 11.90 percent of respondents believe there is a chance of earning a handsome amount of money by cultivating tobacco, reflecting its economic appeal. Moreover, 18.34 percent of tobacco farmers consider by cultivating this crop they are lost. These insights show that tobacco farming offers substantial financial incentives, despite the associated risks, making it an economically viable but environmentally and health-compromising practice.

5. CONCLUSION & DISCUSSION

One of the leading agricultural sectors in Bangladesh is tobacco growing, which raises several challenging issues related to environmental effects, health risks, and economic viability. According to (Hassan et al., 2015), tobacco cultivation offers farmers a pathway to improve their livelihoods, providing a reliable source of income and increasing their living standard. Additionally, the economic significance of tobacco extends beyond individual farmers, playing an essential role through export earnings and domestic consumption, which supports the country's economy significantly. Furthermore, to determine the primary factors of

tobacco farming techniques, Rahman et al. (2020) conducted an extensive survey of 100 tobacco farmers in the Kushtia area, a region well known for its high rates of tobacco growing. The study identified the most critical tobacco predictors using the logistic regression model. The result showed that the decision to cultivate tobacco is primarily influenced by the availability of land, market demand, and farmer's educational attainment. Consequently, this study clarifies the essential factors that push tobacco farming in Bangladesh, providing an advanced understanding of the fundamental incentives and obstacles faced by the industry. Moreover, Hossain and Rahman (2013) thoroughly investigated the socio-economic characteristics of those who engaged in tobacco production in the Kushtia district in Bangladesh. Their investigation revealed that students and adults were actively involved in the tobacco industry, emphasizing the broad participation in this field among many age groups.in addition, the result found that a sizeable portion of the population was illiterate and that tobacco farming was a significant source of income for those with lower levels of education. Additionally, many studies have emphasized the socio-economic consequences of tobacco farming, particularly about health effects (Hossain & Rahman, 2013; Karim et al., 2016; Sansone, 2014). These various research studies have not thoroughly investigated the economic and social effects of tobacco farming in rural Bangladesh. District-level studies did not focus on the cost-benefit analysis directly linked to tobacco production. On the contrary, our paper proposes a multifaceted solution focusing on this matter with supporting regulations, sustainable agricultural methods, and educational programs to help tobacco farmers find a balance between environmental care and financial profit.

5.1 Strengths and Limitations

The study has several strengths. Firstly, it offers a comprehensive analysis of the costs and benefits of tobacco production, including an inventory of all the expenses, such as labor, seeds, fertilizer, and other direct operating costs. This makes it possible to have a clear understanding of tobacco farming aspects. Secondly, descriptive statistics for sociodemographic and economic variables also aid valuable data about the characteristics of tobacco cultivation. Moreover, the multiple linear regression model helps determine the variables influencing the net return of tobacco farming and gives detailed information about diverse profitability. The study also highlights tobacco cultivation's adverse health and environmental impact through data on respondent's attitudes toward these problems. Additionally, it offers practical suggestions for improving tobacco production techniques, ensuring the availability of high-quality seeds, and better irrigation management for boosting productivity.

The study is limited in its generalizability because of its emphasis on Kushtia. It does not deeply explore the educational influences on tobacco cultivation and the particular health impact on farming techniques. It focuses more on economic rather than social issues, and using cross-sectional data may create biases and long-term insights.

5.2 Suggestion & Research Directions

Tobacco is an important and leading staple and cash crop in Bangladesh. Though tobacco production harms farmers' health and the environment, farmers can earn higher profits. Farmers associated with tobacco products in the study area are economically very well off, and socially, their living standards are also increasing daily. The problem is that farmers are not aware of the health problems and environmental problems caused by tobacco production. Because most farmers are illiterate or have lower educational status, it can be easily said that tobacco production is profitable.

Based on the results and analysis of the study, some recommendations may be suggested, which are discussed below:

1. To magnify tobacco production, excellent-quality seeds should be insured, and old seeds should be withdrawn because many farmers use their previous year's sources.
2. To increase tobacco production, fertilizers, and Pesticides should be provided to the farmers on time and at a cheaper rate; the quality of fertilizer and insecticides should be ensured; and the balanced use of fertilizer should be ensured.
3. The availability of irrigation water in times of need and its management are the main reasons for the growth of agriculture. Therefore, adequate measures should be taken to promote irrigation water management.
4. To increase tobacco production, proper guidance should be provided.
5. Institutional credit from tobacco companies should be made available quickly under easy terms. Every farmer should be provided with a selling card to efficiently sell their tobacco at the right price in the right place.
6. To protect tobacco farmers' health, government health incentives should be given to the farmers.

REFERENCES

[1] Lawrence, S. et al. (2001). Persistence of Web References in Scientific Research. *Computer*. 34, 26-31. doi:10.1109/2.901164, http://dx.doi.org/10.1109/2.901164
[2] Smith, Joe, (1999), One of Volvo's core values. [Online] Available: http://www.volvo.com/environment/index.htm (July 7, 1999)
[3] Strunk, W., Jr., & White, E. B. (1979). *The elements of style.* (3rd ed.). New York: Macmillan, (Chapter 4).
[4] Van der Geer, J., Hanraads, J. A. J., & Lupton R. A. (2000). The art of writing a scientific article. *Journal of Scientific Communications*, 163, 51-59
[5] Ali, M. Y., Islam, M. F., Rahman, M. R., Sheema, M. K., & Akhtar, M. R. 2015. Tobacco farming in Bangladesh and its

impact on the environment. IOSR Journal of Environmental Science, Toxicology and Food Technology, 9(12): 27-33. https://doi.org/10.9790/2402-091232733
[6] Bangladesh Bureau of Statistics (BBS). 2017. [Website]. Retrieved from https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/3acbc97e_6ba3_467b_bdb2_cfb3cbbf059f/Voluntary-National-Review-VNR-2017.pdf
[7] Bangladesh Bureau of Statistics (BBS). 2020. Statistical yearbook of Bangladesh (28th ed.). Dhaka: Author.
[8] Bangladesh Bureau of Statistics. 2014-2023. Yearbook of agricultural statistics. Bangladesh Bureau of Statistics. https://bbs.gov.bd/site/page/3e838eb6-30a2-4709-be85-40484b0c16c6/Yearbook-of-Agricultural-Statistics
[9] Barkat, A., Chowdhury, A. U., Nargis, N., Rahman, M., Khan, M. S., Kumar, A., & Chaloupka, F. J. 2012. The economics of tobacco and tobacco taxation in Bangladesh. Paris: International Union Against Tuberculosis and Lung Disease. https://tobacconomics.org/uploads/misc/2019/10/tobacco_taxation_r14102019-1.pdf
[10] Cochran, W. G. 1977. Sampling Techniques (3rd ed.). John Wiley & Sons.
[11] Faruque, G. M., Wadood, S. N., Ahmed, M., Parven, R., Huq, I., & Chowdhury, S. R. 2019. The economic cost of tobacco use in Bangladesh: A health cost approach. Bangladesh Cancer Society. doi: 10.33394/bcs.2018.2484
[12] Food and Agriculture Organization of the United Nations (FAO). 2023. FAOSTAT statistical database. Retrieved April 16, 2023, from http://www.fao.org/faostat/en/#data
[13] Genilo, J. W. R., & Sharif, M. R. 2015. Tobacco industry governance and responsibility discourses in Bangladesh. South East Asia Journal of Public Health, 5(2): 13-22. https://doi.org/10.3329/seajph.v5i2.28308
[14] Gilmore, A. B. 2005. Tobacco and transition: Understanding the impact of transition on tobacco use and control in the former Soviet Union. https://escholarship.org/uc/item/3rw2c04c
[15] Hassan, M. M., Parvin, M. M., & Resmi, S. I. 2015. Farmer's profitability of tobacco cultivation at Rangpur district in the socio-economic context of Bangladesh: an empirical analysis. International Journal of Economics, Finance and Management Sciences, 3(2): 91-98. https://doi.org/10.11648/j.ijefm.20150302.13
[16] Hossain, M. M., & Rahman, M. M. 2013. A socioeconomic analysis on tobacco cultivation in Kushtia District of Bangladesh. Social Sciences, 2(3): 128-134. DOI: 10.11648/j.ss.20130203.14Investopedia. 2023. Descriptive statistics. Retrieved September 20, 2023, from https://www.investopedia.com/terms/d/descriptive_statistics.asp
[17] Israel, G. D. 1992. Determining sample size. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences (IFAS), EDIS.
[18] Karim, R., Nahara, N., Shirinb, T., & Rahmana, M. A. 2016. Study on tobacco cultivation and its impacts on health and environment at Kushtia, Bangladesh. Journal of Bioscience and Agriculture Research, 8(02): 746-753. https://doi.org/10.18801/jbar.080216.89
[19] Khan, D. A., Bhatti, M. M., Khan, F. A., Naqvi, S. T., & Karam, A. 2008. Adverse effects of pesticides residues on biochemical markers in Pakistani tobacco farmers. International Journal of Clinical and Experimental Medicine, 1(3): 274.
[20] Khan, D., Bashir, M., & Zulfiqar, M. 2005. Estimation of Net Returns from Main Crops in District Malakand. Journal of Applied Sciences, 5(9): 1564-1568. https://doi.org/10.3923/jas.2005.1564.1568
[21] Krejcie, R. V., & Morgan, D. W. 1970. Determining sample size for research activities. Educational and Psychological Measurement, 30: 607-610.
[22] Kutub, M. J. R., & Falgunee, N. 2015. Environmental degradation due to tobacco cultivation in Bangladesh: A case study of Doulathpur, Kushtia. Geografia, 11(7).
[23] Lecours, N., Almeida, G. E., Abdallah, J. M., & Novotny, T. E. 2012. Environmental health impacts of tobacco farming: a review of the literature. Tobacco Control, 21(2): 191-196.
[24] Lopes-Ferreira, M., Maleski, A. L. A., Balan-Lima, L., Bernardo, J. T. G., Hipolito, L. M., Seni-Silva, A. C., ... & Lima, C. 2022. Impact of pesticides on human health in the last six years in Brazil. International Journal of Environmental Research and Public Health, 19(6): 3198.
[25] Magati, P., Lencucha, R., Li, Q., Drope, J., Labonte, R., Appau, A. B., ... & Zulu, R. 2019. Costs, contracts and the narrative of prosperity: an economic analysis of smallholder tobacco farming livelihoods in Kenya. Tobacco Control, 28(3): 268-273. http://dx.doi.org/10.1136/tobaccocontrol-2017-054213
[26] Nargis, N., Thompson, M. E., Fong, G. T., Driezen, P., Hussain, A. G., Ruthbah, U. H., ... & Abdullah, A. S. 2015. Prevalence and patterns of tobacco use in Bangladesh from 2009 to 2012: evidence from International Tobacco Control (ITC) Study. PloS one, 10(11): e0141135. DOI: 10.1371/journal.pone.0141135
[27] Ochola, S. A., & Kosura, W. 2007. Case study on tobacco cultivation and possible alternative crops–Kenya. University of Nairobi. http://erepository.uonbi.ac.ke/handle/11295/73253
[28] Prasad, V. M. 2007. Case study of tobacco cultivation and alternate crops in India. In the first meeting of the Ad Hoc Study Group on Alternative Crops, which was established by the Conference of the Parties to the WHO Framework Convention on Tobacco Control. https://www.who.int/docs/default-source/searo/india/tobacoo/india-case-study.pdf?sfvrsn=143f1fae_2

[29] Rahman, H., & Parvin, J. 2017. Ethics and economics of tobacco farming: A case study of rural Bangladesh. IOSR Journal of Humanities and Social Science, 22(2): 56-65. https://doi.org/10.9790/0837-2202045665
[30] Rahman, M. Z., Kabir, M. H., Alam, M. M., & Islam, S. 2020. Determinants of tobacco cultivation in Kushtia district, Bangladesh. International Journal of Agricultural Extension, 7(3): 239-246. https://doi.org/10.33687/ijae.007.03.2977
[31] Sahadewo, G. A., Drope, J., Witoelar, F., Li, Q., & Lencucha, R. 2020. The economics of tobacco farming in Indonesia: results from two waves of a farm-level survey. Chicago, IL: University of Illinois at Chicago. https://www.tobacconomics.org/files/research/654/indonesia-economics-of-tobacco-farming.pdf
[32] Sansone, N. 2014. Perceived Risk of Tobacco Products among Adult Tobacco Users in Bangladesh and India. http://hdl.handle.net/10012/8924
[33] Statista. 2022. Tobacco products in Bangladesh [Statistical report]. Retrieved September 19, 2023, from https://www.statista.com/outlook/cmo/tobacco-products/bangladesh
[34] Statista. 2022. Tobacco Products in Bangladesh: Market Outlook. Retrieved April 16, 2023, from https://www.statista.com/outlook/cmo/tobaccoproducts/bangladesh. https://www.scribbr.com/statistics/descriptive-statistics/
[35] Talukder, A., Haq, I., Ali, M., & Drope, J. 2020. Factors associated with cultivation of tobacco in Bangladesh: a multilevel modelling approach. International Journal of Environmental Research and Public Health, 17(12): 4277.
[36] World Health Organization (WHO). 2023. Tobacco. Retrieved June 8, 2023, from https://www.who.int/news-room/fact-sheets/detail/tobacco