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Ghana's Planting for Food and Jobs Programme: A Look at the Role of Capability in Farmers' Participation

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ABSTRACT

An objective interpersonal comparison of wellbeing requires that people's capabilities are considered. This paper operationalizes Sen's capability concept in maize-based farming systems and assess how it influences farmers' participation in the Planting for Food and Jobs programme in the Bunkpurugu-Yunyoo District of the Northern region, Ghana. We used data from 314 households through multi-stage sampling procedure. Capability was quantified using factor analysis, while its determinants were identified through multiple linear regression analysis. Afterwards, an instrumental variable probit model was used to examine the effect of capability on programme participation. The factor analysis results reveal two attributes of capability, which were labeled as human capability and institutional capability. These capability attributes are significantly enhanced by availability of markets and good roads. The probit model results provide substantial evidence that both attributes of capability influence farmers' participation in the Planting for Food and Jobs programme. Specifically, a one standardized unit increase in institutional capability increases the probability of participation by 10.45%. The findings indicate that, for effective participation in agricultural interventions, farmers' capabilities need to be enhanced. This could be achieved through the provision of, and/or improvement in infrastructure, including roads and markets in remote production centers.

Keywords: Agricultural interventions, Factor Analysis, Planting for Food and Jobs, Sen's capability, Northern Ghana

1. Introduction

FAO (2015) reports indicate that Ghana achieved the Millennium Development Goal One target of halving poverty and malnutrition by the end of 2015. Despite this notable success, the FAO report and other researchers confirm that over a quarter of the Ghanaian population still lives below the poverty line of US$ 1.25/day, with the three northern regions of Ghana being the most affected (Cooke, Hague, and McKay 2016). Both policy makers and academics believe that the persistence of these problems are as a result of the low productivity in the agricultural sector, since Ghana's economy is essentially agrarian. MoFA (2017) outlines farmers challenges as including low accessibility and availability of certified seeds, insufficient nutrient fertilizer application, lack of extension services to farmers, weak linkages between producers and markets, and limited use of information and communication technology (ICT). The major players in Ghana's agricultural sector are smallholder farmers who contribute about 80% of the total agricultural output in the country (FAO, 2015), but producing major staple cereals like maize, rice, sorghum and millet, largely under rain fed conditions.

It is unequivocally argued in the economic growth and development literature that agricultural productivity growth is a necessary step towards national economic development (Pingali 2007; Ranis and Fei 1961; Lewis 2013; Lewis 1954; Valdés and Foster 2010). Since the onset of the Green Revolution (GR) paradigm, a strategy that has been advocated as capable of improving agricultural total factor productivity is agricultural intensification, which involves the use or combination of improved germplasm, fertilizer, organic resources and other modern technologies. This GR mindset has been tapped into Ghana's ongoing flagship Planting for Food and Jobs (PFJ) programme, which was started in the year 2017.

The PFJ programme has an intervention package, where improved seeds and fertilizer prices are subsidized by 50% in order to provide an even ground for farmers to access farm inputs. According to MoFA (2017) report on the strategic plan for implementation of the PFJ programme, unlike the normal reduction in input prices, the government distributed fertilizer based on an installment plan for farmers. Farmers under the programme are initially required to pay half of the subsidized price (i.e., 25% of the total cost) at the time of collecting the inputs, while the remaining half (i.e., 25% of the total cost) is paid after the produce is harvested. Beneficiaries who fail to repay the remaining half of the cost of inputs after harvest for two consecutive seasons become ineligible for participating in the programme in subsequent years, until all dues are fully cleared. In addition, internal controls, proper governance and management as well as checks and balances are imposed to curb elite capture. The PFJ programme being national in scope, it covers all the 216 districts in Ghana where the targeted food crops are cultivated. The programme targets productive and resource poor farmers who are willing to participate and raise their current factor productivity

levels. Each participant farmer can access subsidized inputs to cultivate a maximum of only 2 hectares (MoFA 2017).

It is important to mention that prior to the PFJ programme, other policies and programmes had been implemented; however, most have not been entirely successful. Therefore, successive governments continue to search for best programmes and policies that could help improve agricultural sector growth and development. For example, in 2008 the fertilizer subsidy programme was introduced by the government of Ghana (FAO 2015); however, it did not achieve the intended objective because fertilizer application remained considerably low after almost a decade of its implementation. Some of the challenges that contributed to the failure of the fertilizer subsidy programmes to achieve its intended objectives include lack of financial support, late delivery, politicization of distribution, smuggling and other related corrupt activities (Jayne et al. 2018; Banful 2011). Notwithstanding these implementation challenges and reported failures, Ghana government is still dedicated to promoting on-farm factor productivity growth through intensification of targeted crops in order to enhance job creation in the agriculture and other related sectors.

Participation in the PFJ programme is entirely voluntary, which obviously means that people's capability could play a role. By capability, we refer to Sen (1993) concept of capability and human development. According to Sen (1993), capability consists of the real freedoms or opportunities that a person has to achieve what is desirable and treasured to an individual's real life. The capability approach advocates that we are only justified to compare people's wellbeing if they have equal advantage in terms of the real freedoms and opportunities. In specific terms, the PFJ programme targets smallholder farmers who often live in deprived areas with numerous infrastructural bottlenecks, and unequal advantages in accessing agricultural inputs. Many of the farmers also have limited access to education and other factors that could enhance capability to participate in agricultural interventions.

Previous research in Ghana on participation in agricultural interventions concentrate on resources such as wealth or income and other socioeconomic factors that influence participation (Martey et al. 2013; Martey et al. 2014; Asante, Afarindash, and Sarpong 2011; Iddrisu, Ansah, and Nkegbe 2018), while the role of capability is ignored. While the 'resources approach' focuses on the 'ends'

the capability approach focusses on the 'means'. In the language of Sen (1993), the means are the capabilities, while the ends are the functionings (which are the realized outcomes). The means approach is considered more suitable for interpersonal comparison of wellbeing because people differ in the rate of conversion of capabilities into valuable capabilities based on available conversion factors (Burchardt and Hick 2018). The absence of conversion factors for some category of farmers could simply make certain functionings infeasible to attain. Thus, the role of the conversion factors in improving capabilities and for the sustainability of agricultural interventions like the current PFJ programme is arguably nontrivial.

In considering the role that capability plays in the participation of agricultural intervention programmes, the first difficulty remains how to adequately operationalize and measure capability in farming systems context. This is because capability is multidimensional, and unobserved, thus making it difficult to measure (Robeyns 2006, 2005). Meanwhile, improving people's capability first requires an understanding of which factors enhance or erode it, so that appropriate interventions could be developed and implemented. For this reason, this study first aims to operationalize capability in maize-based farming systems in the Bunkpurugu-Yunyoo district of northern region, Ghana. The second objective is then to assess how differences in maize farmers' capabilities influence their participation in the ongoing PFJ programme.

The rest of the paper is organized as follows. Section 2 provides a description of the study area, data and analytical techniques. In section 3, the main results and discussions are outlined, while section 4 concludes the paper and provides some policy implications.

2. Materials and Methods

2.1 Study area and data

Bunkpurugu-Yunyoo district is located in the north- eastern corner of the northern region of Ghana. The district has a land area of about 1,257.1 square kilometers with a population density of about 98 persons per square kilometer. It shares boundaries with Garu-Tempane district in the north, to the east Togo, to the west with East Mamprusi district and to the south with Gushegu and Chereponi districts. The district lies in the tropical continental western margin and experiences a single rainfall, with a maximum in May to October after which it comes under the

influence of the tropical continental air mass (a dry moisture laden wind which blows in north-easterly direction). The mean annual rainfall ranges between 100 mm to 155 mm and 30ºC to 40ºC for the annual temperature. The district lies in the interior woodland savannah belt and has grasses as the common vegetation interspersed with few trees such as sheanut trees, baobab and neem. The grasses grow in tussocks, reaching a height of about 3 meters. Based on the 2010 census, about 97.9% of the households in the district engage in crop farming with maize being the dominant crop. Figure 1 below shows the map of Bunkpurugu-Yunyoo district.

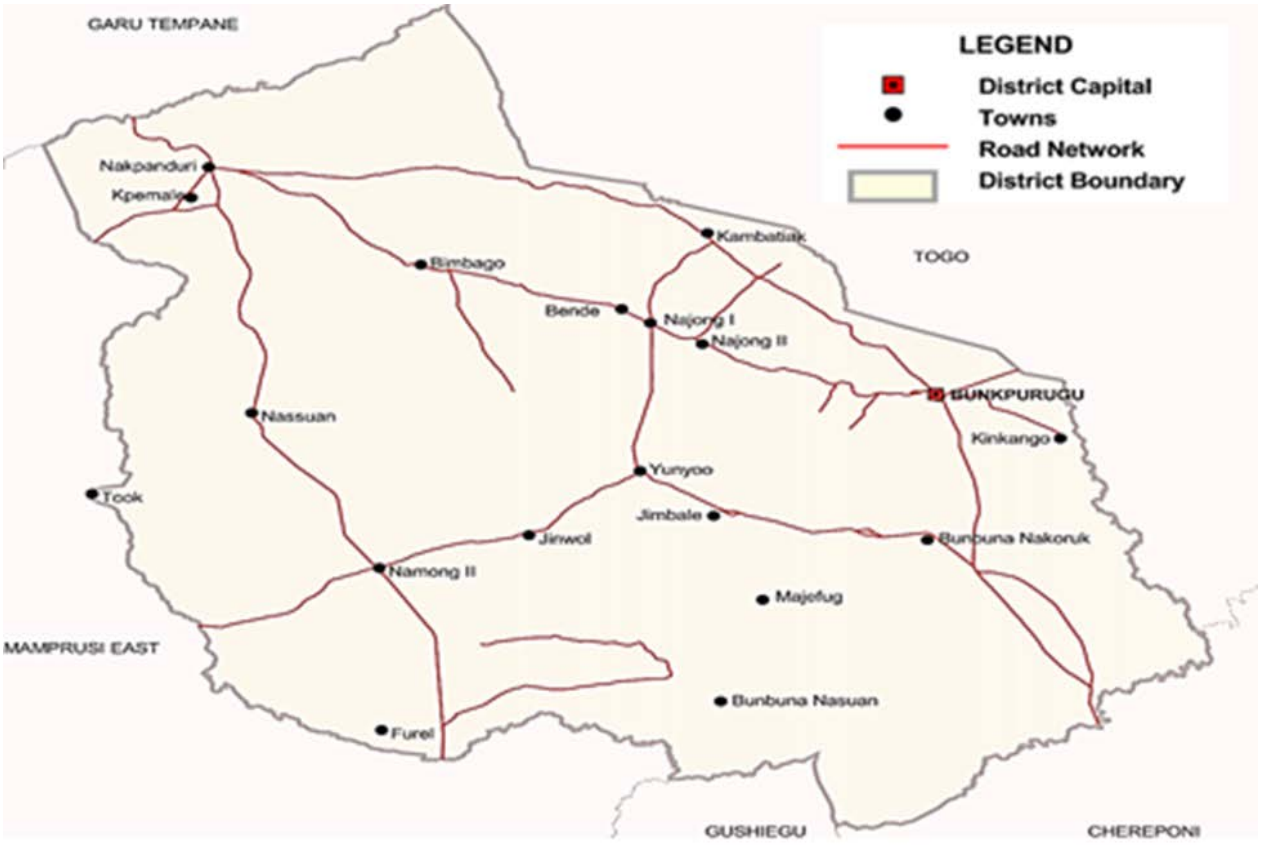

Figure 1: Map of former Bunkpurugu-Yunyoo district

A cross-section of maize farmers in the district were selected through a two-stage sampling technique. In the first stage, fifteen communities were randomly selected from the district. In the second stage, twenty-one respondents, consisting of nine PFJ programme participants and 12 non-participants, were randomly selected and interviewed by means of a questionnaire as survey instrument. The communities selected are Bimbago, Bimbago South, Nakpanduri, Tomoni, Kambateak, Bunkpurugu, Nassuan, Janandel, Jimbale and Kpemale, Bende, Yunyoo, Badimsuguru, Guangbeang and Jinwol.

Data collection took place within the months of December, 2017 and January, 2018. The questionnaire captured information relating to socioeconomic characteristics, indicators of capability, dwelling characteristics, land ownership and use, other income sources, political participation, markets, e-agriculture and PFJ programme participation challenges. A total of 135 participants and 180 non-participants in the PFJ programme were involved in the survey. This resulted in a total of 315 respondents; however, after data entry and cleaning, 13 respondents were omitted from the analysis due to incomplete information on them, leaving 302 valid observations for the final analysis.

2.1 Analytical framework

2.2.1 Capability and its determinants in maize-based farming systems

To find reliable indicators for operationalizing and measuring capability, we used a factor analysis technique developed by Kim and Mueller (1978), where the latent capability variable was measured from observed variables, labelled $x_1, x_2, x_3 \ldots \ldots \ldots \ldots \ldots x_n$. These observed variables are series of Likert-scale like questions that are believed to relate to capability based on the literature (Comim, Qizilbash, and Alkire 2008; Greco, Skordis-Worrall, and Mills 2018; Alampay 2006; Hatakka and Lagsten 2012). In this study, 21 questions that relate to capability were constructed for the survey. Given responses to these questions (observed variables), capability ξ is expressed as a linear combination of the observed variables in equation (1).

$$\boldsymbol{X = \lambda\xi + \epsilon} \qquad (1)$$

where X is a vector of capability indicators, λ represents factor loadings, which measures the relationship between capability and the indicators, while ϵ is the error term. Capability index scores are derived for each farmer when the factor scores are generated for each farmer. A multiple linear regression, given in equation (2) is then used to examine the factors that influence capability.

$$\xi = \boldsymbol{z\delta} + \boldsymbol{u} \quad (2)$$

where x is a vector of farm, farmer-specific and institutional variables that influence capability; b is a vector of unknown coefficients to be estimated, and v is the NIID (0,1) error term. The x vector variables are defined in table 1. The linear regression model specified in equation (2) is used as the first stage regression in the instrumental variable probit regression discussed under section 2.2.2.

2.2.2 Econometric analysis of capability effect on participation in the PFJ programme

To examine the effect of capability on PFJ participation, we follow several econometricians (Greene 2003; Gujarati 2009; Wooldridge 2009) and use the binary probit model. However, we suspect that capability is not entirely exogenous to participation, because farmer characteristics such as self-efficacy and industriousness which influence participation are also likely to affect participation. For this reason, we use the instrumental variable probit model to account for any potential endogeneity.

To set up the model, participation (y) is dummied, where a participant is coded 1 and 0 for a non-participant. Since the inclination to participate in the PFJ programme, y^* is unobserved, it is modelled as function of observed characteristics, x including capability, in equations (3a-3c) as follows:

$$\boldsymbol{y^*} = \boldsymbol{b_0} + \sum_{j=1}^{k} \boldsymbol{b_j x_j} + \boldsymbol{e} \quad (3a)$$

$$\boldsymbol{\xi} = \boldsymbol{\delta_0} + \sum_{j=1}^{k} \boldsymbol{\delta_j z_j} + \boldsymbol{u} \quad (3b)$$

$$\text{with } \begin{pmatrix} e \\ u \end{pmatrix} | z \sim \mathcal{N}\left[0, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right] \quad (3c).$$

In model (3a), we observe

$$y = \begin{cases} 1 & if \quad y^* > 0 \\ 0 & if \quad y^* \leq 0 \end{cases} \quad (3d).$$

Here, $x_j = (x_{1j}, \xi_j)$, y^* is a latent or unobserved variable, e is the random error associated with the PFJ participation model. In model 3a, x_j is endogenous as long as $\rho \neq 0$, otherwise it is exogenous, and ordinary probit model could be used to estimate the causal effect of capability on PFJ participation.

The empirical specification of the instrumental variable probit outcome model is specified in equation (4) as:

$$y^{*}=\beta_0 + \beta_1 institutional\ capability + \beta_2 human\ capability + \beta_3 age + \beta_4 household\ size + \beta_5\ education + \beta_6\ Ttotal\ land\ owned + \beta_7\ non-farm\ income + \beta_8\ extension\ service + e_i \quad (4)$$

where the $\beta_{,s}$ are unknown parameters to be determined. Measurement of variables are found in table 1 below.

Table 1: Explanatory variables and their hypothesized effects in the various econometric models

Variable	Measurement	Model *a priori* expectation	
		Capability	Participation in PFJ
Age	Years	+	+
Household size	Number of people eating from the same pot		+
Total stock of land	Acres	+	+
Visit of agricultural extension officer	1 if farmer receives extension services, 0 otherwise		+
Non-farm income	1 if farmer earns non-farm income, 0 otherwise	+	+
Distance to the nearest access road	Minutes by walking	+	_
Ownership of party card	1 if farmer owns a party card, 0 if otherwise		+
Capability	Measured as standardized factor scores from factor analysis		+
Access to credit	1 if farmer had access to credit, 0 otherwise	+	

Good price received for maize in previous harvest season	1 if farmer received good price for maize output, 0 otherwise	+	
Distance to output market	Minutes by walking	_	
PFJ programme participation	1 if farmer participated in the PFJ in 2017 cropping season, 0 otherwise		
Sex	1 if male, 0 if female	+	+
Distance from farm household to the farm	Minutes	_	_
Availability of input market	1 if input market is available in community, 0 otherwise	+	+
Type of road	1 if road is tarred, 0 otherwise	+	+
Land tenure system	1 if farmer owns the land, 0 otherwise	+	
Experience	Number years spent in farming	+	+

3. Results and Discussions

3.1. Socioeconomic characteristics of survey households

The sex distribution shows skewness towards males (87.42%), and many of the respondents were married (82.12%) at the time of the data collection. All other things being equal, married household have the advantage of family labour, especially considering that the PFJ intervention involves fertilizer use, which demands labour. Furthermore, majority of the respondents (67.55%) had no formal education. Musah (2013) reported that about half of adults in Ghana neither attended school nor completed Junior High School. According to Musah (2013), education creates the platform to find extra employment in the non-farm sector. With majority of the respondents in the district having no formal education, it is no surprise that the average person is not engaged in formal non-farm occupation. Undoubtedly, the low level of education in the

district could also affect farmers' participation in the PFJ programme, since education broadens an individual's understanding of issues related to programmes and policies.

Table 2: Distribution of the Socio-Demographic Characteristics of Maize Farmers in the Bunkpurugu-Yunyoo District.

Characteristic	Frequency	Percentage (%)
Sex		
Female	38	12.58
Male	264	87.42
Total	**302**	**100**
Marital status		
Married	248	82.12
Single	20	6.62
Divorced	10	3.31
Widowed	24	7.95
Total	**302**	**100**
Level of education		
Primary	32	10.60
JHS	40	13.65
SHS	18	5.96
Tertiary	8	2.65
No-formal education	204	67.55
Total	**302**	**100**

3.2 Summary statistics of explanatory variables used in the models

On the average, a participant maize farmer was 52.24 years, while a non-participant was 42.14 years old. While the participants are quite older than the non-participants, both fall within the active working age, and therefore have the potential to contribute to agricultural sector productivity growth. In terms of household membership, a participant household contained an average of 10 members, and non-participants, 8 members. In relation to education, the average participant had 2.21 years of education while that of a non-participant was 3.02 years. This implies very low levels of education of the farmers.

The average distance from residence to farm for the participants is 56.75 minutes by walking, and 69.90 minutes by walking for non-participants. Considering the average time spent, participants

tend to spend less time in walking to the farm which could induce participation in the programme. Again, participants tend to spend less time (43.31 minutes by walking) to access input markets than the non-participants (63.24 minutes). On the contrary, participants (35.59 minutes by walking) spend more time accessing output markets than non-participants (23.07 minutes). Also, with proximity to nearest access road, participants tend to be close (31.42 minutes by walking) than the non-participants (41.02 minutes). In totality, the participants have advantage in terms of accessible roads, proximity to their farm sites as well access input, which loosely indicates that participants were more advantaged to participate in the programme than non-participants.

For agricultural resources for production, land is the most important resource for the farmer. All else equal, the larger farms are expected to generate higher outputs. From the survey, participants cultivated an average 8.95 acres of maize, while the non-participants cultivated 5.27 acres. Similarly, the average farm experience of a participant was 30.71 years and 17.09 years for non-participants. The labour used by participants and non-participants averaged 29.90 and 29.30 person-days, respectively. Statistically therefore, there appears to be no difference in labour input for maize production between participants and non-participants. Besides land and labour, non-farm income is often needed for farm investment. The mean amounts of non-farm income are GH₵189.40 and GH₵ 111.67 for participants and non-participants, respectively. The relatively large average non-farm income of the participants could enhance their personal conversion factors to participate in the PFJ programme.

Since the survey involved participants and non-participants, a t-test was conducted on the model's socioeconomic, institutional and production variables to observe any statistically significant differences. The outcome indicates that age, household size, distance to the nearest access road, distance to the nearest input market, total land size, framers' experience, distance to the nearest output market, and non-farm income had statistically significant differences. This implies that, on average, the participant farmers were older, had larger households, travelled less distance to their farms, nearest access roads, nearest input markets. Participants are also more educated, have larger farms, are more experienced, and generate higher non-farm income sources than the non-participants.

3.3 Indicators of Capability and Factor Analysis

The principal factor method was used in this analysis, while Oblimin rotation method was employed to facilitate categorization. Results of the factor analysis indicates that 14 out of the 21 Likert-scale like statements reliably contribute to the capability scale and form the basis for measuring determinants of capability in maize-based farming systems (Table 4). The responses to the statements were best described by two main factors that represents two attributes of capability. The two factors explained 86.4% of the variance (Table 5) in the indicators. The first factor explains 55.8% of the variance and consists of nine statements relating to access to fertilizer, improved seeds, access to extension staff, access to credit, access to better market prices, unrestricted access to inputs, education, farm experience and political participation. The second factor explained 30.6% of the variance and consisted of five statements in the rotated factor solution, which related to knowledge on how to apply inputs, having voice in making decisions regarding farming, access to non-farm income sources, gender and mode of land acquisition.

Based on the factor loadings between each latent variable and the observed variables, we identified two attributes of capability as human and institutional capabilities (Table 5). Human capability are mainly human factors that relate to the freedoms and opportunities enjoyed by a farmer as a result of his or her personal factors like income, gender, ability to take decisions on one's own, among others. On the other hand, institutional capability are institutional factors that capture freedoms and opportunities of exogenous origin, and consists of access to markets, access to inputs, education, political participation, among others.

Table 4: Summary statistics of explanatory variables used in the regression models

Variable	**Participants**				**Non-participants**				
	Mean	Std. Dev	Minimum	Maximum	Mean	Std. Dev	Minimum	Maximum	T-test
Age	55.24	13.54	26	90	42.14	13.43	17	79	8.39***
Household size	9.39	3.93	2	24	7.55	3.75	1	23	4.14***
Education (years)	2.2	3.75		15	3.02	4.62	0	15	1.64*
Distance from household to the farm (minutes)	56.75	41.73	3	240	69.90	52.90	2	240	2.35***
Distance to the nearest input market (minutes)	43.31	17.55	3	120	63.24	43.42	15	280	5.00***

Distance to the nearest access road (minutes)	31.42	16.53	1	70	41.02	33.64	1	180	3.02***
Distance to the nearest output market (minutes)	44.05	19.13	3	150	52.27	31.87	15	240	2.63***
Farm size (acres)	8.95	5.54	2	30	5.27	3.68	1	40	6.91***
Experience (years)	30.71	13.65	4	60	17.09	12.28	1	60	9.11***
Labour	29.90	14.69	5	100	29.30	17.69	5	105	0.31
Non-farm income	189.40	209.93	0	900	111.67	212.61	0	1000	3.17***

NB: ***,**, and * indicate significance at 1%, 5% and 10% respective

Table 5: Indicators (statements) for measuring capability in maize-based farming systems in Bunkpurugu-Yunyoo District

Statements	Mean	Strongly disagree %	Disagree %	Neutral %	Strongly agree %	Agree %
I am able to access fertilizer and agro-chemicals without much obstacles	3.48	9.93	59.93	0.33	1.99	27.81
I am able to have relevant information and knowledge on how to use fertilizer and other agro-chemicals	1.64	1.66	1.66	-	44.04	52.65
I am able to have access to improved maize seeds whenever I deem necessary	3.93	13.25	77.15	-	0.66	8.94
I am able to have unrestricted access to extension staff and extension information	3.98	8.28	87.09	-	1.32	3.31
I am able to have access to credit for investment in maize production	3.81	8.94	77.48	0.33	0.66	12.58
I am able to have access to market for my maize produce and at better prices	3.25	10.26	48.34	0.33	2.65	38.41
I am able to have voice in decisions regarding maize farming	2.09	3.31	9.60	-	20.53	66.56
I am able to have access to non-farm income sources, which determines my level of investment I make in farm lands	3.15	6.62	48.01	0.33	1.92	49.71
I have unrestricted access to inputs at any time I wish to apply to my maize farm	3.55	7.28	67.88	0.66	2.98	21.19
My gender plays a role in getting access to land	2.60	5.30	25.50	0.33	6.95	61.92

My mode of land acquisition determines my level of investment	2.64	3.31	30.46	0.33	7.28	58.61
My level of education determines access to farm land	3.38	7.95	58.94	0.33	3.64	29.14
My experience in farming determines the level of investment I make in farm lands	3.16	8.94	46.03	0.33	3.31	41.39
My level of political participation determines my access to inputs	3.64	9.93	67.88	0.99	2.65	18.54

NB: Statements were measured using a 5-scale for all the items: 1-strongly agree, 2-agree, 3-neutral, 4-disagree, 5-strongly disagree

Table 2: Factor analysis and indicators of capability in maize-based farming systems

Indicators of capability	Unrotated solution		Oblimin rotated solution		Uniqueness
	Factor 1	*Factor 2*	*Factor 1*	*Factor 2*	
I am able to access fertilizer and agro-chemicals without impediments	0.461		0.461		0.7209
I am able to obtain relevant knowledge on how to use fertilizer and other agro-chemicals		0.316		0.322	0.7948
I am able to have access to improved maize seeds whenever deem necessary	0.560		0.554		0.6337
I am able to have unrestricted access to extension staff and extension information	0.390		0.430		0.7283
I am able to have access to credit for investment in maize production	0.324		0.352		0.7755

I am able to have access to market for my maize produce and at better prices	0.456		0.455		0.6942
I am able to have voice in decisions regarding maize farming		0.607		0.633	0.5663
I am able to have access to non-farm income sources, which determines my level of investment I make in farm lands		0.302		0.323	0.7933
Due to my gender, I'm able to get easy access to land		0.373		0.438	0.6861
I am able to access to inputs at any time I wish to apply on my maize farm without restriction	0.351		0.351		0.7277
The nature on my access to land affects the level of investment I make in the farm				0.342	0.7568
The level of education I have makes me able to access farmland without hassle	0.428		0.410		0.7132
The level of experience I have in farming affects the level of investment I make in the farm	0.414		0.462		0.7119
The level of political participation makes me able to have ready access to inputs I need	0.476		0.495		0.6907
Model characteristics					
Eigenvalue of factor	2.07658	1.14128	2.04208	1.23199	
Proportion of variance explained by factor (%)	55.75	30.64	54.82	33.07	

Statements were measured using a 5-point Likert-scale for all the items: 1-strongly agree, 2-agree, 3-neutral, 4-disagree, 5-strongly disagree; selected factors have eigenvalues greater

than 1; selected variables have factor loadings larger than 0.3; Total variance accounted for is 86.4%.

3.4 Determinants of Capability in Maize-based Farming Systems

The outcome of the multiple linear regression on factors that influence capability are presented in table 7. The models perform modestly well with very significant F-statistics and explanatory power. For institutional capability, sex, farm distance, proximity to access roads, non-farm income and availability of input markets are statistically significant. With human capability, the significant variables include availability of output market, having received good price for maize in previous season, farming experience and road type. In relation to sex, males have higher institutional capability than females. With superior access to resources, males often participate in political and social activities, which makes them better able to acquire those essential resources that are necessary to enhance their institutional capabilities. In contrast, most females lack economic, social and physical power to access most of the resources that could make them institutionally capable.

Distance to the nearest access road was negative and has a significant influence on farmers' institutional capability at 1%. Nussbaum (2011) differentiates between internal capabilities and external conditions that facilitate or obstruct successful functionings. Nussbaum notes that internal capabilities are the internal powers of a person and can only be fully utilized when combined with suitable external conditions to form "combined capabilities". Holding all else constant, the closer the distance from farm household to the access road, the less the stress involved in carrying out farming activities in terms of transportation of inputs and outputs. For that matter, farmers who are closer to accessible roads are able to put their internal capabilities to full utilization due to improved environmental conversion factors.

Distance from household to the farm had a negative effect on an individual's institutional capability and statistically significant at 10% level. According to Levine (2004), the problem of poverty is the problem of loss, either of capability or of opportunity. This means farmers who stayed far away from their farms are less well-off than those who have their farms closer to their

households. The finding also agrees with our *a priori* expectation because the distance from household to the farm should have an inverse relation to capability. This is based on the fact that longer distances lead to more cost in terms of transporting input and output, to and from the farm respectively.

Improved infrastructure plays a significant role in the socioeconomic lives of farm households. accordingly, we find that distance to the nearest access road plays an important role in institutional capability, just as availability of input markets. Farmers that live closer to access roads tend to have higher institutional capabilities, and the same is true for farmers who live in communities with input markets. According to Sen (2013), deprived built environmental factors such as poor access roads represents lack of opportunity, and this reduces institutional capability to a significant degree. The poor access roads limit farmers' ability to transport harvested produce to markets due to high transaction costs. With markets being available in the farmer's community, these transaction costs are drastically reduced and therefore access to the inputs is improved. Also, farmers who derive income from non-farm sources tend to be more capable institutionally, even though this is only marginally significant. Non-farm income is an important personal conversion factor that can enrich one's capability. Sen therefore notes that socio-political institutions and norms that support functioning must be available so that the opportunity and process aspects of freedom could be met. Thus, farm households earning non-farm incomes have improved institutional factors that support functioning. Much the same, when farmers earn non-farm incomes, they are more likely to be able to afford inputs at any time they require.

For human capability, farmers who are closer to output markets are better off than those that are far off. With long distances to output markets, farmers would have to travel long distances and as a result decreases their capability. Also, the long distances are associated with higher transaction costs when transporting farm produce to the market. Such a circumstance may even work to crowd out some farmers for participating in markets, and only be confined to subsistence production. On the other hand, experienced farmers have lower scores on human capability than younger ones. One could argue that younger farmers tend to be often adventurous, taking advantage of their youthful age to make use of their personal conversion factors.

Table 3: Determinants of capability in maize-based farming system

Variable	**Institutional Capability**		**Human Capability**	
	Coefficient	Std. Error	Coefficient	Std. Error
Age	0.004	0.0030		
Sex	0.309**	1306		
Distance to the farm	-0.002*	0.0009		
Access to credit	0.499	0.3127	-0.275	0.3130
Distance to the nearest access road	-0.005***	0.0016		
Non-farm income	0.143*	0.0873	-0.115	0.0885
Availability of input market	0.621***	0.0878	0.105	0.1179
Distance to output market			-0.002*	0.0016
Total land size			0.018	0.0104
Farmers' experience			-0.008**	0.0035
Good previous season price of maize			0.273***	0.1027
Type of road			0.250***	0.0968
Ethnicity			0.178	0.1373
Model diagnostics				
R –Squared	0.23		0.11	
F-statistic	11.97		3.73	
P-value	0.000		0.001	
Number of observations	302		302	

NB: *, ** and * denotes 1%, 5% and 10% significant levels respectively**

Finally, the type of road has a positive effect on human capability. Farmers whose communities are connected with tarred roads are superior in terms of human capability. Smith (2016) noted that buildings, roads and bridges are important aspects of the built environment that enhance a person's capability. The environmental factors combine with personal conversion factors to help in a

person's mobility, because farmers with tarred roads may encounter less stress and retardation to movement and carting goods from farm to homes or markets.

Effect of Capability and Other Factors on Participation in the PFJ Programme

The Probit estimates on the factors that influence participation in the PFJ programme are reported in table 7. The two capability attributes, and eight other explanatory variables were statistically significant determinants of participation in the PFJ programme. The Likelihood Ratio chi-square statistic as well as the Count R-squared values indicate that the proposed

model does a good job in explaining participation in the PFJ programme. Moreover, the Wald Chi-squared test of exogeneity for capability indicates that capability is indeed endogenous. This means that we would have produced bias and inconsistent estimates if we had used the simple binary probit model.

Table 7: Factors that influence farmer participation in PFJ programme

Variable	Coefficient	Std. Error	Marginal effect (%)
Institutional capability	1.349***	0.107553	10.28**
Human capability	0.821**	0.352431	6.42
Age	0.014*	0.008580	0.68***
Household size	0.022	0.020386	0.71
Farmers' education	0.053	0.198117	7.66
Stock of land	0.053*	0.027599	1.65*
Nonfarm income	0.088	0.151521	9.88**
Visit of extension agent	0.181	0.281872	-5.49
Constant	-2.004**	0.603630	
Factors influencing participation via capability			
Road distance			-0.23***

Output market distance	0.14***
Input market distance	-0.04
Farm distance	-0.07**
Type of road	-12.62
Farm experience	0.31*
Assets	-2.34***
Party card	0.20
Muslim	5.61
African Traditional Religion	-8.70***
Model diagnostics	
LR Chi-squared = 158.93; P-value = 0.000; Count R-squared = 77.81%; N = 302	
Wald test of exogeneity: chi-square (df=2) = 39.13	Prob > chi-square = 0.0000

NB: *, ** and *, denotes 10%, 5% and 1% significant levels respectively.**

From the results and in accordance with expectation, both attributes of capability are important causal factors of PFJ participation. Specifically based on the coefficients, institutional capability positively and significantly influences farmers' participation at 1% level, while human capability does so at 5% level. In line with the propositions by Tsai (2011), differences in capabilities and functionings are often traced back to inequalities of conversion factors such as weak institutions, and other socio-environmental constraints (Smith 2016). With this finding, all efforts channeled to bridge the inequality gap in capability is vital to increase farmers participation in the PFJ programme. The marginal effect shows that if farmers institutional capability increases by 1 standardized unit, the likelihood of participating in the PFJ programme increases by approximately 10%, *ceteris paribus*. Increasing institutional capability means improving access to agricultural extension services, markets and inputs. Since the PFJ programme requires repayment for some inputs after the production season, it is understandable that improving access to these institutional factors are more likely to increase participation. Markets are needed to sell the harvested grains so that repayment for the inputs becomes easy. Sen (2002) indicates that no individual can think, choose or act without being influenced in some way by the society he or she belongs. Thus, freedom of choices should be available in the society in which individual lives. Since human development involves the enlargement of people's capabilities, the need for conducive social and environmental conversion factors to exist such that commodities could be readily converted into functionings is nontrivial (Sen 2001; Nussbaum 2001).

Other factors, apart from capability, that directly influence participation are age, stock of land and non-farm income. On the other hand, factors that influence participation through their effect of capability are distance to access roads, distance to output markets, distance to farm, farm experience, assets and religion (being a Christian versus African Traditional Religion). Age has a significant positive effect on the probability of participation, with a marginal effect of 0.68%. Per the results, younger farmers are less likely to participate in the PFJ programme, a result that contradicts the findings of Boughton et al. (2007), who found a negative effect of age on maize market participation in Mozambique. With maize farming households in the context of the programme under discussion, our result may be plausible in the sense that older farmers are more influential than the young when it comes to intervention programmes like the PFJ. Ordinarily, besides men having better access to land and other productive resources, the aged have improved human capability in terms of political participation which makes them more influential than the young. Also, most of the young may have less economic opportunities due to deprived social conversion factors.

In terms of stock of land, we find that farmer participation in the PFJ programme is directly related to acres of land owned. An increase in the stock of land by one acre increase the likelihood of participation by 1.65% more likely to participate in the PFJ programme. Many farmers who own large stocks of land tend to get extra income from leasing lands to tenants, which may serve as sources of finance for farm investment, and also could help to generate income for the repayment of costs of inputs. This finding confirms *a priori* expectation, like the findings of Musah (2013) on maize market participation.

As already highlighted in section 3.1, non-farm income is often needed for farm investment. For programmes of this sort that demands investment in other production resources such as irrigation or herbicides, the role of non-farm income is important. Therefore, as expected non-farm income had positive influence on participation. Farm households with off-farm income often have better financial capability than those who depend solely on farm income. The improved financial capability makes them ready to try any programme or policy introduced to them.

The distance from residence to farm site reduces farmer participation in the PFJ programme, probably because poor roads and longer distances could serve as disincentives for farmers to participate in the PFJ programme. Also, if there is an output market in a farmer's community or close by, the likelihood of participation increases by about 0.14%, other things held constant. This finding makes sense because farmers that are closer to output markets probably have lower transaction costs. Furthermore, experience had a positive effect on participation in the PFJ programme, but only statistically significant at 10%. Normally, farmers with more experience in maize farming could possibly have participated in one or more agricultural interventions programmes and for that matter, may know the value and better appreciate the PFJ programme over the years. Besides that, such farmers may also have better market arrangements or business

relations that help to sell their outputs, thereby providing an edge to participate in the programme than less experienced farmers.

Moreover, farmers that have access to tarred roads are less likely to participate compared to farmers whose roads are untarred. This is quite unexpected but not implausible. Probably, farmers that have tarred roads could easily engage in other non-farm activities, or improved access to markets due to the tarred roads may mean that they have alternative sources of financing their farming activities. Such a condition could reduce the likelihood that such people have to participate in agricultural interventions. Finally, distance to the nearest access road reduces participation at 1% significance level by 0.23%. Since distance to the nearest access roads is a function of cost, it means that farmers who reside far away from accessible roads are less likely to participate in the PFJ programme.

4. Conclusions and Policy Implications

In this paper, we have operationalized capability so that we could determine how it affects maize farmers' participation in the ongoing PFJ programme. We used data from 302 farmers in the Bunkpurugu-Yunyoo district of Northern region, consisting of 134 participants in the PFJ programme and 168 non-participants. With factor analysis, we identified two attributes of capability and labelled them as *human* and *institutional* capabilities. Institutional capability is determined by statements relating to access to fertilizer, improved seeds, access to extension services and staff, access to credit, access to markets and better prices, unrestricted access to inputs, level of education, experience and political participation. Likewise, human capability consists of five statements in the rotated factor solution that related to knowledge on how to apply inputs, having voice in making decisions regarding farming, access to non-farm income sources, gender and mode of land acquisition.

Using a multiple linear regression, we discovered that these capability attributes are likely to be improved by good access roads, availability of input and output markets. In assessing the effect of capability on PFJ programme participation, an instrumental variable probit model was used due to endogenous capability variable. The findings were that both institutional and human capabilities increase the likelihood of participation to a significant extent. Besides capability, other socioeconomic and production variables that affect farmer participation in the PFJ programme are age, distance to farm, availability and proximity to output market, stock of land owned, farm experience, non-farm income, type of road to community and distance to nearest access road.

The findings indicate that participation in the programme will benefit from improved infrastructure, through the construction of, at least, feeder roads from maize production centers to places where there is demand for the produce. This will help facilitate the activities of the smallholder farmers and enhance their factor productivity. Access to inputs should be enhanced through the establishment of community or village markets or by extending the pillars the PFJ programme to include other important production resources. Establishing markets where farmers can easily get

access to inputs also has the possibility to reduce transactions costs associated with travelling long distances to nearby communities where input markets exist.

Effective extension services and supervision also has the tendency to ensure that farmers receive timely and appropriate assistance.

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