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Implication of educational reforms on agrarian labour: The case of free SHS on maize farms in Ghana

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ABSTRACT
This paper examined how Ghana's Free Senior High School Policy affects labour availability on maize farms in Ghana. Using survey data from 550 maize farming households, the study employed descriptive statistics and a Tobit regression model to construct a measure of the severity of labour constraints and to classify maize farming households along a continuum from severe to low labour scarcity. The analysis further explored how household and farm characteristics influence the severity of labour shortages during critical periods of the production cycle. The research also identifies other key causes of labour severity among maize farming households. The results revealed a significant labour scarcity challenge for maize farmers, particularly during planting and harvesting periods, due to increased student enrolment under the free SHS. The Tobit regression analysis indicated that key socio-economic factors, such as household size, farm size, the number of household members enrolled in SHS, and access to extension services, significantly influence the severity of labour scarcity among maize farming households. These findings suggest that education reforms that expand secondary enrolment can unintentionally reduce the supply of family labour to smallholder agriculture. The findings underscore the potential of mechanization and labour-efficient technologies as interventions to alleviate the impact of labour scarcity on agricultural production.

Contribution/Originality: This study fills the literature by providing a comprehensive investigation of how Ghana's free secondary education reform affects on-farm labour in maize farms in Ghana. It documents and quantifies the effect of Free Senior High School on measured labour demand and supply gaps among maize households using a Tobit model.

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1. INTRODUCTION
Agriculture is the primary source of sustenance for millions of people worldwide and, in the case of Ghana, it caters to the food and economic needs of both rural and urban households. It plays a pivotal role in the sustainable development of Ghana's economy, employing approximately 34% of the active labor force, as reported by Ferreira,

Almazán-Gómez, Nechifor, and Ferrari (2022). Maize, being one of the most important crops grown within the agricultural sector, accounts for about 50–60% of total cereal production in Ghana and is the key staple crop in the country (Obour, Arthur, & Owusu, 2022). It has played an increasing and diverse role in the nation's agri-food systems.

The Ministry of Food and Agriculture (MoFA) (2021) reports that the distribution of the labour force by economic activity in Ghana is as follows: agriculture (33.7%), industry (23.4%), and services (42.9%). Labour productivity is an important aspect of all agricultural production and can affect farming outcomes positively or negatively. More than 82.5% of rural folks in Ghana rely on primitive farming methods, mostly depending on household labour, resulting in inefficient production processes and low output (Ghana Statistical Service, 2014). In recent times, the decline in agricultural labour due to high rural-urban migration rates, poor working conditions, and the seasonal nature of production has been a serious concern. Additionally, the introduction of the Free Senior High School (SHS) policy, a flagship government initiative aimed at providing free and accessible secondary education to all, has been speculated to have further contributed to the decline of on-farm labour.

The Free SHS policy was implemented in 2017 to provide free and accessible secondary education. This resulted in a substantial increase in enrollment, particularly in rural areas (Ministry of Education Ghana, 2022). Compared to the pre-policy year of 2016/17, with 362,775 students enrolled, there was a significant rise to over 432,954 in 2018 and 404,851 in 2019. In subsequent years (2020 to 2022), enrollment increased from 425,397 to 463,453 students. Estimates indicate that this trend has continued, with approximately 1.2 million students benefiting from the Free SHS policy by the end of 2024. This data underscores the policy's effectiveness in expanding access to secondary education (Free SHS Secretariat, 2023). While this has undoubtedly expanded access to education and positively impacted human capital development, it has raised concerns about its unintended consequences on agricultural labour availability. As more young people opt for schooling in place of contributing to on-farm labour, this tradeoff can potentially result in a shortage of labour in the agricultural sector, affecting crop production. Though both public and private investments in education are vital, Dzanku and Tsikata (2022) contended that there are significant opportunity costs related to the labour market at the household level, especially in developing nations where agricultural production is still primarily done by manual labour. As such, our main contention is that despite the necessity of public investments in education in the form of the free SHS Policy, such investment may come with significant opportunity costs related to the labour market, especially at the rural household level.

Based on the ensuing developments, this study seeks to investigate the effect of the Free SHS initiative on farm labour supply and its implications for maize farming in Ghana. To understand how the increased student enrollment due to the Free SHS can affect on-farm labour availability, the study further analyzes farmers' perceptions of the FSHS and its short-term and long-term effects on farm labour supply in rural areas. Following Shyamalie et al. (2020), the extent of labour severity in maize farming and its underlying causes are assessed. This study also adopts labour demand-supply gap analysis to investigate labour severity rates and employs the Tobit regression model to analyze relevant factors influencing labour severity in maize farms. By addressing these objectives, the research aims to shed light on the dynamics of labour severity in the context of the Free SHS policy and its implications for agricultural production activities in Ghana.

2. LITERATURE REVIEW

Maize cultivation in Ghana dates to the late 16th century and has been a crucial staple crop in the southern regions (Darfour & Rosentrater, 2016). It is hardly mechanized and relies on unskilled labour, leading to low productivity (Ministry of Food and Agriculture (MoFA), 2020). Thus, any policy that may hinder the already constricted labour force in the industry may further jeopardize its output gains. In rural Africa, including Ghana, the adoption of labour-saving and productivity-boosting technologies is low (Dzanku & Tsikata, 2022). Smallholder farmers depend heavily on household labour due to the lack of off-farm employment and schooling opportunities. Family labour, once central to these farms, is diminishing due to factors such as rural-urban migration, the decline of polygamy, and rising school attendance (Johnson & Perry, 2005; Twum-Baah & Nabila, 1995). As a result, smallholders increasingly rely on hired labour, which impacts the cost of crop production (Prabakar, Devi, & Selvam, 2011).

The Free Senior High School (FSHS) policy, implemented in September 2017, has sought to expand access to education in Ghana by eliminating fees and providing learning materials, thereby reducing the financial burden on families. This initiative aligns with international objectives, such as the United Nations' Sustainable Development Goal 4, which promotes equitable and quality education for all. Since its inception, the FSHS policy has been credited with increasing enrollment, particularly among disadvantaged groups, growing by over 1.2 million between 2017 and 2023 (Free SHS Secretariat, 2023). The policy has been instrumental in encouraging students to pursue tertiary education and professional careers, thereby expanding the labour market in non-agricultural sectors (Duflo, Dupas, & Kremer, 2021). The influx of educated individuals into the labour market, particularly the public sector, has contributed positively to the country's development, while also alleviating the financial burden on parents (Adu-Ababio & Osei, 2018).

However, the FSHS policy may have unintended consequences on the agricultural labour market. It has heightened the aspirations of young people to pursue non-agricultural careers, further reducing the availability of labour for farming activities. Evidence suggests that educated individuals are less likely to engage in farm work, and this shift from agriculture has had negative effects on farming (Jolliffe, 2004; Sumberg, Yeboah, Flynn, & Anyidoho, 2017). This is compounded by labour shortages in agriculture, which lead to lower productivity, increased production costs, and higher consumer prices. Despite the potential of education to enhance agricultural production, particularly through improved labour efficiency, the immediate effect of the FSHS policy may have negative consequences on the

availability of labour for smallholder farms (Dzanku & Tsikata, 2022). Recent studies suggest that while education plays a role in improving productivity in agriculture, its effect is often mixed in developing countries. According to Dunham, Arunatilake, and Perera (1997), more educated and politicized youth often shun farm employment due to the stigma associated with it, harsh working conditions, and traditional management practices. Yang (2004) and Jolliffe (2004) also found that free secondary education improved agricultural productivity in Asia. However, in Ghana, the effect of education on occupational choices tends to pull individuals away from agriculture, negating any positive productivity effects. Abraham, Ohemeng, and Ohemeng (2017) and Sackey (2005) have both demonstrated that education significantly influences occupational decisions and labour market participation, particularly for women. Yet, the inconsistency remains; although higher education levels contribute to the broadening of the labour market in non-agricultural sectors, they concurrently worsen labour shortages in agriculture, which remains critical for livelihoods in rural Ghana.

This duality highlights the complex nature of balancing educational advancements with the agricultural labor needs of the country. While policies like the FSHS enhance long-term national development through increased human capital in the public sector, they also risk undermining agricultural activities, which are essential for food security and rural economic stability.

3. MATERIALS AND METHODS

3.1. Theoretical and Conceptual Framework

The theoretical underpinning of this study encompasses a key concept crucial for understanding the dynamics of labour severity in the context of education and agricultural production. At the heart of this framework is the theory of labour utilization rate, a theoretical construct examining the effectiveness of a workforce's allocation of labour. Drawing from neoclassical economic theory, individuals make rational choices about labour market participation and non-market activities to maximize utility. In rural contexts, such as farm households, the allocation of time between on-farm and off-farm work becomes pivotal. The labour utilization rate framework assesses factors influencing labour supply decisions, encompassing off-farm opportunities, wages, education, and household characteristics. This framework contributes to understanding how labour resources are optimally employed and can be enhanced. Additionally, the framework delves into labour demand-supply gap analysis, shedding light on the intricate dynamics of labour markets.

Labour, a pivotal production factor, engages both the demand side, comprising companies and institutions, and the supply side, represented mainly by households. The labour demand-supply gap evaluation considers factors such as population trends, remuneration, and macroeconomic product demand. In this study, the analysis involves assessing seasonal labour requirements against the available labour pool for farming, and as such, the severity of labour shortage is quantified as a percentage (Shyamalie et al., 2020). This framework provides a comprehensive view of labour shortages or surpluses and their implications for agricultural activities. By incorporating this theoretical element, the current study aims to investigate the effect of the Free Senior High School (FSHS) policy on labour severity in Ghana. While examining the intricate relationships between labour utilization rates and labour demand-supply dynamics, this research seeks to illuminate the potential consequences of the FSHS initiative on labour availability and agricultural activities. This comprehensive framework offers a structured approach to understanding and addressing the complexities of labour severity within the agricultural sector, particularly the maize industry.

Conceptually, this study adopts a framework that acknowledges the complex nature of educational reforms and their potential impact on the educational system and agricultural activities. Figure 1 illustrates how the Free SHS policy, introduced as an educational reform, leads to intended social, economic, and psychological effects that ultimately generate an unintended outcome on farm labour availability. The framework illustrated in Figure 1 recognizes that educational reforms are often implemented to achieve specific intermediate consequences, such as improving student achievement, enhancing teacher effectiveness, or promoting equity in educational opportunities (Gabriel & Allington, 2012; Khavenson & Carnoy, 2016).

The conceptual framework also acknowledges that these reforms may not always unfold as intended, leading to unintended outcomes. This notion aligns with the findings of numerous scholars who have explored the unintended consequences of educational policies and reforms (Bleiberg, Brunner, Harbatkin, Kraft, & Springer, 2025; Lewis & Lewis, 2008). The conceptual framework serves as a guiding structure for the study, allowing for the exploration and examination of both the intended intermediate consequences and the potential unintended outcomes on agricultural activities resulting from the implementation of educational reforms. The free SHS policy's intended outcome was to increase student enrollment by abolishing secondary fees. This can lead to a more educated and skilled workforce in the long term.

The Free SHS Policy in Ghana could have unintended consequences of reducing the availability of on-farm labour in rural areas. With more students staying in school, there may be fewer of them available to help on the farms. This could negatively affect agricultural production in Ghana, which is already facing challenges due to its dependence on unmechanized labour. By embracing this framework, the research aims to provide a comprehensive understanding of the reform process, shedding light on the intricate interplay between policy intentions, implementation realities, and the multifaceted nature of educational systems (Gabriel & Allington, 2012).

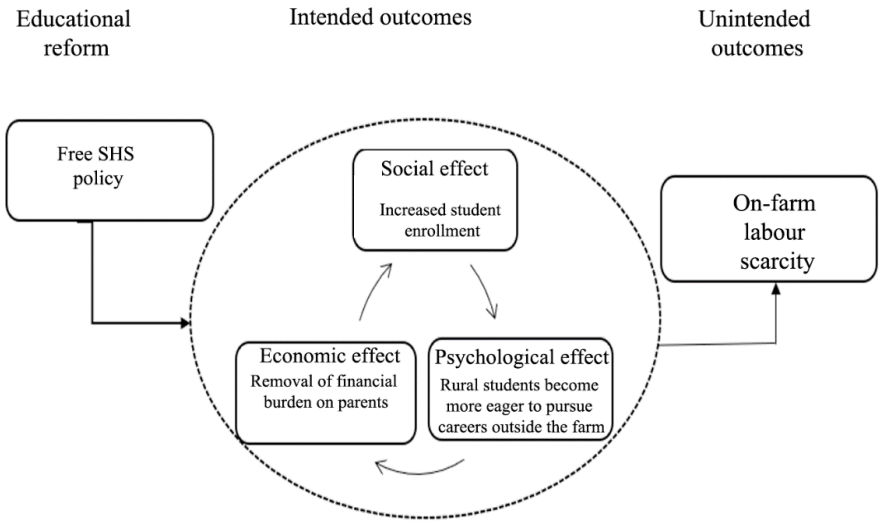

Figure 1. Conceptual framework.
Source: Modified from Pham, Schlander, Eckford, Hernandez-Villafuerte, and Ubels (2023).

3.2. Analytical Procedure

3.2.1. Descriptive and Perception Concepts

To analyze respondents' characteristics, descriptive statistics were used to summarize the data through frequency distributions. To better understand the effects of the Free Senior High School (SHS) policy on labor supply for agriculture, a survey employing a 5-point Likert scale was conducted (Onumah, Al-Hassan, Ocran, & Béné, 2023). This scale included options such as (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5= strongly agree), allowing farmers to express their perceptions of how the Free SHS policy has affected labor availability for production activities. Perception questions on the contributory factors of labor severity were also ranked on a 5-point scale (1= very important, 2= important, 3= neutral, 4= somewhat important, and 5= not important). The responses were categorized into four potential causes: "FSHS" (Free SHS), "High Mortality Rate," "Labor Migration," and "Low Wages." The collected qualitative data on perceptions were analyzed using means, rankings, and bar charts to provide a descriptive assessment of the relationship between the Free SHS policy, its effect on labor availability for agricultural activities, and possible contributory factors to overall labor severity in rural areas.

3.3. Labour Severity

A detailed examination of labour scarcity was essential to understand its severity and the contributing factors. The analysis started by identifying the overall labour severity rates through an evaluation of the gap between labour demand and supply. The seasonal labour requirement (demand) and available seasonal labour (supply) were determined for maize farms. The demand-supply gap, representing shortages or excesses of labour, was then calculated. This gap was further expressed as a percentage of the total labour required for each farm, yielding the severity rate. This is expressed as:

Demand and Supply Gap = labour required − Labour available

Whereby,

- Total Labour Required = Annual or Seasonal Labour Requirement (Demand for Labour).
- Labour available = Annual/seasonal man-days available (Supply of labour).

The severity rate is calculated by expressing the demand-supply gap as a percentage of the labour required for each farm.

$$Labour\ Severity\ (\%) = \frac{Demand\ Supply\ gap}{total\ labour\ requirements} \times 100 \quad (1)$$

3.4. Determinants of Labour Severity

The Tobit regression was used to ascertain the socio-economic factors that influence the level of severity of labour shortages. The Tobit model, also known as the censored regression model, is used in cases where the dependent variable is censored. That is, for some observations, either the dependent variable is not fully observed or only within certain limits. The Tobit model is appropriate in cases where the dependent variable has a level of censoring, such that it cannot be less than a certain value or is observed only if it exceeds some threshold.

In analyzing factors that influence labour severity, the Tobit model can be specified as follows

$$LS_i^* = X_i\beta + \epsilon_i, \epsilon_i \sim N(0, \sigma^2) \quad (2)$$

The observed dependent variable, $LS_i^*$is defined as:

$$LS_i^* = \begin{cases} y_i^* & \text{if } y_i^* > \tau \\ \tau & \text{if } y_i^* \leq \tau \end{cases} \quad (3)$$

Where:

- LS_i^* is the latent, or unobserved, dependent variable.
- X_i refers to the vector of independent variables, including the intercept.

- β is a vector containing coefficients to be estimated.
- $\epsilon_i$is the error term, normally distributed with mean zero and variance σ2.

Here, τ denotes the threshold or point of censoring; τ = 0 if the variable is censored at zero.

LS_i^* (Latent Variable): This represents the true underlying labour severity that could potentially be observed.

The use of the Tobit model in analyzing agricultural labor issues has been widely adopted in the literature, as it effectively handles the censored nature of dependent variables (Mazibuko & Antwi, 2019). This approach is particularly appropriate when the dependent variable represents a limited range, such as labor severity rates bounded between 0 and 100. Furthermore, the Tobit model accounts for potential bias that may arise from omitting observations with a value of zero for the dependent variable, a common issue in labor market studies (Arabmazar & Schmidt, 1982; Heckman, 1979). By incorporating both the intensive and extensive margins of labour severity, the Tobit model provides a more comprehensive understanding of the determinants influencing the severity of labour shortages (Moffatt, 2005; Wooldridge, 2010). The Tobit regression model used in this paper is operationalized as:

$$LS_i^* = \beta_0 + \sum_{j=1}^{10} \beta_j X_{ji} + e_i \qquad (4)$$

Where,

LS_i^* ➔ Labour Severity, X_1 ➔ Education, X_2 ➔ Age, X_3 ➔ Gender, X_4 ➔ Experience, X_5 ➔ Household Size, X_6 ➔ Num_Labour_SHS (Number of household on-farm workers that are SHS students), X_7 ➔ Farm Size, X_8 ➔ Farm Machinery, X_9 ➔ Household dependency ratio, X_{10} ➔Access to extension services.

The study used very important variables to evaluate labour severity in maize farming households. These include education level, measured and operationalized as the number of years of formal education by the household head. The age of the household head is measured in years at the time of data collection. Gender is treated as a binary variable, where 1 = male and 0 = female. Experience is captured as the total years of farming experience. Household size was measured as the number of household members, including individuals within and outside the immediate family structure who live together and may contribute to household activities. Num_Labour_SHS is one of the key variables of interest and was measured as the number of senior high secondary (SHS) students from the household who are potential on-farm labourers. This variable is crucial as it captures the direct effect of the Free SHS policy on labour severity. Farm size, measured in hectares, represents the area under maize cultivation. Farm machinery was measured as the value of machinery used on the farm, expressed in Ghana cedis. The household dependency ratio compares the number of dependents to working-age household members. Access to extension services was measured as a dummy variable, where those who had extension contact were assigned one (1), otherwise zero (0).

3.5. Data Description and Study Area

This study investigates the dynamic relationship between the free Senior High School (SHS) policy and labour severity in maize farming across Ghana, with a particular emphasis on the Northern, Upper East, Upper West, Brong Ahafo, and Volta regions, as seen in Figure 2, where the educational initiative has been most beneficial (Strategy & Research Dept, 2023). Figure 2 illustrates the district map of Ghana, highlighting the study regions and the specific districts from which maize farming households were sampled. The coloured areas show the Northern, Upper East, Upper West, Ahafo, and Volta regions, while the hatched shaded districts within these regions mark the actual study sites. This map situates the sampled communities geographically and shows that the survey covers maize farmers from diverse ecological and production zones. The Ministry of Education, Ghana (2019) noted in their annual Education Sector Performance Report that the Free SHS policy had significantly benefited regions with historically low educational outcomes, particularly in the Northern, Upper East, Upper West, and Volta regions.

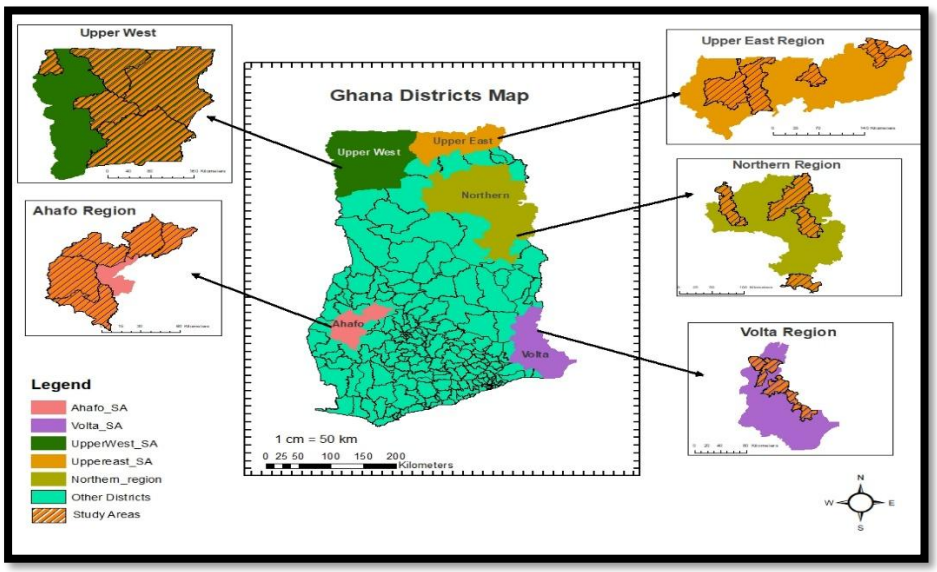

Figure 2. Map of study regions, showing the location of selected districts.
Source: Department of Agricultural Economics and Agribusiness Department, University of Ghana.

While the analysis encompasses the entire country, specific attention is given to these areas that have experienced a substantial increase in student enrollment and retention rates due to the reduction of financial barriers through the free SHS policy. The Northern, Upper East, and Upper West regions have consistently ranked among the lowest in terms of educational outcomes (Ministry of Education, Ghana, 2019) and are expected to be profoundly impacted by the free SHS policy. The Brong-Ahafo, Volta, and Eastern regions, with their significant agricultural sectors and rural communities (Al-Hassan & Diao, 2007), are also likely to witness changes in the availability of off-farm labour as more students are expected to enroll to complete their SHS. These regions engage in diverse farming practices, including land rotation, inter-cropping, and mixed farming, with key crops like cocoa, maize, and cassava being cultivated. The regions also stand out for their youthful population, primarily residing in rural areas. Economic activities in these regions are predominantly agrarian, with a significant portion of the labour force engaged in the agricultural sector.

By examining these six regions, where the free SHS policy has the potential to be most transformative, this study aimed to capture the nuanced effects of increased educational access on the agricultural labor landscape. A multi-stage sampling technique was employed to select respondents for this study. Following a purposive sampling of the six regions in the first stage, four districts from each region, based on their agricultural production levels, with high maize production, were selected in the second stage. During the third stage, four farming communities within the selected districts were randomly sampled based on their population size. Finally, in the fourth stage, six farming households from each community were randomly selected from the communities' experiences and perspectives of maize farmers across the study area. However, after data cleansing, a sample size of 550 observations was used for the analysis.

3.6. Ethical Statement

Before collecting the data, ethical approval was secured from the seminar committee of the Department of Agricultural Economics and Agribusiness at the University of Ghana following the presentation of the thesis proposal. Consent was also obtained from all communities involved prior to field data collection. Careful attention was given to issues related to informed consent, anonymity, and confidentiality for study participants. Each respondent was approached individually, and verbal informed consent was gathered from all participants included in the research. Well-trained enumerators thoroughly communicated the research objectives, confidentiality measures, potential risks and benefits, as well as the option to withdraw from the survey at any time. Individuals who chose to opt out were excluded from the study and were never coerced into participating in the fieldwork. All respondents were assured that their answers would be linked to unique codes to maintain their anonymity.

4. RESULTS AND DISCUSSION

4.1. Descriptive Findings

From Table 1, the study area exhibits a notable gender difference among the 550 maize farm household heads, with 401 (73%) males and 149 (27%) females. This echoes findings from previous research by Taku-Forchu, Doe, and Smith (2015), indicating that maize farming is predominantly male-dominated. This skewness could be attributed to cultural factors and differential access to productive resources such as land, where men typically have greater ownership rights. The survey highlights the educational background of the farming household heads, revealing that the maximum years of formal education is 19 years, and the minimum is 0 years. Education is a potential catalyst for improving farming practices and productivity, as educated farmers are better equipped to understand and implement advanced techniques. This finding is consistent with studies by Nyagaka, Obare, Omiti, and Nguyo (2010) results from Table 1 also indicate that a significant proportion, 354 (66%), of maize farmers have a household size ranging from 1 to 5, with 186 (34%) having a household size between 5 and 10, while a minor portion, 10 (2%), fall between 11 and 15. The average age of maize farmers was 46 years, with a range of 27 to 70 years. This suggests that the majority of farmers are in their active and productive age, contributing to the cultivation and management of their farms.

Table 1. Descriptive statistics of the respondents.

Characteristics		Frequency
Gender	Female	149
	Male	401
Years of education	Maximum years	19
	Minimum years	0
Household size	1-5	354
	6-10	186
	11-15	10
Age	20-39	138
	40-59	316
	≥ 60	96
Source of Labour	Family labour	317
	Hired labour	24
	Both	209

Table 1 also shows that the majority of labor for maize farming in the study area comes primarily from family sources (58%), with hired labor accounting for only 4%. Additionally, 38% of farmers use a combination of both family and hired labor. It is noted that family members may easily leave to attend school, which can contribute to labor shortages.

4.2. Perception Findings

4.2.1. Contributory Factors on Labour Severity Among Farming Households

This section presents the results of the descriptive analysis conducted to identify the causes of labour severity based on the responses of 550 respondents. Figure 3 illustrates farmers' perceptions of the relative importance of four potential drivers of labour severity, showing the share of respondents who rate Free SHS, high mortality, labour migration, and low wages along a five-category importance scale from very important to not important. The results from Figure 3 provide valuable insights into the perceived factors contributing to labour severity among the respondents. From Figure 3, labour migration (52.5% - very important) and low wages (47%) emerged as the most prominent factors contributing to labour severity. These findings collectively shed light on the multifaceted nature of labour severity and its implications for agricultural production activities. The result of labour migration highlights the impact of labour outflows on the availability of the workforce within the study area. A study by Ofuoku and Chukwuji (2012) in sub-Saharan Africa found that rural-urban migration significantly contributes to agricultural labour shortages. Abolga (2022) also concluded that in rural communities in Kumasi, agricultural production is hampered in terms of productivity due to a shortage of on-farm labour, which is a result of outmigration by their youthful population. They noted that "the exodus of youth from rural areas to urban centers has led to a decline in agricultural productivity and increased food insecurity."

Additionally, the introduction of the Free SHS policy (35.5% - very important; 15.5% - important) is reflected in the perception findings as a major contributor to labour scarcity, although 21% of respondents believe it is not an important factor in labour shortages. Darvas and Balwanz (2014) stated in their World Bank report on Ghana's education system that while increased access to secondary education may lead to short-term labour shortages in rural regions, it could also have long-term benefits for agricultural output through a more educated workforce. This supports the mixed reactions among respondents regarding the perception of the free SHS as a significant cause of labour shortages in rural areas. Interestingly, no respondents (0%) considered a high mortality rate as "Very Important" in causing labour severity. Conversely, a large proportion of respondents (48%) viewed it as "Not Important," possibly indicating that high mortality rates might not be a widespread concern regarding labour severity.

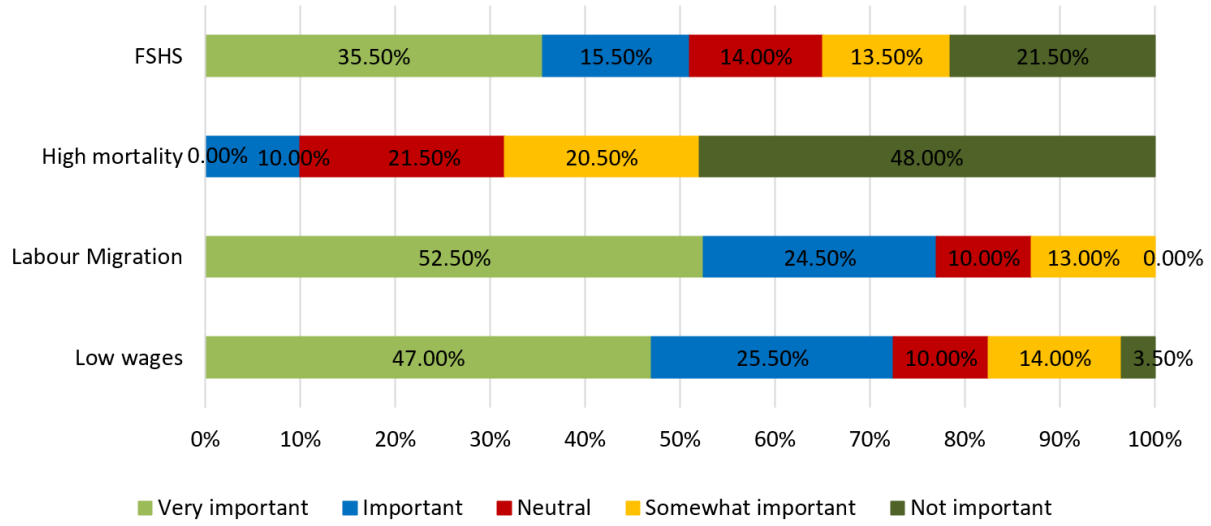

Figure 3. The perception of the contributory factors on labour severity among farming households.

4.2.2. Relationship between the free SHS and Labour Supply

Farmers' views on the Free SHS policy's impact on labour supply provided several important insights. All the 550 participants were familiar with the policy, and most agreed that increased student enrolment has created challenges in securing household farm labour. According to Table 2, the most common perception, with an average score of 4.15, is that rural high school students or graduates are expected to enter the job market due to the Free SHS policy. This reflects a growing interest in non-farm employment. The second most common perception is that the Free SHS policy has reduced the availability of farm labour, due to the rise in rural student enrolment. This is supported by qualitative interviews from a study by Dzanku and Tsikata (2022), which found that higher school attendance among young people, driven by Free SHS, has affected agricultural labour supply. As education levels increase, individuals tend to seek better-paying, non-farming jobs, potentially shrinking the pool of farm workers (Jolliffe, 2004). Ranking third in Table 2 with a mean score of 3.37, farming households report that rural high school students involved in farming are unable to work during school hours. Managing both education and farm work presents a challenge for these students, which could affect labour availability.

The fourth perception emphasizes the challenge of recruiting farm workers among SHS students or graduates. Free education can reduce the labor pool in sectors requiring intensive manual work, such as agriculture, which aligns with previous studies. The fifth perception suggests that while the Free SHS policy encourages education, it may contribute to a long-term labor shortage, particularly in agriculture. Dunham et al. (1997) note that educated youth tend to avoid farm work due to its social stigma, tough conditions, and outdated management practices.

Table 2. Farmers' perception of the FSHS and its effect on labour supply.

Perception	Mean	Rank
The anticipation of rural high school students or graduates joining career fields has increased.	4.15	1st
The free SHS has a limited household farm labour supply due to increased rural student enrollment.	3.72	2nd
Rural high school students who are farm workers are unable to work on the farms during school time.	3.37	3rd
It is difficult to hire farm workers who are SHS students or graduates.	3.33	4th
The free SHS will be a factor causing farm labour severity in the long run.	3.27	5th

In summary, the analysis presents a complex view of the Free SHS policy's effect on labor availability. It suggests that increased access to education might push rural students away from farm labor, raising concerns about future workforce shortages in agriculture. This finding supports Jolliffe, (2004) observation that educated individuals are often steered away from agricultural jobs. Farmers also agreed that rural high school students were less available for farm work during school periods.

4.2.3. Labour Supply Gap

Table 3 illustrates key descriptive statistics on labour dynamics in the agricultural sector, highlighting labour severity, seasonal worker availability, and household labour participation. The seasonal labour requirement of the farms was identified for each maize farming household by the farmers' heads according to the farm activities undertaken. Available farm labour was also recorded for each farm. Farms experience a notable labour shortage, with an average labour severity rate of 27.23%.

Table 3. Descriptive statistics on labour demand supply gap analysis.

Variable	Mean	Standard deviation
Labour Severity rates (%)	27.23%	17.2711
Seasonal supply of farm workers (persons)	4.66	0.1525
Seasonal requirement of workers (persons)	6.45	0.1946
Labour Demand Supply Gap	1.78	0.0981
Household Off-farm workers	1.35	1.092
Number of farm workers who are SHS	1.02	0.076

On average, farms have 4.66 workers during peak seasons but require 6.45, resulting in a demand-supply gap of 1.79 workers. This shortage slows down production activities and farm operations. Additionally, the number of household members working off-farm is 1.35, suggesting that many households are diversifying income sources away from farming. Moreover, only 1.02 farm workers are Senior High School (SHS) students. This confirms that SHS students are difficult to find in the study area for agricultural activities.

4.2.4. Labour Severity in Maize Farms

Farms were categorized into four groups based on labour severity, including adequate labour (severity rate from 0% and below), moderate labour severity (severity rate from above 0% to 25%), high labour severity (severity rates between 25% and 50%), and severe labour severity (severity rates exceeding 50%). As presented in Table 4, the majority of the sample estimates (50.50%) belonged to the high labour severity category. The percentage of farms sampled under the "severe" category (2%) is the lowest among the other categories.

Table 4. Number and percentages of maize farming households with different labour severity.

Category of labour shortage	Number of maize farming households	Percentage %
Severe	11	2.00%
High	278	50.50%
Moderate	154	28.00%
Adequate	107	19.50 %
Total	550	100.00%

4.2.5. Factors Influencing Labour Severity

Table 5 shows the Tobit regression results of the factors influencing labour severity among maize farming households. Notably significant factors among them include age, gender, household_size, num_labour_SHS, farm_size, household_dependency_ratio, and access to extension services. The results indicate that age (-0.322) is inversely related to labour severity. This implies that older farmers are less likely to experience severe labour shortages than younger ones. A possible explanation is that older farmers may have more experience in farm labour management or have superior social networks within their communities that enable them to mitigate labour shortages. Guo, Wen, and Zhu (2015) indicated that older farmers in China utilize their networks more effectively in securing farm labour. These more aged farmers may be equally capable of responding to labour shortages by adjusting farming practices through better planning of seasons and utilizing labour-saving technologies.

Gender, with a coefficient of -2.904, shows that male-headed households are less likely to experience labour severity compared to female-headed ones. This result highlights the gender disparities in access to production resources in rural areas. Male-headed households often have greater access to both family and hired labour and generally operate more mechanized farms (Kumar & Quisumbing, 2015). Female-headed households, on the other hand, may face increased labor demands due to limitations in accessing labor-saving technologies.

Table 5 also shows a positive correlation between household size and labour severity, with a coefficient of 1.070. This may seem surprising, as one would assume that larger households can supply more labour. However, this could be explained by the distribution of household members to non-farm activities, schooling, or migration. With the Free SHS policy promoting school attendance, children who would typically work on the farm are becoming less available, even in bigger households. Dzanku and Tsikata (2022) support this by noting that increased education among rural youth results in a shift away from farm labor, regardless of household size. Thus, although larger families may have more potential workers, they may also face increased demands on their members' time due to off-farm work or education, which contributes to labor shortages on the farm.

The variable of interest, which is the number of household members who are SHS students (coefficient = 3.506), also positively influences labour severity. This supports the hypothesis that although the Free SHS policy may be beneficial for education, it contributes to labour shortages in agriculture by reducing the availability of household members for farm work. Students who would have otherwise participated in farm activities are now occupied with their studies, and the resulting gap in labour supply can be challenging to fill, especially during peak production seasons. This aligns with findings by Jolliffe (2004), who found that greater availability of higher-level education among young people in rural areas results in a decreased propensity for them to engage in agricultural work. Consequently, more educated young people tend to seek wage employment outside agriculture, thereby exacerbating the labour shortage within rural agricultural production areas (Dzanku & Tsikata, 2022).

The results also indicate that farm size and labour severity are negatively related, as expressed by the coefficient (-1.989), implying that larger farms experience lower labour severity compared to smaller farms. This finding may appear unexpected, as larger farms typically require more labour for their operations.

Table 5. Tobit regression analysis.

Variables	Coefficient	P>t	
Education	-1.028	0. 705	
Age	-0.322***	0.008	
Gender	-2.904*	0.085	
Experience	0.248	0.202	
Household Size	1.070**	0.044	
Num_Labour SHS	3.506***	0.003	
Farm Size	-1.989***	0.000	
Farm Machinery	-0.002	0.185	
Household dependency ratio	1.964***	0.000	
Access to extension Services	-2.125***	0.000	
_cons	29.854	0.000	
Tobit regression	Number of obs	=	550
	LR chi2(9)	=	281.29
	Prob > chi2	=	0.000
Log likelihood = -635.975	Pseudo R2	=	0.1840

Note: Significance level: ***, **, * is 1%, 5% and 10% respectively; 102 left-censored observations at Labour severity rates ≤ 0; 5 right-censored observations; 443 uncensored observations.

Nguyen and Warr (2020) also found that larger farms in Vietnam faced more labor constraints since they required more labor than smaller farms, thus contrasting the results. A study by Caunedo and Kala (2021) indicates that as farms mechanize, particularly larger ones, there is a notable decrease in the demand for family labor. This shift occurs because mechanization allows for the substitution of labor with machinery, thereby reducing reliance on hired labor for various farming tasks. The study found that larger farms tend to have higher rates of machinery ownership compared to smaller farms, which often rely more on family labor due to their scale of operation. This can explain the results obtained in this analysis.

The household dependency ratio variable shows a positive relationship with labour intensity, reflected by a coefficient of 1.964. A higher dependency ratio, consisting of children and the elderly, indicates more non-working members compared to those of working age in the household, which increases the labour burden on those available for agricultural work. Dzanku and Tsikata (2022) also highlight that high dependency ratios in rural households worsen labour shortages, as fewer family members can assist with farm duties, with many occupied by caregiving or other non-productive activities. Moreover, dependents like children are often in school, particularly with initiatives like Ghana's Free SHS program, further limiting their contribution to farm labour.

Table 5 also shows that access to agricultural extension services has a negative impact on labour intensity, as reflected by the coefficient (-2.125). This indicates that households receiving extension support are less likely to experience labour shortages due to the adoption of advanced farming practices promoted by these services. This finding is consistent with Kassie, Jaleta, Shiferaw, Mmbando, and Mekuria (2013), who found that better access to extension services significantly reduces labour constraints in smallholder farming systems. Extension services encourage modern farming techniques and improved crop management, which not only boost productivity but also help reduce labour demands.

Although the coefficient (-1.028) indicates that education does not have a statistically significant impact on reducing labour severity, its potential indirect effects should not be overlooked. Higher levels of education among household heads may create opportunities for income diversification, allowing for the use of hired labour and the adoption of better farm management practices, which can indirectly reduce labour demands. While education did not directly address labour shortages in this study, it is linked to broader socio-economic advantages, such as increased awareness of labour-saving technologies and non-farm income sources, which could help alleviate labour constraints in the long run.

The Tobit regression results reveal that variables like education level, farm machinery use, and years of farming experience did not have a significant impact on labour severity rates. While the Free SHS policy has expanded educational opportunities for many young individuals, it has unintentionally led to labour shortages in the agricultural sector, particularly during critical times such as planting and harvesting. These outcomes highlight the importance of policy measures that can balance enhanced educational access with the need to tackle agricultural labour shortages, potentially through the promotion of mechanization and labour-saving innovations.

5. CONCLUSION

The study explored the impact of the Free Senior High School (SHS) policy on the agricultural sector, with a particular emphasis on maize farmers' perceptions of reduced on-farm labor due to increased student enrollment. It also assessed the extent of labor shortages and identified potential factors influencing this in the study area. Descriptive analysis using frequency distributions was applied to characterize respondents, while a 5-point Likert scale was used to evaluate the relationship between the Free SHS policy and labor supply. Additionally, a labor demand-supply gap analysis was conducted to assess the severity of labor shortages. The Tobit regression model was employed to examine the socio-economic factors affecting labor shortage rates.

The paper revealed the prevalence of labour shortages on maize farms, particularly when senior high school students return to school. It demonstrates that the Free SHS policy significantly contributes to labour shortages, alongside other factors like labour migration and low wages, positioning it as a key factor in the declining agricultural workforce. From the perception findings, it was clear that all farmers were aware of the Free SHS policy, with a substantial percentage recognizing its role in exacerbating labour shortages during school terms. The descriptive statistics also showed that rural senior high school students are increasingly inclined towards non-farming career paths due to the policy. As a result, farmers anticipate that the Free SHS policy will lead to a long-term increase in rural students seeking non-farm employment opportunities. Overall, the analysis of farmers' perceptions identifies labour migration, low wages, and the Free SHS policy as the main drivers of labour shortages in maize farming households.

The demand-supply gap analysis revealed that farm labour availability averaged around five workers per farm, with approximately one SHS student engaged in farming. Over 50% of the farms faced severe labour shortages, with only a small percentage having sufficient or surplus labour. On average, farms required 6.45 workers but had just 4.66 available, resulting in a labour gap of 1.75 workers per farm. Tobit regression analysis identified key factors influencing labour shortages in maize farming households, including age, gender, household size, farm size, household dependency ratio, access to extension services, and the number of SHS students involved in farming. A significant finding was that households with more SHS students experienced greater labour shortages. While the Free SHS policy has provided educational opportunities for rural students, it may have unintentionally exacerbated farm labour shortages, as students who previously participated in farming are now focused on their education. As a result, households with Free SHS beneficiaries are facing more acute labour shortages during the school term. Additionally, descriptive statistics showed that rural SHS students are increasingly gravitating towards non-farming careers, with farmers anticipating that the Free SHS policy will lead to more students pursuing non-farm employment opportunities in the future. Farmers perceive labour migration, low wages, and the Free SHS policy as the primary drivers of labour shortages in maize farming households.

This paper fills a critical gap in the literature by emphasizing the need for targeted interventions to address labor shortages in agriculture caused by the educational advancements linked to the Free SHS policy. It advocates for the promotion of agricultural mechanization, supported by government subsidies or low-interest loans, and comprehensive training for farmers in modern technologies. Additionally, it suggests greater integration of educational and

agricultural policies, with an emphasis on community engagement to ensure timely and effective implementation. These strategies aim to balance the growth of educational opportunities with the urgent demands of agricultural production, fostering more sustainable rural development.

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REFERENCES

Abolga, D. A. (2022). Migration and settlement: Exploring what drives rural-urban displacement in Kumasi, Ghana. Master's Thesis. Norwegian University of Life Sciences, Ås.

Abraham, A. Y., Ohemeng, F. N. A., & Ohemeng, W. (2017). Female labour force participation: Evidence from Ghana. *International Journal of Social Economics*, *44*(11), 1489-1505. https://doi.org/10.1108/IJSE-06-2015-0159

Adu-Ababio, K., & Osei, R. D. (2018). *Effects of an education reform on household poverty and inequality: A microsimulation analysis on the free Senior High School policy in Ghana*. WIDER Working Paper No. 2018/147. UNU-WIDER.

Al-Hassan, R. M., & Diao, X. (2007). *Regional disparities in Ghana: Policy options and public investment implications*. IFPRI Discussion Paper No. 00693. International Food Policy Research Institute.

Arabmazar, A., & Schmidt, P. (1982). An investigation of the robustness of the Tobit estimator to non-normality. *Econometrica*, *50*(4), 1055-1063. https://doi.org/10.2307/1912776

Bleiberg, J., Brunner, E., Harbatkin, E., Kraft, M. A., & Springer, M. G. (2025). Taking teacher evaluation to scale: The effect of state reforms on achievement and attainment. *Journal of Political Economy Microeconomics*, *3*(3), 568-610. https://doi.org/10.1086/732837

Caunedo, J., & Kala, N. (2021). *Mechanizing agriculture*. NBER Working Paper No. 29061. National Bureau of Economic Research. https://doi.org/10.3386/w29061.

Darfour, B., & Rosentrater, K. A. (2016). *Maize in Ghana: An overview of cultivation to processing*. Paper presented at the Proceedings of the 2015 ASABE International Meeting. American Society of Agricultural and Biological Engineers.

Darvas, P., & Balwanz, D. (2014). *Basic education beyond the Millennium development goals in Ghana: How equity in service delivery affects educational and learning outcomes*. Washington, DC: World Bank Publications.

Duflo, E., Dupas, P., & Kremer, M. (2021). *The impact of free secondary education: Experimental evidence from Ghana*. NBER Working Paper No. 28937. National Bureau of Economic Research. https://doi.org/10.3386/w28937.

Dunham, D., Arunatilake, N., & Perera, R. (1997). *The labour situation on Sri Lankan tea estates: A view to 2005 (Research Studies, No. 13)*. Colombo, Sri Lanka: Institute of Policy Studies.

Dzanku, F. M., & Tsikata, D. (2022). Implications of socioeconomic change for agrarian land and labour relations in rural Ghana. *Journal of Rural Studies*, *94*, 385-398. https://doi.org/10.1016/j.jrurstud.2022.07.010

Ferreira, V., Almazán-Gómez, M. Á., Nechifor, V., & Ferrari, E. (2022). The role of the agricultural sector in Ghanaian development: A multiregional SAM-based analysis. *Journal of Economic Structures*, *11*(1), 6. https://doi.org/10.1186/s40008-022-00265-9

Free SHS Secretariat. (2023). *Placement and enrolment statistics*. Retrieved from https://freeshs.gov.gh/p/26/placement-statistics

Gabriel, R., & Allington, R. (2012). Constructing and measuring teacher effectiveness in global education reform. In International Perspectives on Education and Society. In (pp. 203-228): Emerald Group Publishing Limited. https://doi.org/10.1108/S1479-3679(2012)0000016014

Ghana Statistical Service. (2014). *Ghana living standards survey round 6 (GLSS 6): Poverty profile in Ghana (2005-2013). Ghana Statistical Service.* Retrieved from https://www2.statsghana.gov.gh/docfiles/glss6/GLSS6_Poverty%20Profile%20in%20Ghana.pdf

Guo, G., Wen, Q., & Zhu, J. (2015). The impact of aging agricultural labor population on farmland output: From the perspective of farmer preferences. *Mathematical Problems in Engineering*, *2015*, 730618. https://doi.org/10.1155/2015/730618

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, *47*(1), 153-161. https://doi.org/10.2307/1912352

Johnson, B. K., & Perry, J. J. (2005). *Labor supply on the US professional Golfers' association tour*. Danville, KY: Centre College.

Jolliffe, D. (2004). The impact of education in rural Ghana: Examining household labor allocation and returns on and off the farm. *Journal of Development Economics*, *73*(1), 287-314. https://doi.org/10.1016/j.jdeveco.2003.02.002

Kassie, M., Jaleta, M., Shiferaw, B., Mmbando, F., & Mekuria, M. (2013). Adoption of interrelated sustainable agricultural practices in smallholder systems: Evidence from rural Tanzania. *Technological Forecasting and Social Change*, *80*(3), 525-540. https://doi.org/10.1016/j.techfore.2012.08.007

Khavenson, T., & Carnoy, M. (2016). The unintended and intended academic consequences of educational reforms: The cases of Post-Soviet Estonia, Latvia and Russia. *Oxford Review of Education*, *42*(2), 178-199. https://doi.org/10.1080/03054985.2016.1157063

Kumar, N., & Quisumbing, A. R. (2015). Policy reform toward gender equality in Ethiopia: Little by little the egg begins to walk. *World Development*, *67*, 406-423. https://doi.org/10.1016/j.worlddev.2014.10.029

Lewis, S. E., & Lewis, J. E. (2008). Seeking effectiveness and equity in a large college chemistry course: An HLM investigation of peer-led guided inquiry. *Journal of Research in Science Teaching*, *45*(7), 794-811. https://doi.org/10.1002/tea.20254

Mazibuko, N. V. E., & Antwi, M. A. (2019). Socio-economic factors influencing smallholder farmers agricultural infrastructure availability, accessibility and satisfaction: A case on North West province in South Africa. *OIDA International Journal of Sustainable Development, 12*(5), 11-26.

Ministry of Education Ghana. (2019). *Education sector performance report (ESPR). Planning, Budgeting, monitoring and evaluation unit (PBME), education sector.* Accra, Ghana: Ministry of Education, Planning, Budgeting, Monitoring and Evaluation Unit (PBME).

Ministry of Education Ghana. (2022). *Free SHS policy.* Accra, Ghana: Ministry of Education Ghana.

Ministry of Food and Agriculture (MoFA). (2020). *Agriculture in Ghana: Facts and figures.* Retrieved from https://mofa.gov.gh/site/images/pdf/2020%20Agriculture%20In%20Ghana%20Facts%20&%20Figures_%20MASTER.pdf

Ministry of Food and Agriculture (MoFA). (2021). *Agricultural sector progress report 2015. 2021. Accra.* Retrieved from https://mofa.gov.gh/site/images/pdf/AGRICULTURE%20IN%20GHANA%20(Facts%20&%20Figures)%202021.pdf

Moffatt, P. G. (2005). Hurdle models of loan default. *Journal of the Operational Research Society, 56*(9), 1063-1071. https://doi.org/10.1057/palgrave.jors.2601922

Nguyen, H. Q., & Warr, P. (2020). Land consolidation as technical change: Economic impacts in rural Vietnam. *World Development, 127*, 104750. https://doi.org/10.1016/j.worlddev.2019.104750

Nyagaka, D. O., Obare, G. A., Omiti, J. M., & Nguyo, W. (2010). Technical efficiency in resource use: Evidence from smallholder Irish potato farmers in Nyandarua North District, Kenya. *African Journal of Agricultural Research, 5*(11), 1179-1186.

Obour, P. B., Arthur, I. K., & Owusu, K. (2022). The 2020 maize production failure in Ghana: A case study of Ejura-Sekyedumase municipality. *Sustainability, 14*(6), 3514. https://doi.org/10.3390/su14063514

Ofuoku, A. U., & Chukwuji, C. O. (2012). The impact of rural-urban migration on plantation agriculture in the Niger Delta region, Nigeria. *Journal of Rural Social Sciences, 27*(1), 1-16.

Onumah, E. E., Al-Hassan, R. M., Ocran, J., & Béné, C. (2023). Analysis of fishers' wellbeing in the western region of Ghana. *Development in Practice, 33*(7), 783-795. https://doi.org/10.1080/09614524.2023.2185183

Pham, P. D., Schlander, M., Eckford, R., Hernandez-Villafuerte, K., & Ubels, J. (2023). Developing a conceptual framework for socioeconomic impact research in European cancer patients: A 'best-fit'framework synthesis. *The Patient-Patient-Centered Outcomes Research, 16*(5), 515-536. https://doi.org/10.1007/s40271-023-00632-z

Prabakar, C., Devi, K. S., & Selvam, S. (2011). Labour scarcity–its immensity and impact on agriculture. *Agricultural Economics Research Review, 24*, 373-380. https://doi.org/10.22004/ag.econ.119387

Sackey, H. A. (2005). *Female labour force participation in Ghana: The effects of education.* AERC Research Paper No. 150. Nairobi, Kenya: African Economic Research Consortium.

Shyamalie, H. W., Karunarathne, B. M. N. C., Pilapitiya, H. M. C. G., Lakshani, P. T. P., Chathuranga, T. H. I., & Nadeeshani, K. W. N. (2020). An analysis of the impacts of labour scarcity on land productivity in Sri Lankan tea plantations. *Tropical Agricultural Research, 31*(4), 54-64. https://doi.org/10.4038/tar.v31i4.8421

Strategy & Research Dept. (2023). *Ghana education sector report. GCB Bank.* Retrieved from https://www.gcbbank.com.gh/research-reports/sector-industry-reports/358-ghanas-education-sector-report-2023-v2-1/file

Sumberg, J., Yeboah, T., Flynn, J., & Anyidoho, N. A. (2017). Young people's perspectives on farming in Ghana: A Q study. *Food Security, 9*(1), 151-161. https://doi.org/10.1007/s12571-016-0646-y

Taku-Forchu, J., Doe, J., & Smith, A. B. (2015). Gender dynamics in maize farming: A study of farm household heads in Sub-Saharan Africa. *Journal of Agricultural Studies, 23*(4), 101-115.

Twum-Baah, K. A., & Nabila, J. S. (1995). *Migration research study in Ghana.* Accra, Ghana: Ghana Statistical Service.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data.* Cambridge, MA: MIT Press.

Yang, D. T. (2004). Education and allocative efficiency: Household income growth during rural reforms in China. *Journal of Development Economics, 74*(1), 137-162. https://doi.org/10.1016/j.jdeveco.2003.12.007