African Multidisciplinary Journal of Research (AMJR) Vol. 5 (2), 2020, ISSN 2518-2986 (21- 47)

Impact of Agribusiness Training on Youth Empowerment: A Case Study of Fadama Graduate Unemployed Youth and Women Support (GUYS) Programme in Nigeria

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Abstract

Agripreneurship is increasingly being recognized as an important and valuable strategy to reduce the high dependency of young people on white-collar jobs as well as increase employment opportunities in the non-formal sector. Thus, it has become one of the key African governments' investments in the creation of sustainable employment as well as improvement of livelihoods of young people. Based on this, development stakeholders in many African countries have come together in recent times to support agripreneurship by organizing agribusiness training programmes which specifically target this category of the population. Despite the numerous training interventions, there is a dearth of empirical evidence on what has worked and what has not. Using the case of Fadama Graduate Unemployed Youth and Women Support (GUYS) programme, this study used the Propensity Score Matching (PSM) method to investigate the impact of agribusiness training on youth empowerment in Nigeria. A total of 977 respondents comprising of 455 participants and 522 non-participants were sampled across three states. PSM model results showed that after controlling for all confounding factors, participation in training in the Programme had about 11 percent increase in youth empowerment index score. This implied a positive change in the economic status and livelihoods of the youths who participated in the agribusiness training of the Programme. Thus, the study suggests that programmes such as the Fadama GUYS should be encouraged and out-scaled elsewhere in Africa as they can inspire youths to engage in agribusiness and thereby contribute to reduction of youth unemployment as well as enhancement of youth empowerment.

Keywords: Agribusiness, Youth empowerment, Youth unemployment**,** Agribusiness training

Introduction

Nigeria is the most populous country in Africa with a population of about 195,874,740,[1] out of which according to Awogbenle and Iwuamadi (2010), 60% is between 18 and 35 years, an age category regarded to as youths (Nigeria Youth Policy Document, 2009). Hence, it can be inferred that Nigeria is largely a youthful country (Emeh & Eke, 2012). The country is enormously endowed with abundant resources capable of empowering the youths for positive outcomes which can bring about sustainable social and economic development (Odeh & Okoye, 2014). Despite many studies proving that youths are valuable assets which is germane to successful and sustainable nation-building (Mutuku, 2011; Hope, 2012), the general characteristics of Nigeria youths depicted by a high rate of unemployment and underemployment clearly indicate that this segment of the population is faced with tough economic challenges. The National Bureau of Statistics (2018) reported that as at the third-quarter of 2018, 55.4 per cent of young people were either underemployed or unemployed (doing nothing) compared to 52.6 per cent in the same period of the previous year (2017). This report shows an increased unemployment rate of about 5 per cent in the space of one year. Over the years, unemployment has eaten really deep into the fabric of Nigeria thereby pushing many young people to either roam the streets meaninglessly searching for a living (Ali & Salisu, 2019) or engage in illegal activities and thereby increasing crime rate in the country. In view of this, stakeholders have come to realize that the most challenging policy question that has to be addressed sooner than later is the growing rate of youth unemployment. Hope (2012) affirms that to mitigate the several challenges faced by young people in Nigeria, government and development partners would have to focus on developing and implementing relevant and sustainable strategies, policies and programmes which favours this large segment of the population. According to the author, failure to do this could lead to enormous political, social, economic, and cultural consequences which is already evident in the country. It is for these reasons that trainings such as vocational and entrepreneurial training came into being. This will help to convey relevant skills to young people which will not only reduce unemployment – a severe national scourge - but will also aid youth empowerment.

Entrepreneurship development has been closely linked to social and economic development.

[1] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=NG&view=chart visited on July 25, 2019

It is believed that a lasting solution to youth unemployment is embedded in helping young people to create their own jobs (become Entrepreneurs). This is well articulated by Maigida, *et al*. (2013) who argued that the only sustainable way to empower Nigerian youths is to provide them with adequate and qualitative training and education which will enable them to be job creators instead of seekers. At the centre of all these job creation initiatives is the agricultural sector which has been identified as one of the sectors capable of generating sustainable employment opportunities for a large number of young people (Yami *et al*., 2019). Based on this, agribusiness training has become one of the important Nigerian government initiatives to empower young people as well as inspire them to become job creators.

In recent times, the government with the support of development partners have shown their political commitment towards empowering young people through agribusiness training. According to Yami *et al*. (2019), there are increasing investment on agricultural programmes aimed at promoting youth participation in agribusiness to reduce youth unemployment problems and subsequently empower this category of the population. The country has seen a remarkable number of interventions by both the private and public sectors in recent times. Examples include; Npower, Youth Commercial Agriculture Development Programme (YCAD), Youth Employment in Agriculture Programme (YEAP), Youth Initiatives for Sustainable Agriculture (YISA) and The Livelihood Improvement Family Enterprise (LIFE)**.** Awogbenle and Iwuamadi (2010) reported that between 1986 and now, there have been a number of remarkable initiatives by various administrations to promote youth empowerment through the generation of gainful self-employment This also corroborates the findings of Yami *et al*. (2019) that indeed there have been numerous interventions aimed at achieving youth empowerment through agribusiness in Nigeria. However, these authors also agreed that despite the increasing number of interventions, there is a dearth of empirical evidence as to what worked or what did not, making it difficult to make practical policy recommendations.

It is also worth noting that there is very scanty literature on youth empowerment in Nigeria (Emeh & Eke, 2012; Okoli & Okoli, 2013; Ibrahim, 2013; Hashim, 2014). To fill this research gap, this study investigated the impact of agribusiness training on youth empowerment, taking the case of Fadama Graduate Unemployed Youth and Women Support (GUYS) programme.

Thus, the study will serve as a guide to those aiming to research similar subject as well as provide practical evidence on the impact of youth programmes, thereby, driving evidence-based policy making which could benefit other African countries.

Background on Fadama GUYS Programme

In an effort to reduce youth unemployment and empower young people through agribusiness, the Fadama GUYS programme was introduced in 2017 by the Federal government of Nigeria, in collaboration with the World Bank and state governments. Funding was through a tri-partite agreement between each state government, the federal government and the World Bank. The programme covered a total of twenty-three states across Nigeria and targeted young people between 18 and 35 years of age. The training covered different agribusiness fields which include; Agricultural production (Crop and livestock), agricultural marketing, crop and livestock processing and financial management.

Theoretical background

The paper is anchored on the theory of change. According to Rogers (2014), the theory is the building block for impact evaluation. It is a key which underpins any impact evaluation, given the cause-and-effect focus of the current study (Gertler *et al.*, 2016). The theory was developed by Weiss (1995) and it describes how and why an initiative (such as training intervention) works. In other words, "it explains how the activities undertaken by an intervention" (such as a project, programme or policy) contributes to the result or the set of results which lead to expected or observed impacts. According to Gertler *et al*. (2016), the theory describes a chain of events which results into outcomes, explore the conditions needed to arrive at the outcome and clearly shows the causal logic behind the programme.

In the current study, the ultimate goal of the Fadama GUYS programme was to empower young people through agribusiness. To achieve this, the primary initiative taken was agricultural training which captures training on animal/crop production, marketing of agricultural products, processing, and financial management practices. These chains of events are expected to empower the participants to have better economic outcomes (Gertler *et al*., 2016). Specifically, participants are trained in different areas of agribusiness to gain desirable skills and attributes which could

contribute to their agripreneurship performance and subsequently empower them in the field of agribusiness.

Study Methodology

Study Area

The study was conducted in three states across Nigeria between January and March 2019. These include Abia, Ekiti and Kebbi States representing the South-eastern, South-western and North-western regions respectively. Abia state occupies a total land area of about 4,900 sq km. The estimated population as of 2016 was about 3,699,168 people (National Bureau of Statistics, 2011). Ekiti state is mainly an upland zone with a total land area of about 5,435 sq km. As of 2006, the state had a population of 2,398,957 people (National Bureau of Statistics, 2011) of which more than 75 percent were actively engaged in Agriculture. Kebbi state is located in the north-western part of Nigeria with a total land area of about 36,985 km sq out of which 12,600 km sq is cultivated for agricultural purposes. According to the National Bureau of Statistics (2011), the estimated population of Kebbi State as of 2016 was 4,440,000. As indicated by the United Nations Development Programme (2018), as of 2017, the unemployment rate in these states were of 39.6 percent, 18.6 percent and 11.6 percent, respectively.

Figure 1: Map of Nigeria showing the study areas

Sampling and Data Collection

Primary data was sourced from a total of 977 respondents comprising of 455 Fadama GUYS programme participants and 522 non-participants in the study areas. The survey included detailed information on key youth empowerment variables and other relevant socioeconomic characteristics such as age, gender, education and marital status. The questions were programmed on Open data kit and data were collected using phones and tablets by trained enumerators across the three states.

The study adopted a multi-stage sampling technique. In the first stage, three states were purposively selected. The choice of these states was based on the relatively high number of participants in the Fadama GUYS programme in 2017, to ensure representation of a state from each region where the programme was conducted (Northern, Western and Eastern), and similarity of the states in terms of specific characteristic since the three states ranked high is agricultural activities (more than 70 per cent of the population in all the states are engaged in agriculture). The aim of this was to ensure that the respondents are comparable to allow aggregation and generalization of results. In the second stage, the study population was divided into two strata: participants and non-participants. In the third stage, respondents were randomly selected from two sampling frames. The first sampling frame consisting of a complete list of youths who were trained under the FGP in 2017 was used in gathering the treated group and a second sampling frame consisting the list of community youths obtained from the local governments where the training was conducted was used in gathering the control group. The random selection of both the treatment and control group was done via random numbers generated using Microsoft Excel. The proposed sample size for participants was 488 and 600 for non-participants. The higher number of non-participants is to enhance the matching exercise. However, due to resource constraints, transportation limitations, and busy schedule of some of the respondents, only 455 was reached among the participants and 522 among the non-participants, making a total of 977 respondents.

Measurement of Youth Empowerment

Youth empowerment was measured with 15 indicators. Based on existing literature on youth empowerment indicators, a list which describes the important aspects of youth empowerment was sdeveloped (Muiruri, 2015 and International Labour Office, 2018).

These indicators are presented in Table 1. The indicators were subjected to Principal Component Analysis (PCA) in order to extract the essential components required to construct a non-standardized youth empowerment index (YEI). Based on Kaiser's criteria (Kaiser, 1960 ~~eigenvalue of 1 and above~~), several components were generated and retained for the construction of YEI. The proportion of each of the retained component was used as the weights in generating the non-standardized index following Equation 1. Also, the KMO value was used to show how much the retained components explained the variation in the data. According to Antony & Visweswara (2007), this value is considered as the middling which implies that the data is good for the analysis.

$$YEI^{NS} = \sum_{i=1,\dots n} \left\{ \frac{Proportion\ of\ PC\ Variation}{Total\ Variation\ of\ retained\ Component}\ X\ PC_i \right\} \quad (1)$$

Where:

PC = Principal component

i = Value of retained PC

YEI^{NS} = Non-standardized Youth Empowerment Index

To standardize the index, Equation 2 was be applied.

$$YEI^{S} = \frac{YEI^{NS}_{i\dots n} - Min\ YEI^{NS}_{i\dots n}}{Max\ YEI^{NS}_{i\dots n} - Min\ YEI^{NS}_{i\dots n}} \quad (2)$$

Where:

YEI^{S} = Standardized Youth Empowerment Index

YEI^{NS} = Non-standardized Youth Empowerment Index

$Min\ YEI^{NS}$ = Minimum non-standardized Youth Empowerment Index

$Max\ YEI^{NS}$ = Maximum non-standardized Youth Empowerment Index

Propensity Score Matching Method

This study adopted the Propensity Score Matching (PSM) method to deal with the problem of selection bias since participation in any programme may not be random. Many impact evaluation studies have adopted this method in analysing the impact of interventions or programmes (Asfaw & Shiferaw, 2010; Ahmed & Haji, 2014; Haji & Legesse, 2017; Balde, *at al.*, 2019).

The method is one of the non-parametric estimation procedures which relaxes the assumptions of functional forms imposed by parametric models and it is not restricted by distributional assumptions (El-Shater *et al*., 2015). It helps in comparing the observed outcomes of the participants with the outcomes of the non-participants (Heckman, Ichimura, & Todd, 1998). The basic idea behind this approach is to find in the group of participants, those who have similar relevant pre-treatment observable characteristics with the non-participants (Haji & Legesse, 2017). PSM essentially estimates youths' propensity to participate in the programme and it is commonly estimated using either the Probit of Logit regression model as a function of the observable characteristics of the youths and then matches youths with similar propensities. The PSM produces a variable called the propensity score which is the probability that a youth would participate in the programme and based on the youth's observable characteristics. We adopted the three widely used matching methods or algorithm for the purpose of comparison and robustness (NNM, CBM and KBM).

However, due to unobservable differences between the participants and non-participants of the programme, the PSM procedure alone may not yield conclusive results (there is overestimation or underestimation of the outcome) (Balde, *et al.*, 2019). To avoid this, we perform the test of balancing. We checked the matching quality through visual examination of the PS graph and by examining the pseudo r-squared, standardized bias, number of matched, high number of insignificant variables after matching sample and t-test. According to Caliendo & Kopeinig

(2008), a good matching quality is depicted by low pseudo r-squared, a mean standardized bias between 3 and 5 per cent, a large number of insignificant variables after matching and a large number of matched sample. Thus, the main feature of the matching procedure involves creating the conditions of a randomized experiment so as to evaluate a causal effect as in a controlled experiment (Asfaw & Shiferaw, 2010).

Let G_i^T and G_i^C be the outcome variable for participants and non-participants, respectively. The difference in the outcome between two groups can be calculated using Equation (3)

$$\Delta_I = G_i^T - G_i^C \quad (3)$$

Where:

G_i^T: Outcome of treatment (Youth empowerment of the ith individual, when he/she participates in the training programme,

G_i^C: Outcome of the non-participant

Δ_I: Change in the outcome which can be attributed to training for the ith individual.

Equation 4 can be expressed in causal effect notational form, by assigning $T_i=1$ as a treatment variable taking the value 0 if a respondent did not receive treatment (non-participant) and 1 otherwise. Thus, the Average Treatment Effect can be expressed as:

$$\text{ATE} = \text{E}\left(G_i^T \middle| T_i = 1\right) - \text{E}\left(G_i^C \middle| T_i = 0\right) \quad (4)$$

Where:

ATE= Average Treatment Effect, the treatment effect on the outcome variables.

$\text{E}(G_i^T | T_i = 1)$: Average outcome for those who participated in the programme, (T_i=1).

$E(G_i^C | T_i = 0)$: Average outcome of those who did not participate in the programme, (T_i=0).

The ATT for the sample is given by Equation 5:

$$ATT = E(G_i^T - G_i^C \mid T_i = 1) = E(G_i^T | T_i=1) - E(G_i^C | T=1) \quad (5)$$

The NNM estimator was used to pick the comparison group. This method could use a multiple nearest-neighbours or single nearest-neighbour with the closest propensity score to the corresponding participant unit (Asfaw & Shiferaw, 2010). The method could also be applied with or without replacement where the former allows a given non-participants to match with more than one participants (Adebayo, *et al*., 2018; Austin, 2014; Asfaw & Shiferaw, 2010; Caliendo & Kopenig, 2005). To check the robustness of our result, the impact estimate calculated using the NNM method was compared to the estimates of the CBM and KBM estimators.

Variables used in the participation and impact empirical models

Participation was measured as a dummy variable which takes the value of one if a youth participated in the training and zero otherwise. The other outcome variable considered in this study is the youth empowerment index (YEI). As discussed earlier, the index was computed using PCA based on existing literature on youth empowerment. A summary of the variables included in the logit regression (participation model) is presented in Table 2. The variables were selected based on scanty existing literature on youth participation in agricultural training programmes and youth empowerment (International Labour Office, 2018; Muiruri, 2015; United Nation, 2014; Maigida et al., 2013; Meredith, Lucas, Dairaghi, & Ravelli, 2013; Okoli & Okoli, 2013).

Results and discussion

Factors explaining youth participation in agribusiness training in the Fadama GUYS programme

The main results of the factors explaining the probability of participation in the Fadama GUYS programme (FGP) are presented in Table 3. The pseudo r-squared was 0.26 which shows that overall, the characteristics of the participants were not so distinct. This low pseudo r-squared is good for the analysis because, according to Ahmed and Haji (2014), a low pseudo r-squared within this range is essential as it helps in finding a good match between two groups. In addition, the likelihood ratio test and the chi-square also reveal that the model is fit for the analysis.

According to the logistic regression results, only three out of the twelve variables included in the model (Marital status, Head of household years of education and Productive asset index score) were not statistically significant (Table 3). On one hand, age, years of formal education of the youth, ownership of agribusiness venture, intention, youth perception about agribusiness training and perception about agribusiness positively and significantly influenced youth participation in agribusiness training in the FGP. On the other, gender and household size had a negative and significant influence on participation in agribusiness training.

Matching Estimator

According to Radicic *et al* (2014), Caliendo & Kopenig (2008), Sianesi (2002), a good matching estimator must fulfill a number of criteria which include; low pseudo r-squared, large number of insignificant variables after matching, large number of matched sample size and low mean SB between 3 and 5 percent. For the purpose of comparison, this study adopted NNM, KBM and CBM. However, the best matching algorithm based on the analysis was the NNM with four matches. Before matching, the pseudo r-squared was 0.2567. however after matching, the pseudo r-squared was reduced to 0.005 (see Table 4). Also, the likelihood ratio after matching shows that all the regressors in the treatment group were statistically insignificant which implies that the null hypothesis of joint significance could be rejected (Caliendo & Kopenig, 2005). The mean bias after matching was reduced to 4.1 percent from the initial value of 38.1 which indicates that there was an 89 per cent reduction and falls within the recommended mean bias of between 3-5 per cent.

Matching Participants and Non- Participants

The estimated mean, minimum and maximum values of the propensity scores for all sampled youths were 0.466, 0.010 and 0.971 respectively (Table 5). The corresponding figures for participants were 0.634, 0.059 and 0.971 respectively while that of the non-participants were 0.319, 0.010 and 0.923. Thus, the common support region lies between 0.059 and 0.971. To obtain a good quality match between participants and non- participants, the estimated propensity scores should satisfy the common support condition. Therefore, observations whose estimated propensity scores were not within the common support region was discarded so as to avoid bad matches. Subsequently, respondents with estimated propensity scores of less than 0.059 and greater than 0.971 were not considered for the matching.

Testing for Common Support

Only 36 cases representing four per cent of the entire sample size were lost to common support restriction using the NNM estimator (Table 6). This indicates that using the NNM estimator, only 36 respondents have a propensity score which lies outside the common support region (between 0.059 and 0.971). These cases were excluded from the analysis to avoid bad matches. However, there was enough overlap for the matching exercise. Using the other two estimators (KBM and CM), more cases (55) representing 7 per cent were lost to common support restriction.

In addition, Figures A.1, A.2, A.3 in show the estimated propensity score on the horizontal axis and their equivalent frequencies on the vertical axis for the three matching estimators. The three figures validate that very few cases were excluded from the analysis. Also, the propensity score distribution of the treated and control groups confirms that both groups had enough overlap which implies that the common support condition was fulfilled.

Testing the balance of Covariates

Among the three matching estimators tested in this study (namely; the Kernel bandwidth, Radius Caliper and Nearest Neighbour), the NN matching estimator with 4 matches was found to fit the data best. After choosing the best estimator, we went further to check the balancing of relevant covariates in the treatment and control groups. This was done using the criteria already specified. The results of the covariate balances in Table 6 show that after matching the two (treated and control) groups had close or almost the same matched sample means which was not the case before matching. For instance, before matching, the mean age of the participants was 27 years

while for non-participants was 24 years. However, after matching, the means were 27 years for both the control and treated groups (see Table 6). This implies that the covariates were well balanced and the two groups were comparable. Thus, covariates whose differences were statistically significant before matching became balanced and statistically insignificant after matching. This is because, according to Sianesi (2002), matching ensures balancing of the covariates in order to minimize selection bias. For the purpose of comparison, the results of the covariate balancing test shows that after matching, there was an 89 per cent reduction in the mean SB using the NNM and CBM estimators while an 87 per cent reduction was achieved using the KBM estimator (Table 7). This implies that after matching there was no observable differences in characteristics of the participants and non-participants.

It was also observed that after matching, using NNM and KBM estimators (Tables 6 and 8), all the variables became statistically insignificant which was not the case before matching, therefore indicating a good counterfactual. However, using the CBM estimator, one out of the 12 variables included in the model remained statistically significant (see Table 7).

Testing for Hidden Bias (Sensitivity Analysis)

One limitation of PSM is that it only compares the treated and control units based on observable characteristic (Asfaw & Shiferaw, 2010). Thus, it does not account for unobserved characteristics which may likely influence the decision to participate in the programme which may lead to hidden bias. Therefore, this raises questions about the consistency and robustness of the PSM estimates.

However, conducting a sensitivity analysis helps to examine whether the inferences about participation impacts may be questionable due to unobserved characteristics or variables in the data set. This study adopted the Rosenbaum bounds (rbounds) test to check the sensitivity of the estimates, testing the null hypothesis that unobserved characteristics have no effect on the outcome estimate. According to Hujer, *et al.* (2004), the gamma level, which is the odd ratio of differential treatment effect due to unobservable characteristics, is reported at the point where 10 per cent level of significance is exceeded.

The results of the sensitivity analysis on hidden bias reported in Table 9 shows that the critical level of gamma (**γ**) for the impact of FGP on youth empowerment varies between 2.90 and 2.95.

This implies that for the impact estimates to be nullified, the unobservable variable would have to increase the odds ratio of participation in the programme by up to 195 per cent. We, therefore, conclude that even large amounts of unobserved heterogeneity would not change the inference about the impact estimate of agribusiness training in FGP on level of youth empowerment.

Explaining effect of participation in agribusiness training on youth empowerment

After controlling for observable confounding factors, Table 10 shows the results of the Average Treatment of the Treated (ATT) of the three matching estimators on the outcome variable, youth empowerment. The impact of youth's participation in agribusiness training in FGP on their empowerment is revealed by the difference between the ATT of the control and treated groups. The results of the NNM, CBM and KBM estimators in Table 10 show that the participants of FGP had higher empowerment index score than non-participants. The positive difference in ATT obtained from the three estimators implies that participation in the programme resulted in a positive increment in the youth empowerment index score. The results further show that the difference in the ATTs of the three estimators were statistically significant at 1 per cent (Table 10) which agrees with the findings of Judith (2014) and Caliendo & Kopenig (2005) that the three estimators should give similar results with only slight differences based on the efficiency of the matching estimator involved. Thus there is a clear demonstration that agribusiness training had a positive impact on the youth empowerment in the FGP.

Conclusion and Policy Recommendations

This paper has clearly shown that, after controlling for all confounding factors, participation of youth in agribusiness training has a positive effect on their empowerment. The causal impact estimation with the PSM showed that participants of the FGP have significantly higher empowerment index score compared to the non-participants. Also, results from the sensitivity analysis showed that the impact estimate is robust against any hidden bias. Thus agribusiness training programmes in Sub-Saharan Africa have the potential to enhance youth empowerment if they follow the model of FDP. Governments and other stakeholders are therefore encouraged to initiate or up-scale implementation of such programmes in their countries.

The results of this paper generally confirms the potential direct impact of agribusiness training programmes on improving youth empowerment and thereby improving agriculture and livelihoods. It is believed that these programmes are likely to inspire young people to engage in agribusiness and reduce urban-rural migration, idleness and problems associated with drug and substance abuse among the youth. Further, such programmes would make youth them acquire relevant skills required in agripreneurship, thereby opening up employment opportunities and sustainable means to generate income. Thus, governments, development partners and other stakeholders should consider agribusiness training programmes as one of the priority interventions and strategies of youth development and empowerment. This would imply improvement of budget allocations to youth ministries and relevant state departments in order to fund such initiatives.

Funding

This research was funded by the International Fund for Agricultural Development (IFAD) under the grant number 2000001374 "Enhancing Capacity to Apply Research Evidence (CARE) in Policy for Youth Engagement in Agribusiness and Rural Economic Activities in Africa" Project in the International Institute of Tropical Agriculture (IITA).

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TABLES IN THE TEXT

TABLE 1: INDICATORS OF EMPOWERMENT

Six Domains of Empowerment (6DE)	**Indicators**	**Policy issues that are generally triggered**
Access and decision to credit	1. Decision on use of credit 2. Decisions on source of credit 3. Credit repayment ability	Economic empowerment
Asset ownership	4. Personal assets 5. Agricultural (Productive) assets	
Youth Livelihood	6. Personal living condition (rated between 1 and 10) 7. Household living condition 8. contribution to HH income 9. life contentment (rated between 1 and 10)	Economic empowerment, Social capital, Decision-making and representation
Financial Freedom	10.Consistent source of income 11. Control over use of income 12. Dependence on family for basic needs	
Group Membership	13. Membership of association	
Relationship	14. Closeness to family members 15. Relationship with family	

Source: Author's computation from existing literature on Youth and Women Empowerment

TABLE 2: DEFINITION OF VARIABLES

Variable definition and Codes	Measurement
Dependent variables	
Participation in the training programme	Dummy 1 if Yes, 0 if No
Youth Empowerment Index	Continuous
Independent variables	
Age	Continuous
Years of formal education	Continuous
Gender	Dummy, 1 if male, 0 if female
Household Size	Continuous
Intention to start agribusiness	Dummy, 1 if Yes, 0 if No
Asset index	Continuous
Years of education of Household head	Continuous
Agribusiness ownership	Dummy, 1 if Yes, 0 if No
Migration from original residence	Dummy, 1 if Yes, 0 if No
Perception about training	Dummy, 1 if Yes, 0 if No
Perception of Agribusiness	Dummy, 1 if Yes, 0 if No

TABLE 3: RESULTS OF THE LOGISTIC REGRESSION MODEL

Variable	**Coef.**	**S.E**	**z-value**	**M.E**
Age	0.110	0.025	4.480***	0.027
Years of Formal Education of the youth	0.074	0.031	2.350**	0.018
Gender (Male =1)	-0.417	0.183	-2.270**	-0.104
Marital Status (Married =1)	0.042	0.254	0.170	0.011
Household size	-0.067	0.028	-2.360**	-0.017
Ownership of Agribusiness (Yes=1)	0.940	0.218	4.310***	0.231
Migration status (Migrated =1)	0.397	0.182	2.190**	0.098

Agribusiness Intention (Yes =1)	0.674	0.072	9.320***	0.167
Productive asset index score	-0.042	0.033	-1.300	-0.011
Perception about training (Positive =1)	0.593	0.296	2.010**	0.142
Perception about agribusiness (Positive =1)	0.821	0.271	3.030***	0.192
Head of Household Years of schooling	0.013	0.027	0.480	0.003
Constant	-7.152	0.802	-8.910***	

No of observation = 977

Pseudo r-squared = 0.2567

LR chi2(12) = 346.49

Prob > chi2 = 0.0000

Log likelihood = -501.6626

Source : Stata Output, calculated from Field survey date, 2019
****** p < 0.01, ** p < 0.05, * p < 0.1***

TABLE 4: COMPARISON OF THE PERFORMANCE OF MATCHING ESTIMATORS

Matching Algorithm	Number of Insignificant variables after matching	Pseudo R2 after matching	Matched sample size	Mean SB
Nearest Neighbour Matching				
1	11	0.012	941	4.9
2	12	0.009	941	4.7
3	12	0.007	941	4.7
4	12	0.005	941	4.1
Kernel Matching				
No Bandwidth	12	0.009	941	4.9
0.01	12	0.007	922	4.7
0.05	12	0.009	941	5.3
Caliper Matching				
0.01	11	0.009	922	4.1

0.05	11	0.012	941	4.9
0.25	11	0.012	941	4.9

Source: survey data (2019)

TABLE 5: MEAN OF ESTIMATED PROPENSITY SCORES

Group	Observation	Mean	Min	Max
Total Respondents	977	0.466	0.010	0.971
Participants	455	0.634	0.059	0.971
Non-participants	522	0.319	0.010	0.923

Source: survey data (2019)

TABLE 6: COVARIATE BALANCING TESTS FOR SELECTION BIAS AFTER MATCHING FOR NNM

Variable	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduction bias	t-test	p>t
Age	Unmatched	27.33	24.33	69.9		10.92	0.000
	Matched	26.89	27.13	-5.6	91.9	-0.77	0.440
Years of Formal Education	Unmatched	14.48	13.77	24.1		3.78	0.000
	Matched	14.34	14.49	-5.1	79.0	-0.76	0.445
Gender (Male =1)	Unmatched	0.65	0.68	-6.2		-0.96	0.337
	Matched	0.67	0.69	-3.3	46.4	-0.48	0.631
Marital Status (Married =1)	Unmatched	0.40	0.14	59.1		9.32	0.000
	Matched	0.35	0.34	2.2	96.2	0.29	0.772
Household size	Unmatched	5.63	6.49	-26.1		-4.03	0.000
	Matched	5.79	5.99	-6.0	77.1	-1.04	0.297
Ownership of Agribusiness (Yes=1)	Unmatched	0.43	0.10	82.0		13.00	0.000
	Matched	0.39	0.39	1.2	98.6	0.14	0.888
Migration status (Migrated =1)	Unmatched	0.65	0.63	4.4		0.68	0.498
	Matched	0.65	0.68	-5.4	-23.1	-0.79	0.432
Agribusiness Intention (Yes =1)	Unmatched	3.67	2.55	95.8		14.90	0.000
	Matched	3.59	3.56	2.7	97.2	0.41	0.678
Productive asset index score	Unmatched	4.68	4.35	12.9		1.99	0.046
	Matched	4.62	4.47	6.0	53.0	0.89	0.372
Perception about training (Positive =1)	Unmatched	0.92	0.84	25.6		3.95	0.000
	Matched	0.92	0.92	-2.4	90.6	-0.41	0.679
Perception about agribusiness (Positive =1)	Unmatched	0.90	0.80	30.6		4.72	0.000
	Matched	0.89	0.88	5.6	81.8	0.89	0.372
Head of Household Years of schooling	Unmatched	14.76	14.02	21.1		3.30	0.001
	Matched	14.54	14.65	-3.4	83.9	-0.55	0.584

Source: survey data (2019)

TABLE 7: COVARIATE BALANCING TESTS FOR SELECTION BIAS AFTER MATCHING FOR CBM

Variable	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduction Bias	t-test	p>t
Age	Unmatched	27.33	24.33	69.9		10.92	0.000
	Matched	26.79	27.10	-7.3	89.6	-0.97	0.333
Years of Formal Education	Unmatched	14.48	13.77	24.1		3.78	0.000
	Matched	14.36	14.45	-2.9	88.0	-0.42	0.675
Gender (Male =1)	Unmatched	0.65	0.68	-6.2		-0.96	0.337
	Matched	0.67	0.68	-2.1	65.5	-0.30	0.763
Marital Status (Married =1)	Unmatched	0.40	0.14	59.1		9.32	0.000
	Matched	0.34	0.29	12.9	78.2	1.68	0.094
Household size	Unmatched	5.63	6.49	-26.1		-4.03	0.000
	Matched	5.82	5.98	-4.7	82.1	-0.77	0.442
Ownership of Agribusiness (Yes=1)	Unmatched	0.43	0.10	82.0		13.00	0.000
	Matched	0.38	0.38	-0.6	99.3	-0.07	0.942
Migration status (Migrated =1)	Unmatched	0.65	0.63	4.4		0.68	0.498
	Matched	0.66	0.65	2.1	52.0	0.30	0.767
Agribusiness Intention (Yes =1)	Unmatched	3.67	2.55	95.8		14.90	0.000
	Matched	3.57	3.55	1.9	98.0	0.29	0.773
Productive asset index score	Unmatched	4.68	4.35	12.9		1.99	0.046
	Matched	4.60	4.45	5.9	54.4	0.86	0.393
Perception about training (Positive =1)	Unmatched	0.92	0.84	25.6		3.95	0.000
	Matched	0.92	0.91	1.6	93.9	0.25	0.803
Perception about agribusiness (Positive =1)	Unmatched	0.90	0.80	30.6		4.72	0.000
	Matched	0.89	0.88	4.2	86.1	0.66	0.511
Head of Household Years of schooling	Unmatched	14.76	14.02	21.1		3.30	0.001
	Matched	14.52	14.63	-3.2	84.8	-0.49	0.625

Source: survey data (2019)

TABLE 8: COVARIATE BALANCING TESTS FOR SELECTION BIAS AFTER MATCHING FOR KBM

Variable	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduction bias	t-test	p>t
Age	Unmatched	27.33	24.33	69.9		10.92	0.000
	Matched	26.79	27.14	-8.3	88.2	-1.10	0.271
Years of Formal Education	Unmatched	14.48	13.77	24.1		3.78	0.000
	Matched	14.36	14.55	-6.6	72.7	-0.99	0.322
Gender (Male =1)	Unmatched	0.65	0.68	-6.2		-0.96	0.337
	Matched	0.67	0.69	-3.3	45.8	-0.48	0.635
Marital Status (Married =1)	Unmatched	0.40	0.14	59.1		9.32	0.000
	Matched	0.34	0.32	4.5	92.4	0.58	0.565
Household size	Unmatched	5.63	6.49	-26.1		-4.03	0.000
	Matched	5.82	6.03	-6.1	76.6	-1.03	0.304
Ownership of Agribusiness (Yes=1)	Unmatched	0.43	0.10	82.0		13.00	0.000
	Matched	0.38	0.36	3.7	95.5	0.44	0.661
Migration status (Migrated =1)	Unmatched	0.65	0.63	4.4		0.68	0.498
	Matched	0.66	0.67	-3.3	24.7	-0.47	0.639
Agribusiness Intention (Yes =1)	Unmatched	3.67	2.55	95.8		14.90	0.000
	Matched	3.57	3.52	4.2	95.6	0.64	0.526
Productive asset index score	Unmatched	4.68	4.35	12.9		1.99	0.046
	Matched	4.60	4.41	7.2	44.2	1.04	0.297
Perception about training (Positive =1)	Unmatched	0.92	0.84	25.6		3.95	0.000
	Matched	0.92	0.92	-3.1	88.0	-0.51	0.608
Perception about agribusiness (Positive =1)	Unmatched	0.90	0.80	30.6		4.72	0.000
	Matched	0.89	0.88	2.6	91.4	0.41	0.679
Head of Household	Unmatched	14.76	14.02	21.1		3.30	0.001

Years of schooling	Matched	14.52	14.66	-3.9	81.4	-0.63	0.531

TABLE 9: INDICATORS OF MATCHING QUALITY AND ROBUSTNESS OF RESULTS

	Mean bias			Pseudo-R^2		p>chi2		Gamma
Matching algorithms	**Before**	**After**	**% bias reduction**	**Unmatched**	**Matched**	**Unmatched**	**Matched**	
NNM	38.1	4.1	89	0.26	0.005	0.000	0.930	2.90-2.95
KBM	38.1	4.7	87	0.26	0.007	0.000	0.840	2.90-2.95
CBM	38.1	4.1	89	0.26	0.009	0.000	0.597	2.90-2.95

Source: survey data (2019)

TABLE 10: IMPACT OF AGRIBUSINESS TRAINING ON YOUTH EMPOWERMENT IN FGP

Outcome variable	**Matching algorithm**	**Treated**	**Control**	**ATT (Difference)**	**Std. Error**	**t-value**
Youth Empowerment Index	NNM	6.416	5.692	0.724	0.116	6.25***
	CBM	6.393	5.557	0.836	0.134	6.24***
	KBM	6.393	5.608	0.784	0.112	7.03***

Source: survey data (2019)

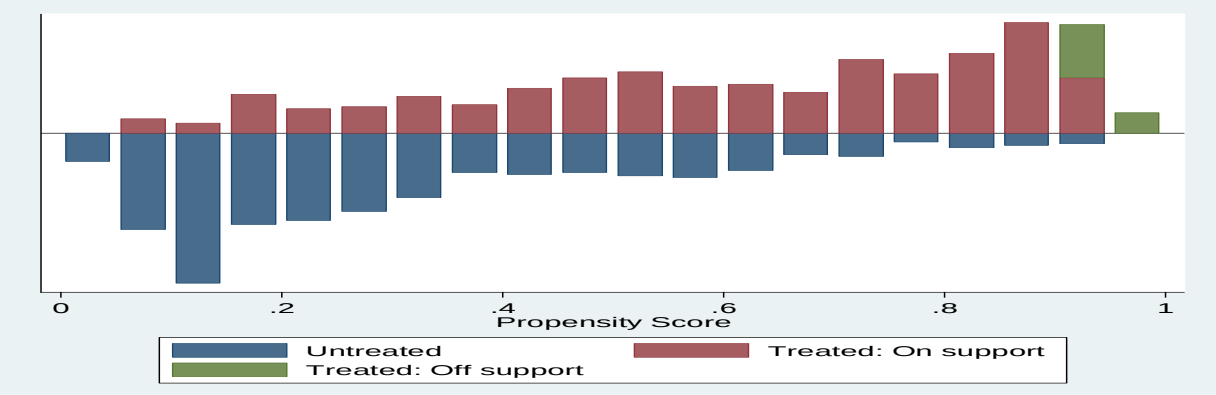

FIGURE A. 1: COMMON SUPPORT GRAPH FOR NNM ALGORITHM

Source: Stata Output, generated from Field Survey data using Psgraph, 2019

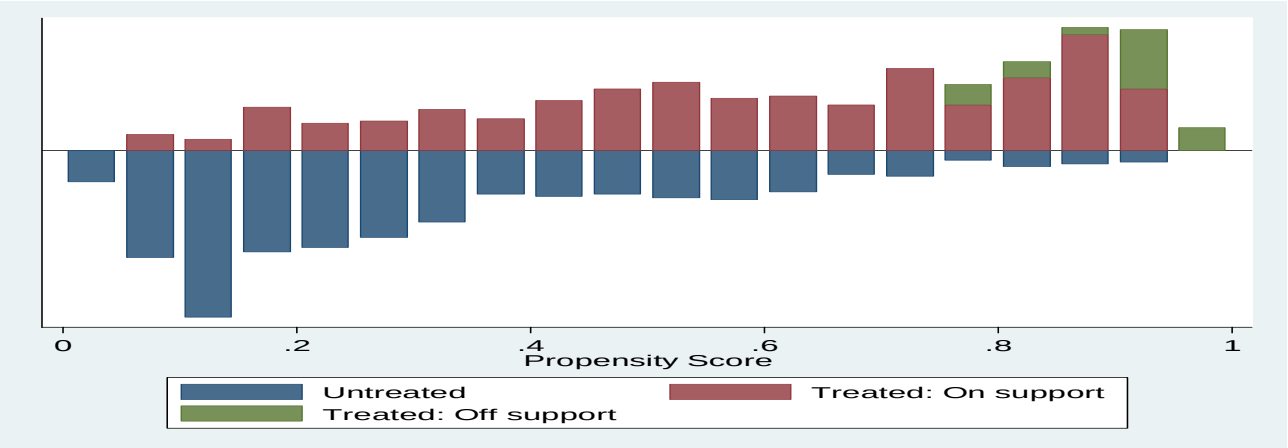

FIGURE A. 2: COMMON SUPPORT GRAPH FOR KBM ALGORITHM

Source : Stata Output, generated from Field Survey data using Psgraph, 2019

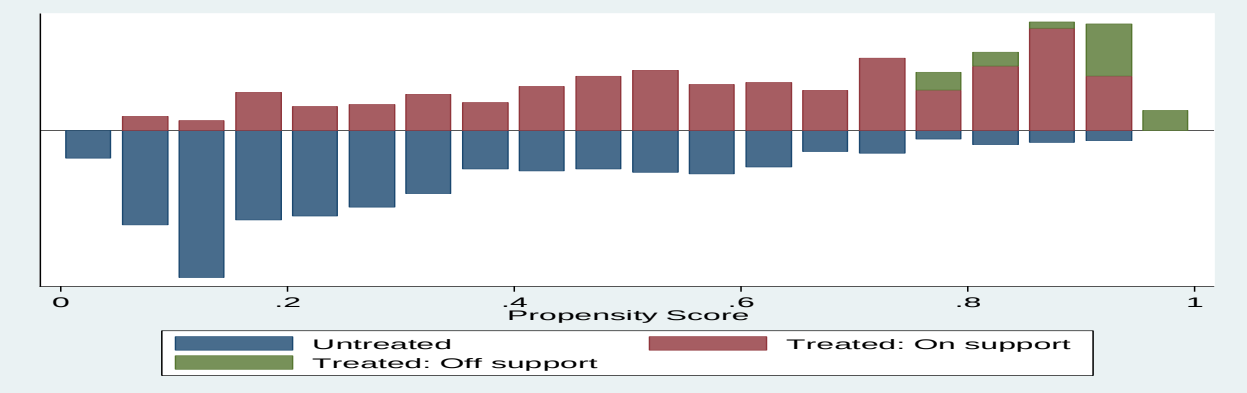

FIGURE A. 3: COMMON SUPPORT GRAPH FOR CBM ALGORITHM

Source: Stata Output, generated from Field Survey data using Psgraph, 2019