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The relationship of employment in the agricultural sector to electric power consumption, government final consumption, and the democracy index in Bangladesh

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Abstract: Agriculture stands as the cornerstone of Bangladesh's rural economy, sustaining not only food production, but also serving as a primary source of employment for its rural populace. Modernising this sector holds the potential to bolster its expansion, and generate further employment opportunities, thereby fostering rural socio-economic development. The purpose of the study is to examine the impact of electric power consumption, government final consumption expenditure, and the democracy index on employment in the agricultural sector in Bangladesh. Employing a dynamic ARDL model, we examined the short and long run dynamics between agricultural employment and other independent variables, utilising data spanning the period from 1991 to 2022. The findings underscore the pivotal role played by electricity in the growth of employment in agriculture. The study illuminates the nuanced interplay between various factors, revealing that government expenditure positively influences the agricultural sector, while the democratic landscape exerts a negative influence. In light of these insights, the paper advocates for strategic policy measures, emphasising the critical need for the government to prioritise the development of the electric sector, recognising it as a linchpin for sustainable agricultural growth and overall socio-economic advancement. Simultaneously, the study highlights the imperative of fostering a conducive political environment, underscoring its direct correlation with positive changes in the agricultural sector. Through these concerted efforts, Bangladesh can pave the way for a more resilient and prosperous agricultural landscape, contributing significantly to its overarching socio-economic development.

Keywords: employment in the agricultural sector; electric power consumption; government final consumption; the democracy index; Bangladesh.

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INTRODUCTION

In the context of a developing country like Bangladesh, despite efforts to move towards industrialisation, a significant portion of the population remains engaged in agriculture. According to the International Labour Organization (ILO) report of 2022, a substantial 38.3 % of the Bangladeshi people are engaged in the agricultural sector[1]. In Bangladesh, the agricultural sector continues to rely on traditional methods, primarily attributed to limited access to modern technology. The development and effective utilisation of modern agricultural technology are heavily reliant on the availability and accessibility of electricity. Like many others, the Bangladesh government has prioritised the development of the electricity sector as a key national advancement goal. In 2022, Bangladesh achieved a significant milestone by achieving 100 % electrification throughout the country[2]. This achievement holds profound implications for modernising Bangladesh's agricultural sector. The availability of electricity has facilitated the adoption of agricultural machinery and equipment, powering irrigation systems, resulting in increased agricultural productivity, enabling multiple crop harvests in a year, subsequently creating more employment opportunities within the agricultural sector. Moreover, electricity enables a robust telecommunication system, aiding farmers in exploring new and more profitable crops or livestock and providing access to new markets. This diversification not only generates new employment opportunities but also reduces dependency on traditional markets. Additionally, with a population of 165 million people, Bangladesh boasts a large internal market of agricultural products. The availability of electricity has spurred the growth of agricultural processing industries within the country, involving the conversion of raw agricultural products into processed goods such as foods, beverages, and textiles, generating employment across various stages of the production process.

Apart from electricity, government final consumption also directly and indirectly influences increased employment in agriculture. Government final consumption refers to the expenditure by the government on goods and services for final use by households, businesses, and the government itself. The Ministry of Agricultural in Bangladesh, allocates

[1] *Bangladesh: The Employment – Environment – Climate Nexus: Employment and environmental sustainability factsheet // International Labour Organization. 2022. P. 1–8. URL: https://www.ilo.org/publications/bangladesh-employment-environment-climate-nexus-employment-and.*

[2] *Advancement of Power Sector // Bangladesh Power Development Board. 2023. URL: https://bpdb.gov.bd/site/page/64a3fade-c8c4-4dc1-a76a-c42065a849d2/-.*

funds for training and support to grassroots farmers, aiming to enhance agricultural productivity. Additionally, the government provides incentive and subsidies for seeds, fertilisers, machineries, and pest control through specialised banks, like the Bangladesh Agricultural Bank. According to the bank's annual report for 2022–2023, it distributed a loan of 81.9 billion BDT across the country in the agricultural sector[3]. The government's investments in research and development contribute to the adoption of modern and efficient farming practices. Additionally, financial support is directed towards building and maintaining agricultural infrastructure, such as irrigation systems, roads, and storage facilities, providing direct and indirect support to the agricultural sector. This not only improves productivity, but also enhances resilience to natural disasters and market fluctuations. Such investments create a ripple effect, stimulating economic growth, and generating employment opportunities across various stages of the agricultural value chain.

Another vital factor related to the agricultural sector is the democratic situation of the country, as it ensures representation, accountability, and responsiveness to the needs of the farmers and rural community. In a democratic system, farmers and the rural community have the opportunity to elect representatives from their ethnic groups, who understand regional issues, and can advocate for their concerns to the government. For instance, in Bangladesh, where annual floods are common, regionally elected representatives inform the government about these issues, leading to measures such as building levees for flood protection. In this manner, they can help build roads, bridges, and distribute government funds to the farmers for buying fertiliser, seeds, and other necessities. Additionally, democratic governments implement local and international trade policies, ensure societal peace, secure the property of the small-scale farmers, and ensure fair treatment for all. Moreover, democratic institutions provide a platform for rural communities to express their opinions, ideas and participate in the decision-making process, fostering an environment conducive to agricultural innovation, investment, and growth. This contributes to national food security, rural economic development, and overall agricultural advancement. In the context of Bangladesh, this country has undergone substantial changes since 2014, resulting in a shift away from direct public representation through voting. This alteration has resulted in a disconnection between public perspectives and demands, thereby influencing the overall social and economic sectors of Bangladesh.

The above factors, in the author's opinion, may impact employment in the agricultural sector. It motivated me to investigate their potential influence on agricultural employment in Bangladesh. The importance of this research stems from its focus on the socio-economic conditions prevalent in Bangladesh. To foster growth and advancement in the agricultural sector, particularly in creating employment opportunities, an adequate energy supply is essential. Moreover, the allocation of government resources and effective democratic governance in countries like Bangladesh can contribute substantially to enhancing agricultural employment. A crucial aspect of this study is its examination of the effectiveness of these factors within the specific context of Bangladesh, highlighting the necessity of this research. The findings have the potential to address challenges in Bangladesh's agricultural employment sector, by assessing the efficiency of the electricity sector, government expenditure, and democratic performance. If inefficiencies are identified in these areas, the policy recommendations derived from this study could provide viable solutions for developing agricultural employment in Bangladesh.

Previously, the influence of various factors on the growth of employment in agriculture was considered in the literature. For example, a unidirectional relationship has been identified between electricity consumption and agricultural growth in both the long and short term for India [1]. Similar results were obtained from the perspective of Turkey, India, Pakistan, and China [2–5]. Some researchers have explored how electricity can modernise agricultural equipment to increase agricultural productivity and reduce greenhouse gas emissions. The authors [6] conducted a study using solar energy to power agricultural machinery aimed at reducing carbon dioxide emissions and modernising farming methods. Similar research has been done concerning developing countries and Bangladesh [7–9].

In [10] demonstrated how government expenditures and agricultural credit play a role in sustainable agricultural development. The authors use panel data from 31 provinces of China for the period from 2009 to 2021, identifying positive results in the agricultural sector related to government spending and agricultural lending. Similar results were found in research for China and Pakistan, respectively [11; 12]. On the other hand, the authors [13] attempted to show that the democratic situation of a country can contribute to agricultural development. They utilised panel data from 50 African countries over the period of 1995 to 2019, revealing that democratic reforms in those countries facilitated the proper utilisation of natural resources and foreign aid for agricultural development.

While previous research efforts [1–9] have explored the relationship between electricity access and agricultural development in various countries, there remains a significant gap in the literature regarding the quantitative examination of the impact of electricity access on agricultural development in Bangladesh. Existing studies have primarily relied on qualitative perspectives [7], which fail to adequately capture the current social and economic changes and utilise updated data. These studies, however, have acknowledged Bangladesh's commendable progress in achieving universal electricity coverage, and its positive impact on the economic sector, as evidenced by government expenditures [10; 11]. Nevertheless, this represents a notable research gap specifically within the context of Bangladesh.

The purpose of this study is to test the impact of electric power consumption, government final consumption, and the democracy index on employment in the agricultural sector in Bangladesh.

METHODS

We have formulated the following empirical model for our study, aiming to explore the intricate relationship between electricity access, government expenditure, political dynamics, and agricultural employment in Bangladesh.

[3] *Progress in implementation of annual action plan: annual Report 2022–2023 // Bangladesh Krishi Bank. URL: https://www.krishibank.org.bd/wp-content/uploads/2023/10/ANNUAL-REPORT-2022-2023.pdf.*

$$EA = f(EPC, GFC, DI), \quad (1)$$

where *EA* is employment in the agricultural sector;
EPC is electric power consumption;
GFC is government final consumption;
DI is for the democracy index.

To examine the components of our empirical model in equation (1), we collected data on the annual employment report in the agriculture sector (LEA), per capita electric power consumption (LEPC), government final consumption expenditure (LGFC), and democracy index (LDI) for Bangladesh. The data were sourced from reputable databases such as the World Development Indicator (WDI), and Economist Intelligence Unit (EIU). The analysis covers the period from 1991 to 2022. Detailed information about the variables is presented in Table 1.

In order to investigate the role of selected factors on employment in the agricultural sector in the context of Bangladesh, we have utilised several econometric methods to check the validity of our data for analysis, and to conduct the analysis to achieve the results. To begin, we will assess the stationarity of our data using the Augmented Dickey Fuller (ADF) unit root test. This test enables us to discern the stationarity characteristics of the data, determining whether it remains stationary at level *I* (0), exhibits first difference *I* (1), or demonstrates a second difference level *I* (2). Rejecting the null hypothesis of non-stationarity occurs if the unit root test results indicate that the data is stationary at the level or the first difference.

Later, we will perform the bound test to examine the long-term relationship among the variables. If the calculated *F*-statistic value is higher than the upper bound, it suggests that the variables are linked in the long run, while a lower value indicates the opposite. We can formulate our hypotheses for the bound testing as follows:

$$H_0 = \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \sigma_5 = 0;$$

$$H_1 \neq \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq \sigma_5 = 0,$$

where H_0 and H_1 represent the upper and lower bounds, respectively;
σ_1 through σ_5 denote the coefficients representing the long-run relationships among the variables.

Considering these hypothetical facts, the ARDL bound testing equation with *r* independent variable can be represented as follows:

$$\Delta LEA_t = \sigma_0 + \sigma_1 LEA_{t-i} + \sigma_2 LEPC_{t-i} + \sigma_3 LGFC_{t-i} + \\ + \sigma_4 LDI_{t-i} + \sum_{i=1}^{r} \beta_1 LEA_{t-i} + \sum_{i=1}^{r} \beta_2 LEPC_{t-i} + \\ + \sum_{i=1}^{r} \beta_3 LGFC_{t-i} + \sum_{i=1}^{r} \beta_4 LDI_{t-i} + \varepsilon_t,$$

where Δ stands for the first difference of the variables;
σ and β represent the long-run relationship between the variables;
t–i indicates the lag length;
ε_t represents the error term.

In the end, we will utilise the modified dynamic ARDL method presented by Jordan and Philips (2018) to analyse the long and short-run relationships among the variables [14]. For our variables, we can write the Jordan and Philips (2018) ARDL method as follows:

$$\Delta LEA_t = \varphi_0 + \theta_0 LEA_{t-i} + \beta_1 \Delta LEPC_t + \\ + \theta_1 LEPC_{t-1} + \beta_2 \Delta LGFC_t + \theta_1 LGFC_{t-1} + , \\ + \beta_3 \Delta LDI_t + \theta_3 LDI_{t-1} + \gamma ECT_{t-1} + \varepsilon_t$$

where φ, Θ, β, and γ represent the coefficients of the variables;
ECT denotes the error correction term, and ε represent the error.

RESULTS

Firstly, we conducted a normality test to ensure that our sample data are normally distributed. To achieve this, we utilised the logarithm values of our data for descriptive analysis, and the statistical results are presented in Table 2.

Notably, a small standard deviation among the variables indicates the normality of the dataset. Having confirmed

Table 1. *Variables and sources*
Таблица 1. *Переменные и источники данных*

Code	Variable Name	Variable Description	Source
LEA	Employment in the agricultural Sector	Number of people involved in the agricultural sector	WDI*
LEPC	Per capita electricity consumption (in kWh)	Per capita electricity consumption in a year	
LGFC	Government final consumption expenditure	All government expenditures for the purchases of goods and services	
LDI	Democracy Index	An index expressing the quality of democracy on a 0–10 scale	EIU**

*Note. * Source: Data Bank: World Development Indicator, 2023 // The World Bank. URL: https://databank.worldbank.org/source/world-development-indicators.*
*** Source: Democracy Index 2022 // Economist Intelligence. URL: https://www.eiu.com/n/campaigns/democracy-index-2022.*

Table 2. *Result of the descriptive statistic*
Таблица 2. *Результаты описательной статистики*

Variable	Observation	Mean	Standard Deviation	Min	Max
LEA	32	16.996	0.076	16.786	17.074
LEPC	32	5.171	0.679	3.920	6.140
LGFC	32	22.579	0.563	21.687	23.552
LDI	32	1.816	0.071	1.692	1.931

Note. LEA is employment in agricultural sector; LEPC is per capita electric power consumption; LGFC is government final consumption expenditure; LDI is democracy index.

Примечание. LEA – занятость в сельскохозяйственном секторе; LEPC – потребление электроэнергии на душу населения; LGFC – государственные расходы на конечное потребление; LDI – индекс демократии.

the normality, we checked the stationary status using the ADF root test. Table 3 illustrates that our data are stationary at level or in the first difference.

Additionally, we performed ARDL bound test approaches, as presented in Table 4. According to the bound test approach, our *F*-statistic value is 5.672, exceeding the upper bound values at a 1 % significance level, indicating co-integration between the variables.

Subsequently, we employed the dynamic ARDL method to examine the short and long-run relationships among the variables, and the outcomes are outlined in Table 5. As per these findings, our initial variables, per capita electricity consumption (*LEPC*), and government final consumption expenditure (*LGFC*), exhibit positive significance at the 5 % and 1 % levels in the long run, respectively. Conversely, the democracy index (*LDI*) demonstrates negative significance in the long run from the perspective of Bangladesh.

DISCUSSION

Historically, Bangladesh's agricultural sector relied solely on natural blessings and lacked modern technology, hindering farmers' ability to maximise productivity. However, with the advancement of electricity, Bangladeshi farmers are now leveraging modern technology in the agricultural sector, leading to heightened agricultural productivity. Furthermore, the expansion of the electricity infrastructure has improved the nationwide telecommunication network, benefiting people of all classes. Additionally, government expenditures, such as the development of transportation systems, provision of training and support to farmers, and offering incentives, have empowered farmers to enhance productivity and access markets beyond their regions. Although the establishment of electricity access and communication connectivity took time, in the long run, it significantly benefited the agricultural sector in Bangladesh. Based on the results, it is evident that electricity access and government final consumption expenditures, contribute to an increase in agricultural employment, particularly in the context of Bangladesh. These findings are consistent with similar results reported by Oluwasola et al. (2020), Nitin (2020), and Rashid and Lei (2023) for Sub-Saharan countries, India, and China respectively [10; 16; 17].

On the contrary, the democracy index exhibits negative significance in the long term for Bangladesh. During significant periods, Bangladesh was governed by dictators and under their rule, public policies failed to improve the standard of living for the people. Although Bangladesh is currently considered a democratic country, in the past three general elections, Bangladeshi people couldn't fully exercise

Table 3. *Unit root test of the data set*
Таблица 3. *Тестирование единичных корней набора данных*

Variable	Level ADF	Δ ADF
LEA	−1.116***	0.114
LEPC	−1.015***	0.002
LGFC	−0.732*	−0.062**
LDI	−1.187***	0.314**

*Note. The symbols *** and ** signify the rejection of the null hypothesis of no unit root at the 1 and 5 % significance levels, respectively.*

*Примечание. *** и ** – отклонение нулевой гипотезы об отсутствии единичного корня на уровнях значимости 1 и 5 % соответственно.*

Table 4. *Approach to bounds test coined by Pesaran, Shin, and Smith [15]*
Таблица 4. *Метод граничных значений Песарана, Шина и Смита [15]*

		10 %		5 %		1 %		*p*-value	
K		*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)
F	5.672	2.72	3.77	3.23	4.35	4.29	5.61	0.000***	0.000***

Note. The upper and lower critical bounds are denoted by I(0) and I(1) at 10 %, 5 %, and 1 % significance level.
Примечание. Верхние и нижние критические границы обозначены как I(0) и I(1) на уровнях значимости 10, 5 и 1 %.

Table 5. *The result of dynamic ARDL simulation*
Таблица 5. *Результаты динамического авторегрессионного моделирования с распределенным запаздыванием*

Variables	Long run test		Short run test	
	Coefficient	Prob.	Coefficient	Prob.
LEPC	0.068** (0.031)	0.037	−0.019 (0.056)	0.731
LGFC	0.113*** (0.032)	0.001	−0.085 (0.088)	0.342
LDI	−0.128* (0.134)	0.081	0.197 (0.155)	0.216
Error correction coefficient	−0.582*** (0.153)	0.001		
R^2	0.554			
N	31			

*Note. ***, **, and * indicate the value of 1, 5, and 10 % significant levels; the values inside the parentheses are standard errors.*
*Примечание. ***, ** и * – значения уровней значимости 1, 5 и 10 %; значения в скобках – стандартные ошибки.*

their voting right. Additionally, due to the lack of a stable political situation between political parties, tension persists in Bangladeshi society. Furthermore, wrong government policies, corruption, and the inability to implement rules and regulations have resulted in improvements in the economic situation for a specific segment of society, rather than benefiting the overall population. In the long run, this situation negatively impacts the overall economic situation of Bangladesh, including the agricultural sector, causing hardship for both farmers and consumers. Similar conclusions were drawn by Zidouemba (2017) in a study spanning 111 developing nations and by Ang et al. (2018) from a global perspective [18; 19].

By employing rigorous quantitative methodologies and up-to-date data, we aim to provide a comprehensive understanding of the relationship between electricity access and agricultural development in Bangladesh, taking into account the role of government fiscal policies and the democratic landscape. Through this research, we aspire to contribute to the existing literature and offer valuable insights for policymakers, stakeholders, and researchers working towards sustainable agricultural development in Bangladesh.

CONCLUSION

Our findings underscore the significant impact of improved access to electricity and increased government final consumption expenditures on enhancing the agricultural sector, thereby creating expanded employment opportunities in Bangladesh. Conversely, an unstable political situation is identified as a factor contributing to reduced employment in the agricultural sector. Effective policies and increased access to electricity emerge as crucial drivers for fostering the development of the agricultural sector, thereby addressing the unemployment challenge in Bangladesh. It is imperative for policymakers to prioritise initiatives aimed at enhancing the electric sector and improving the democratic situation, as these efforts can foster progress across the entire socio-economic landscape of the country.

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Связь занятости населения в сельскохозяйственном секторе с потреблением электроэнергии, конечным государственным потреблением и индексом демократии в Бангладеш

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Аннотация: Сельское хозяйство служит основой сельской экономики Бангладеш, не только обеспечивая производство продуктов питания, но и являясь главным источником занятости для сельского населения. Модернизация этого сектора потенциально может способствовать его расширению и созданию дополнительных возможностей трудоустройства, тем самым стимулируя социально-экономическое развитие сельских районов. Цель исследования – изучение влияния потребления электроэнергии, государственных расходов на конечное потребление и индекса демократии на занятость в сельскохозяйственном секторе Бангладеш. Используя динамическую авторегрессионную модель с распределенным запаздыванием, мы изучили краткосрочную и долгосрочную динамику взаимосвязей между занятостью в сельском хозяйстве и другими независимыми переменными на основе данных за период с 1991 по 2022 год. Полученные результаты подчеркивают ключевую роль доступности электроэнергии в росте занятости в сельском хозяйстве. Продемонстрированы нюансы взаимодействия различных факторов, показано, что государственное финансирование положительно влияет на сельскохозяйственный сектор, в то время как демократический ландшафт оказывает отрицательное влияние. На основании этих выводов предлагается принять соответствующие стратегические меры, подчеркивается острая необходимость того, чтобы правительство отдавало приоритет развитию электроэнергетического

сектора как важного элемента устойчивого сельскохозяйственного роста и общего социально-экономического развития. Обоснована необходимость создания благоприятной политической среды, показана ее прямая корреляция с позитивными изменениями в сельскохозяйственном секторе. Благодаря согласованным усилиям Бангладеш может проложить путь к более устойчивому развитию и процветанию сельского хозяйства, внеся значительный вклад в его социально-экономическое развитие.

Ключевые слова: занятость в сельскохозяйственном секторе; потребление электроэнергии; конечное государственное потребление; индекс демократии; Бангладеш.

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