

CHAPTER TWELVE

Determinants of Incomes for Farmers with Disabilities

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Abstract

We examine the factors that influence the income of Ghanaian farmers with disabilities. We sampled 386 farmers and 62 agricultural extension agents across the sixteen regions of Ghana. We analyzed the data using multiple linear regression models. Non-farm income-generating activities significantly and negatively impact agricultural income, while the proportion of products sold positively correlates with income. Conversely, larger farm sizes and higher proportions of purchased inputs are associated with reduced income, diverging from traditional expectations of these variables. These results suggest that higher farm sizes may dilute resource use efficiency, and high input costs diminish profitability. The study underscores the need for targeted interventions, including optimizing land use, reducing input costs, and promoting non-farm income diversification. Additionally, enhancing market access and providing financial support and technological assistance are crucial for improving the economic stability of farmers with disabilities. These findings offer valuable insights for policymakers and stakeholders aiming to bolster the livelihoods of this vulnerable group and foster greater economic equity within the agricultural sector.

Keywords: Farmers with Disabilities, Incomes, Non-farm, Farm size, Products, Market, Technological Assistance

Introduction

For a very long time, agriculture has been the main driver of economic stability, employment, and food security in many countries. However, there are many obstacles facing the agricultural industry, especially in poorer countries where most farmers barely make ends meet. Among the many different types of farmers, farmers with disabilities are a disadvantaged group that frequently faces extra obstacles to achieving growth and economic stability (Arhin, 2023). To create inclusive policies and initiatives that can improve the livelihoods of farmers with disabilities, it is crucial to comprehend the elements influencing their incomes. Around one billion individuals with disabilities live in the world, most of them are employed in agriculture and are mostly found in rural areas (Arhin, 2023). Agricultural laws and programs tend to marginalize and ignore farmers with disabilities, despite their substantial presence in the industry (Arhin, 2023). Their productivity and income levels may suffer because of their marginalization, since they may have less access to markets, resources, and training (Arhin, 2023). To ensure equitable

economic development and raise the general standard of living for people with disabilities, it is imperative to address these discrepancies.

Farmers with disabilities have difficulties that can have a bigger effect on their earnings. Among these difficulties are physical ones, including disabilities that make it difficult for a farmer to operate machinery, plant, or harvest crops, which lowers output and increases reliance on outside labour. Another critical barrier is access to resources. It is common for farmers with disabilities to have restricted access to land, loans, and agricultural inputs (seeds, fertilizers, tools) (Sango et al. 2022). Discrimination, ignorance, or insufficient policy support may be the root cause of this restriction (Dali, 2018). Enhancing farming practices and yield requires education and training. Due to physical constraints, a lack of programs specifically designed for them, or societal views, farmers with disabilities may encounter obstacles in taking advantage of these opportunities. Selling agricultural products requires market access, but for farmers with disabilities, this might be problematic because of transportation issues, discriminatory policies, or a lack of market knowledge. Farmers with disabilities confront several challenges, including discrimination and social stigma. Negative societal perceptions of disability can result in discrimination and social isolation, which further reduce the opportunity for farmers with disabilities to fully engage in agricultural operations and gain support from the community. The objective of this study is to identify and analyze the essential factors influencing the incomes of farmers with disabilities. By examining this often-overlooked group, the study aims to contribute to the broader discourse on inclusive agricultural development and disability rights. The study provides valuable insights for policymakers, development practitioners, and disability advocates to create a more inclusive and equitable agricultural sector.

Incomes of Farmers with Disabilities

While many people find agriculture an accessible source of income, people with disabilities sometimes find themselves in this industry out of necessity rather than choice. Agriculture is a source of employment and the primary income source for rural households with a PWD member (Siedlecka et al., 2017). 78.4% of PWDs who were employed in metropolitan China were shown to be working in precarious, low-paying agricultural jobs (Wang & Minter, 2018). Research in northern Nigeria also found that people with impairments frequently engage in agricultural work for survival (Sango et al., 2022).

Several contributing factors can affect how much money people with disabilities make from agricultural work. The severity of the condition significantly shapes the dynamics of income, the length of the legally recognized disability status, and the availability of labour (Siedlecka et al., 2017). A farmer's education, experience, and the assistance they receive can significantly impact their revenue (Whelan et al., 2009). For those with disabilities, agro-entrepreneurship comes with its difficulties. For instance, developing small businesses in agriculture for individuals with disabilities in Russia is linked to higher financial risks (Trunin & Osokin, 2022). The link between disability and poverty further muddies the picture of the disability and agricultural income relationship. According to a United States Department of Agriculture survey, one-third of American homes with adults with disabilities that prevent them from working are more likely to experience food insecurity than other households with PWDs (Whittle et al., 2015). Access to agricultural extension services and agricultural income have a well-established relationship (Emmanuel et al., 2016).

However, when disability is factored in, the relationship gets more complicated. Compared to their non-PWD colleagues, farmers with disabilities frequently have less access to extension services, which results in lower income and financial hardship (Friesen et al., 2010). Access to these services is restricted for several reasons, including limited availability of adaptive technology, education, and funding. Access to extension services has a variety of effects on farmers' income. Farmers' capacity to use and benefit from extension services may be influenced by factors such as the availability of labour, the condition of the land, the level of support, and their knowledge and experience (Whelan et al., 2009). Future studies are required to understand these complex dynamics and the demands for better and lived experiences of Farmers with Disabilities (FWDs) in various geographical and socio-economic circumstances.

Non-farm Income for Farmers and Farmers with Disabilities

Non-farm income plays a significant role in the livelihoods of farmers, particularly those with disabilities. Farmers with disabilities face economic and socio-cultural challenges due to their impairments (Sango et al., 2022). In Nigeria, Sango and colleagues highlight the need for more research on farmers with disabilities, especially female farmers, to develop effective disability and gender-inclusive agricultural and entrepreneurship programs (Sango et al., 2022). Smallholder rural farmers in African nations who receive non-farm income have some insurance against the dangers of farming, encouraging them to use innovative production techniques and increase productivity for their well-being (Otekhile and Verter, 2017). According to research conducted in the Gopal Ganj District in India, farmers typically received 35.12% of their income from non-farm sources, while 64.88% came from farm sources (Mina et al., 2022). Regression analysis by Mina et al. (2022) showed that farm income was positively correlated with several factors, including age, household size, education, farm size, agricultural training, access to credit facilities, association with agrarian cooperatives, and distance to the nearest market. Non-farm income also influenced overall agricultural revenue, demonstrating that livelihood diversification contributes to total household welfare (Mina et al., 2022). Similarly, Agole et al. (2021) observed that young farmers with disabilities (FWDs) often experience poverty and food insecurity because they rely primarily on small farms and unskilled labour for survival. They further noted that FWDs tend to work in less lucrative jobs and earn lower incomes compared to farmers without disabilities. Additionally, musculoskeletal disorders are frequently reported among fruit tree farmers, which can reduce productivity and overall income levels (Kim et al., 2019).

In the Ghanaian context, the key concern is not only what drives farm or non-farm income individually but what determines total income among farmers with disabilities. Studies in Ghana have shown that total income for rural households is influenced by multiple structural and socio-economic factors such as education level, access to productive resources, household size, farm size, access to credit, and participation in farmer-based organizations (Asante et al., 2020; GSS, 2021). Access to extension services and agricultural technology also plays a vital role in improving income-generating capacity. However, persons with disabilities often face compounded challenges including limited access to land, financial services, extension support, and physical infrastructure, which restricts their ability to expand livelihood activities (Addai et al., 2019). Therefore, understanding what drives total income among FWDs in Ghana requires an integrated approach that considers both farm and non-farm components as part of a unified livelihood system. This approach allows for better policy design and intervention strategies that promote inclusion, enhance productivity, and reduce poverty among people with disabilities in the agricultural sector.

Despite having impairments, many fruit tree producers put in long hours, which could exacerbate their physical health problems (Kim et al., 2019). Rural non-farm income diversification has enhanced household well-being and encouraged agricultural technology adoption (Danso-Abbeam et al., 2020). Increased non-farm income diversification increases the likelihood of adopting agricultural technology, vastly improving household welfare (Danso-Abbeam et al., 2020).

Farmers with higher and off-farm incomes are more likely to repay their loans than those with lower incomes (Kuye & Edem, 2019). Income from off-farm activities can support the family's needs and reduce dependence on farm profits during the loan period (Kuye & Edem, 2019). In rural livelihoods, possessing multiple income sources implies a diversified income base, which enhances household resilience and reduces vulnerability to agricultural shocks. (Malami et al., 2021). Greater income diversification among smallholder farmers might result from expanding sources of revenue and non-farm income (Malami et al., 2021).

Diversifying the agricultural sector can help increase climate change resistance. Comparatively, farmers who refuse agricultural diversification incur greater farm income loss than farmers who diversify their income-generating activities (Kiani et al., 2021). The adoption of agricultural diversification can be influenced by institutional and demographic variables, including subsidies, education, and awareness-raising campaigns (Kiani et al., 2021). Consequently, non-farm income is crucial to farmers' livelihoods, especially for those who have disabilities. It offers a way to increase agricultural income, diversify sources of income, and lessen the hazards of farming. Land rights, personal traits, and access to resources and support systems are a few examples of the variables that might affect non-farm income and how it affects farmers' overall income and well-being.

Methodology

Data Collection Instruments

We created two distinct semi-structured questionnaires: one for farmers with disabilities to understand their needs, challenges, and experiences with agricultural extension programs, and another for officers to investigate their knowledge, attitudes, and practices regarding agricultural extension and the requirements of farmers with disabilities. Various methods were employed to guarantee that the questionnaire reached as many farmers with impairments as possible, considering the Department of Agriculture's restricted reach to farmers with disabilities. A sizeable pool of respondents was obtained by collaborating with the social welfare department, which regularly and directly interacts with individuals with disabilities in district and municipal assemblies.

The study population comprised persons with disabilities within the selected study area. The total population count was obtained from two primary sources: the Department of Social Welfare and the Jehovah's Witness outreach team. These two institutions maintain detailed records of individuals with disabilities, providing a reliable foundation for identifying potential participants. In collaboration with the Jehovah's Witness outreach team, a sampling frame was developed by merging rosters from both the Department of Social Welfare and the outreach database. The combined list was carefully reviewed to eliminate duplicates and verify the accuracy of the information. Participants were then randomly selected from this consolidated roster, ensuring that every individual had an equal chance of inclusion and minimizing potential selection bias. After the random selection, the research team cross-checked the chosen names with both

institutions to confirm eligibility and willingness to participate. The verified individuals constituted the final study sample used for data collection.

A total of 122,209 farmers with disabilities from Ghana's sixteen regions of Ghana constituted the study's population (GCA, 2019). Using the sampling approach of Krejcie & Morgan (1970), the sample size was calculated, and a total of 386 farmers with disabilities were found to be in the sample. The Department of Social Welfare and the Department of Agriculture in the various Metropolitan, Municipal, and District Assemblies (MMDAs) in all sixteen regions of Ghana provided a list of all farmers with disabilities, from which the sample was chosen. The sample was a simple random one, stratified by district and region. Interviews were conducted with agricultural extension officers in each of the 16 regions who assist farmers with disabilities. For the study, interviews with sixty-two agricultural extension officers were conducted.

Table 1.0 Regional Distribution of Farmers with Disabilities and Agricultural Officers in Ghana (Total FWD Population: 1,240)

Region	Number of FWDs Interviewed	Number of Agricultural Officers
Ashanti	26	4
Brong-Ahafo	24	4
Central	24	4
Eastern	24	4
Greater Accra	24	2
Northern	24	4
Upper East	24	4
Upper West	24	4
Volta	24	4
Western	24	4
Western North	24	4
Bono East	24	4
Ahafo	24	4
Northeast	24	4
Oti	24	4
Savannah	24	4
TOTAL	386	62

Analytical procedure

The study employed multiple linear regression to examine the relationship between farm income and its determinants among farmers with disabilities (FWDs). This method was chosen because it allows for assessing the effect of multiple independent variables on a single continuous dependent variable while controlling for other factors.

The general model specification is given as:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon_i$$

Where:

- Y_i : Farm income of the farmer with a disability.
- X_1 : Non-farm income.
- X_2 : Proportion of products sold.
- X_3 : Farm size.
- X_4 : Proportion of purchased inputs.
- β_0 : Intercept.
- $\beta_1, \beta_2, \beta_3, \beta_4$: Coefficients representing the effect of each independent variable on farm income.
- ϵ_i : Error term capturing unobserved factors affecting farm income.

The analysis was conducted using statistical software, which estimated the coefficients (β) and tested their significance to determine which factors significantly influence farm income. Assumptions of the regression model, including linearity, normality, homoscedasticity, and absence of multicollinearity, were checked to ensure the validity of the results.

Results and Discussion

Table 2.0: Key Descriptive Statistics

Variable	Categories/Values	Percentage (%)	Key Implications
Age Distribution of Extension Officers	26–38 years	30.0	Younger AEAs may lack experience and disability-specific knowledge, limiting service quality.
	39–48 years	53.3	The majority group, at its career peak, is better equipped with modern tools, but the aging workforce trend.
	49–59 years	16.7	Older AEAs provide seasoned expertise but may struggle with new technologies for FWDs.
Non-farm Income (FWDs)	Farmers with non-farm income	32.0	Diversification improves welfare, debt repayment, and technology adoption.
	Farmers without non-farm income	68.0	Heavy reliance on farming increases vulnerability to shocks and financial instability.
Farmer Group/FBO Membership (FWDs)	Members of farmer groups/FBOs	28.7	Group participation enhances access to resources, support, and inclusion.
	Non-members	71.3	The majority were excluded due to accessibility barriers, stigma, and inadequate inclusive structures.

Age Distribution of Extension Officers

The workforce of Agricultural Extension Agents (AEAs) is predominantly aging, with the majority over 39 years of age. Older AEAs bring valuable experience and familiarity with the challenges faced by farmers with disabilities (FWDs), including knowledge of disability issues and traditional farming practices. However, they may have limited exposure to modern technologies and adaptive equipment that can enhance productivity and inclusion. Conversely, younger AEAs tend to be more technologically adept, yet they often face knowledge gaps regarding disability-inclusive practices. This duality underscores the need for continuous professional development and training programs that balance the benefits of experience with the adoption of modern innovations and inclusive techniques.

Non-Farm Income of Farmers with Disabilities (FWDs)

Analysis shows that only 32% of FWDs engage in income diversification, while the majority (68%) rely solely on farming. Non-farm income plays a critical role in enhancing financial resilience, enabling farmers to access credit, adopt new technologies, and buffer against income shocks. Heavy reliance on farming exposes FWDs to multiple risks, including climate variability, market fluctuations, and limited cash flow. Encouraging income diversification through small businesses, vocational activities, or service provision could strengthen household welfare, reduce vulnerability, and improve overall livelihood sustainability for FWDs.

Farmer Group/FBO Membership

The study further reveals that only 28.7% of FWDs are members of farmer groups or Farmer-Based Organizations (FBOs), leaving 71.3% excluded. Barriers to participation include physical inaccessibility, social stigma, and the absence of inclusive organizational structures. Membership in groups or FBOs is vital, as it facilitates information sharing, collective bargaining, access to extension services, and participation in training programs. Addressing both social and logistical barriers can promote inclusion, enabling FWDs to actively contribute to agricultural development and benefit from collective resources and support mechanisms.

Income Determinants of Farmers with Disabilities in Ghana

This study examines the factors affecting the income of farmers with disabilities (FWDs) in Ghana. The analysis identifies key determinants, with significant variables including non-farm activities, farm size, the proportion of purchased inputs, and the proportion of products sold. While the proportion of products sold positively influences income, non-farm activities, farm size, and purchased inputs negatively impact income. Other factors, such as age, gender, education, and disability-related variables, do not significantly affect income.

Table 4.1: Results of the Multiple Linear Regression Analysis of Demographic and Socio-economic characteristics that Affect the income of FWDs

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	4.793	1.114		4.304	.000	2.594	6.993
AGE	.142	.138	.098	1.031	.304	-.130	.415
Gender	.032	.299	.007	.108	.914	-.557	.622
Education	-.067	.094	-.051	-.715	.476	-.254	.119
Type of Disability	.052	.057	.056	.903	.368	-.062	.165
Source of Disability	.054	.066	.052	.830	.408	-.075	.184
Number of Household dependents	.069	.133	.058	.519	.604	-.194	.333
FBO Membership	-.119	.182	-.037	-.651	.516	-.478	.241
Non-farm Income	-.616	.205	-.198	-3.002	.003	-1.022	-.211
Experience in Farming	.144	.126	.143	1.135	.258	-.106	.393
Cost of production	.128	.146	.086	.881	.379	-.159	.416
Farm size	-.418	.109	-.369	-3.825	.000	-.633	-.202
Proportion Input purchased	-.328	.156	-.137	-2.103	.037	-.636	-.020
The proportion of Products Sold	.720	.173	.256	4.156	.000	.378	1.062

a. Dependent variable: Annual income from farm products sold

Source: Field Data, 2022

According to the regression analysis results, the regression coefficient for the farm size of -0.418 is significant at the 1% level. This means that a unit increase in the farm size results in a decrease of 41.8% in the annual farm income of the farmers, with other factors held constant. This could be because the farmers will not have enough inputs/resources to optimize production as farm size increases. This result is inconsistent with other studies revealing that farm size benefits income.

The finding is inconsistent with a survey undertaken by Yang and Xu (2019) in China, which found that farm size has varying effects on household income. They discovered a strong

link between farm size and income using Hansen's threshold regression model. Similarly, Kadi and Arikan (2014) concluded in a Turkish study that more significant land areas led to higher profitability, which was determined using the stochastic frontier production function to estimate the input elasticity of production. Karima et al. (2022) researched Indonesia and discovered farm size's significant, favourable influence on coffee farmer revenue. According to the same study, farm size considerably impacts rice output and income. Finally, a study conducted in Mali by Coulibaly and Li (2020) found that farm size significantly impacted farmers' yearly family income. Overall, the findings of this regression show that more considerable land holdings not being associated with higher income levels of the FWD. It is crucial to highlight that farm size may contribute to income disparity, and the specific impacts of farm size on income may vary based on various factors, including the type of farming or agricultural activity and the regional environment.

The proportion of farm inputs purchased and its negative relationship with FWDs' incomes highlight an important aspect of productivity, particularly in the context of diminishing marginal returns. As farmers increase their reliance on purchased inputs, the additional cost may outweigh the incremental gains in productivity, thereby reducing overall profitability. This is a classic example of diminishing marginal returns, where beyond a certain point, each additional input yields progressively smaller increases in output. The statistically significant negative coefficient (-0.328) and t-value (-2.103) underline the need for optimal resource allocation. Efficient input management, avoiding unnecessary expenditure, and maximizing returns from existing resources are crucial for enhancing productivity and income sustainability in farming operations.

One study found that smallholder farmers in developing countries who purchased a higher proportion of inputs had lower profits due to the added cost (Saenger et al., 2013). Another study found that smallholder farmers in sub-Saharan Africa who purchased a higher proportion of inputs were less likely to adopt new technologies and had lower incomes than those who purchased a lower proportion of relevant inputs (Jayne et al., 2010). Therefore, this study found that farm size and the proportion of farm inputs purchased negatively and significantly impact annual farm income. The study supports the literature that suggests that larger farm sizes and a higher proportion of farm inputs purchased are negatively related to farm income (Cheng et al., 2019). These findings can provide valuable insights for farmers and policymakers to improve the income of farmers with disabilities.

According to the results of the regression analysis of the study, non-farm income is a significant negative factor in determining annual farm income. Furthermore, the t-value of -3.002 and the beta value of -0.616 highlight the statistical significance and negative influence of non-farm activities on the annual farm income of the FWD in the study area. The negative beta value shows that when non-farm activities increase, farm revenue drops, possibly due to time and resource allocation away from farming methods. However, non-farm incomes may increase the total household income. Numerous studies back up this claim. In their China-based study, Luo and Zhu (2006) discovered that non-farm activity plays an increasingly key role in rural household income and reduces rural income inequality by improving the income of poorer families more than that of more affluent households. In Tanzania, Oni et al. (2009) discovered related results, with non-farm activities contributing more to household income than farming activities. In Nigeria, Israr et al. (2014) discovered that a significant fraction of the population was involved in non-farm income-generating activities, and non-farm income formed a significant portion of total annual household income. This means that nonfarm income-generating activity can be a significant source of income for rural households.

Dabkien (2020) also emphasized the significance of non-farm activity in Lithuania. The researcher discovered that off-farm activities significantly stabilized agricultural income. Many family farms were involved in off-farm activities, highlighting the appeal of part-time or lifestyle farming. It shows that non-farm activities can offer farmers a more consistent source of income than the annual income from farming. Non-farm income has an adverse relationship with farm income, as evidenced by the negative beta value in the regression analysis. This indicates that an increase in non-farm activities corresponds to a decrease in farm revenue, possibly due to the reallocation of time and resources away from farming practices. However, the effects of non-farm income on overall household income are significant. Both the regression analysis and the literature agree that non-farm activity is a statistically significant predictor of income for impaired farmers. Furthermore, non-farm activities are crucial in reducing income disparity and providing a reliable source of income for rural households, highlighting their importance in supporting rural livelihoods.

An analysis of the proportion of products sold as a factor that affects the annual farm income of farmers with disabilities (PWDs) found that it significantly impacts their annual farm income, with a significance value of 0.000 and a beta value of 0.256. It suggests a strong positive relationship exists between the proportion of products sold and the annual farm income of PWDs. The t-value of 4.156 further supports this finding, as it indicates that the relationship between the proportion of products sold and the income of PWDs is statistically significant. It means that PWDs who sell more farm products earn 25.6% more farm income, with other factors constant. The more income from such sales may be used to satisfy the family's other food and material needs. Some farmers may use some of their farm products for household consumption and therefore sell less of the farm products. Some work has been done on PWDs and farmers in general, highlighting the economic challenges PWDs face in agriculture. For example, a study by D  a et al. (2017) found that farmers with disabilities often face barriers in accessing markets, limiting their ability to sell products and generate income (Matungul et al., 2001). Another study by McNaughton and Frey (2018) found that people with disabilities often have limited access to credit, making it difficult for them to expand their operations and increase their sales.

Deichmann et al. (2016) found that while market access and sales are essential factors that affect the income of PWDs, they also found that other factors, such as extension services and the adoption of modern technologies and practices, play a crucial role in increasing PWDs' income. Overall, these findings suggest that, while there is limited literature to support the study on the proportion of products explicitly sold, it is clear that PWDs face economic challenges in agriculture. Improving their access to markets, credit, and extension services and supporting the adoption of modern technologies and practices can help improve their income. It is also essential to address PWDs' barriers to accessing markets and credit, such as discrimination and a lack of accessibility. The analysis suggests that non-farm activity, farm size, the proportion of inputs purchased, and the proportion of products sold are all crucial determinants of PWDs' annual farm incomes. A combination of these factors and other unmeasured variables likely contribute to PWDs' incomes.

Implications of the findings on the Well-being of FWD

The regression analysis of various factors influencing the annual farm income of Farmers with Disabilities (FWD) highlights significant implications for their economic wellbeing. A key finding is the negative relationship between farm size and income, with a unit increase in farm size reducing income by 41.8%. This counterintuitive result suggests that FWDs may lack sufficient resources or inputs to optimize production as farm size grows, leading to inefficiencies. Unlike findings from other studies, this result underscores the need for targeted policies that support FWDs in maximizing the potential of their landholdings. Such measures could include subsidies, access to affordable inputs, and training programs focused on resource management. Another important finding is the negative impact of the proportion of farm inputs purchased on income, reflecting the diminishing marginal returns of additional inputs. As farmers increasingly rely on purchased inputs, their costs may outweigh the productivity gains, reducing overall profitability. This result emphasizes the importance of cost management and optimal resource allocation for FWDs. Policymakers and agricultural extension services can play a vital role by offering training in efficient input utilization and providing subsidized access to essential inputs, helping FWDs improve their productivity while controlling costs.

Non-farm activities were also found to negatively influence farm income, as indicated by the regression's beta value of -0.616. This suggests that time and resources diverted to non-farm activities reduce the focus on farming practices. However, non-farm activities can be a crucial source of supplementary income, contributing to overall household financial stability. In this context, policymakers should encourage a balanced approach, enabling FWDs to engage in non-farm activities without compromising their farm productivity. Programs that support income diversification while fostering efficient time management can significantly improve the economic resilience of FWD households.

The proportion of farm products sold showed a positive and significant impact on farm income, with a beta value of 0.256. This highlights the importance of market access for FWDs, as selling more products directly correlates with higher income. However, FWDs often face barriers such as limited mobility, market discrimination, and restricted access to credit, which hinder their ability to maximize sales. Addressing these challenges through inclusive market linkages, improved mobility solutions, and equitable access to financial resources can enhance the market participation of FWDs and boost their income. Overall, the findings reveal complex interactions between farm size, input costs, non-farm activities, and market access, all of which significantly impact the incomes of FWDs. They also highlight the underlying income disparities within this group, which are influenced by these factors. To improve the livelihoods of FWDs, a multifaceted approach is needed. This includes training programs in modern agricultural techniques, financial literacy, and entrepreneurship, alongside policies that promote equitable access to resources and markets. By addressing these factors holistically, it is possible to create a supportive environment that fosters sustainable income growth and enhances the overall well-being of FWDs.

Conclusions and Recommendations

We investigated the income determinants of farmers with disabilities (FWD) in Ghana through a methodologically rigorous cross-sectional survey. Further analysis of the statistically significant variables revealed that three variables—farm size, the proportion of farm inputs purchased, and non-farm activities—had an inverse relationship with household or farm income. On the other hand, two variables—the proportion of products sold and access to markets—had a

positive correlation with household or farm income. These findings have important implications for the well-being of FWDs and inform actionable recommendations to improve their livelihoods.

Variables with Negative Significance

The variables with a statistically significant negative relationship with household or farm income include farm size, the proportion of farm inputs purchased, and non-farm activities.

- **Farm Size:** The study found that an increase in farm size decreases annual farm income by 41.8%, holding other factors constant. This inverse relationship may result from the inability of FWDs to adequately manage larger farms due to constraints such as limited inputs, labour, or financial resources. This finding suggests that owning or managing large farms may not necessarily lead to better income for FWDs unless additional resources and support mechanisms are in place.
- **Proportion of Farm Inputs Purchased:** A higher proportion of farm inputs purchased negatively impacts income, likely due to diminishing marginal returns. When farmers over-rely on purchased inputs, the associated costs may outweigh the incremental productivity gains, reducing overall profitability. This highlights the need for efficient input management and cost control.
- **Non-Farm Activities:** The involvement in non-farm activities was also found to negatively influence farm income, with time and resources being diverted from farming. While non-farm activities can serve as a source of supplementary income, they may hinder farming efficiency and productivity when prioritized over agricultural activities. These findings emphasize the importance of resource optimization and balanced livelihood strategies to ensure that FWDs derive the maximum benefit from their farming operations.

Variables with Positive Significance

The variables with a statistically significant positive relationship with household or farm income include **the proportion of products sold** and **access to markets**.

- **Proportion of Products Sold:** FWDs who sold a higher proportion of their farm products reported higher incomes, with a 25.6% increase in farm income associated with increased sales. This underscores the importance of market participation for improving the financial outcomes of FWDs. Selling more products allows farmers to generate additional revenue, which can be reinvested in farm operations or used to meet household needs.
- **Access to Markets:** Enhanced access to markets plays a crucial role in increasing the proportion of products sold. Market access allows FWDs to connect with buyers, negotiate better prices, and expand their customer base, leading to higher incomes. Addressing barriers such as limited mobility, discrimination, and poor infrastructure can further amplify these benefits.

Recommendations

Based on these findings, several recommendations can be made to enhance the income and overall well-being of FWDs:

- Support for Resource Optimization: Policies should focus on equipping FWDs with the resources needed to manage their farm sizes effectively. This includes providing subsidies for inputs, access to affordable credit, and training in efficient farming practices.
- Efficient Input Management: Farmers should be trained on cost-effective input utilization to avoid the pitfalls of diminishing marginal returns. Subsidized access to essential inputs can also alleviate the financial burden of purchasing inputs.
- Balanced Livelihood Strategies: Non-farm activities should be encouraged as supplementary income sources, but efforts should be made to balance these with farming activities. Time management training and support for part-time farming models may help mitigate the negative impact on farm income.
- Market Access and Linkages: Improving market infrastructure and creating inclusive market opportunities for FWDs are critical. Programs to address barriers such as mobility challenges and discrimination, along with initiatives to provide market information and training on negotiation skills, will empower FWDs to maximize their sales.
- Capacity Building and Technology Adoption: Training programs on modern agricultural technologies, financial literacy, and entrepreneurship should be prioritized. These will enable FWDs to enhance productivity, reduce costs, and achieve higher incomes.

By addressing these determinants of income through targeted interventions, the economic well-being and overall quality of life of Farmers with Disabilities in Ghana can be significantly improved.

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