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Gender Production Efficiency among Soybean Farmers in Gboko Local Government Area of Benue State, Nigeria

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Abstract **– This study focused on the analysis of gender production efficiency among soy bean farmers in Gboko Local Government Area of Benue State, Nigeria. Primary data were collected from 100 respondents (50 male and 50 female) soybean farmers; through multi-stage random sampling techniques; with the aid of questionnaire and analyzed using descriptive and inferential statistics. The result shows that majority (48%) and (52%) of male and female were between the ages of 41-50 years. Majority (52%) and (64%) of male and female were married. Primary education was attained by majority (32%) of male while majority (50%) of the female had no formal education. The household size of majority (48%) and (42%) ranged between 11 – 14 and 5-10 among male and female farmers. The farm size of majority (48%) and (50%) of the male and female farmers ranged between 3-4.99 and 0- 2.99 hectares; while their annual income ranged between ₦201 – ₦300 respectively. Further analysis shows that majority (62%) and (50%) male and female farmers were full-time farmers; whose farming experience ranged between 11-15 for majority 26 % and 36 % of male and female farmers. Most of the respondents 50 % of the male farmers inherited land while 40% of the female farmers used family land. Labour exchange was used by majority 40% male whereas 40% female hired labour. Inorganic fertilizer was used by majority 40% of the respondents. Majority 90% and 98% and 60% and 70% of the male and female farmers adopted manual tilling and weeding respectively. While harvesting and fertilizer applications were done manually by 100 % and 90% and 96% of male and female respondents whose output in kg ranged between 11,000 -15,000kg and 100-500kg for the male and female soybean farmers respectively. The result of regressions analysis shows that male soya bean farmers were more efficient in the use of resources than their female counterparts with R^2 of 0.851 (85.1%) and 0.666 (66.6%). All independent variables in the regression model were found to be statistically significant. Factors such as high cost of inputs, pests and diseases among others were found to constitute major constraints to soybean production. Two Null hypotheses tested at 0.05 level of significance using F-test and Chi-square were rejected showing that there was significant difference between inputs and outputs obtained by male and female soya bean farmers. The study revealed that there was gender differential in soya bean production. It was recommended that soybean production could be increased by improving farmers' access to basic inputs and through effective extension service delivery and as well as enhancing female farmers' access to farm productive resources.**

Keywords **– Gender, Production, Efficiency, Soybean, Farmers, Benue State, Nigeria.**

I. INTRODUCTION

Soybean (*Glycine max*) is a species of legume, native to East Asia. It is an annual plant that has been used in China for over 5,000 years as a food and component of drugs. It contains significant amount of all the essential amino acids for humans and so is a good source of oil and protein. Soya beans are the primary ingredients in many processed foods, including body product substitutes Crowford, Gary and Lee, (2006). It is the most nutritious of all the commonly consumed legumes. Varieties of soya beans are used for many purposes. They can be used to produce soya bean milk, flour, '*Tampeh*' sauce and '*Daddawa*'local magi (Ojo, 1992). Due to its nutritional and economic value to the people of Nigeria, its production and utilization has greatly increased from mere cash crop and for domestic consumption to an export crop in some parts of the country. This has given rise to its steady increase in production and gender involvement in labour use on the farms World Bank (2000).

Nigeria is the largest producer of soybean for food in the West and Central Africa Root *et al.* (1987). It ranked third in the 1982-1984 period following Egypt and Zimbabwe. Benue State of Nigeria remains the major producer of soya beans, IITA (19789) by producing almost 100 percent of the tonnage exported in early sixties; which accounted for over 70% of soya beans production Singh *et al.* (1987).

Gender relates to socially assigned roles and behaviors attributed to men and women; it refers to the social meeting of biological sex differences. Gender roles are roles that are played by both women and men which are not determined by biological factors but by socio-economic and cultural environment or situation (ICA-ILO 2001; Mollel and Mtenga 2000). It affects the distribution of resources, wealth, work, decision-making, political power as well as enjoyment of rights and entitlements within the family and in public life Welch *et al.* (2000). In agricultural production, gender issues are critical in achieving desired outcome of policies and programmes, which are usually centered on improving the standard of living of farmers through increased productivity, income generation and food security. The contribution of women to agricultural development could be maximized through full integration of women into agricultural and rural development for the purpose of efficiency. Gender influences knowledge perceptions and needs of farmers as well as their access to agricultural technological

information and production resources Rahman *et al.* (2005).

Soya bean production, like other food crops in Nigeria involves male and female farmers who tend to have disproportionate access to farm productive resources. The implication of this imbalance in farm resources access and utilization are likely to have significant effect on the efficiency of resource use in crop production such as soybean. The bridging of actual potential productivity gap among farmers and between gender presents one of the most effective means for promoting agricultural productivity and enhancing the over-all economic development in developing countries like Nigeria Mgbada, (2000). However, the existing level of disparities or differences in access to and utilization of resources in soya bean production in the study area is not known or documented.

In the same vein, the effect of these disparities on the production efficiency of male and female farmers has not been determined empirically. Most of the studies done on soya bean production were concentrated on profitability, breeding, marketing and utilization. Much attention has not been paid to comparative analysis of gender efficiency in soybean production. This study seeks to find answers to the following research questions:

What are the socio-economic characteristics of male and female soybean farmers in the study area?

What are the resources and management techniques used in the production of soy bean in the study area?

What are the gender differentials in resource use efficiency in soybean production in the study area?

What factors constrain soybean production in the study area?

A. Objectives of the Study

The broad objective of this study was to analyze the production efficiency among soybean farmers on gender basis in Gboko Local Government Area of Benue State, Nigeria with a view to specifically:

i) describe the socio-economic characteristics of men and women soybean farmers in the study area;

ii) identify productive resources and management techniques used in soybean production;

iii) determine gender differentials in resource-use efficiency in soybean production, and

iv) identify major constraints to soybean production in the study area.

B. The Hypotheses

The following null hypotheses were tested.

Ho_1: There is no significant relationship between the resources used and output obtained in soybean production by male and female farmers.

Ho_2: There is no significant difference in the level of soybean output between male and female farmers.

II. METHODOLOGY

The study area is Gboko Local Government Area of Benue State Nigeria. It lies between latitudes 630^0 and 810^0 North and longitudes 8^0 and 10^0 East of the Greenwich Meridian; in the Savannah region of Nigeria. It has typical Savannah vegetation and climate. The region has two clearly defined seasons, such as rainy or wet season (April - October) and dry season (October - March).

A multi-stage purposive and random sampling technique was used in selecting respondents for this study. The first stage involved a purposive selection of five (5) districts according to intensity of soya bean production activities in the area from the ten (10) districts that make up Gboko Local Government Area. This was followed by the random selection of two (2) villages from the five (5) districts selected earlier to make up to ten (10) villages. Subsequently, ten (10) soya beans farmers (five male and five female) were randomly selected from each village making a total of 100 respondents (50 male and 50 female soybean farmers) used for the study.

Primary data were collected from sampled male and female soybean farmers using structured questionnaire and interview schedule because of the farmers' level of literacy. Data were analyzed using descriptive and inferential statistics. Objectives (i) and (ii) were analyzed using percentages and frequency tables; objective (iii) was analyzed using four functional forms of multiple regression analysis; while objective (iv) was analyzed using mean scores obtained from a four point likert scale.

Four functional forms of multiple regression model were tried and their a priori expectations are explicitly stated as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + et \text{ (linear)}$$

$$Y = Lnbo + bInX_1 + b_2InX_2 + b_3InX_3 + b_4InX_4 + b_5InX_5 + et \text{ (Semi-Log)}$$

$$LnY = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + et \text{ (Exponential)}$$

$$LnY = Lnbo + b_1inX_1 + b_2lnX_2 + b_3lnX_3 + b_4lnX_4 + b_5lnX_5 + et \text{ (double-log)}$$

Where:

Y = Value of total output by farmers (in Kg)

X_1 = Farm size (hectare)

X_2 = Labour (manday)

X_3 = Fertilizer (kg)

X_4 = Agrochemicals (litres)

X_5 = Planting materials (seed in kg)

et = error term

b_0 = constant

$b_1 - b_5$ = Parameters to be estimated.

The two null hypotheses were tested using F-test and Chi-square at 0.05 level of significance as specified;

$$\text{F-cal} = \frac{R^2(N-K)}{1-R^2(K-I)}$$

Where:

R^2 = Co-efficient of multiple determination

N = Sample size

K = Number of variables

Decision Rule:

If F-cal > F-tab, reject the null hypothesis, otherwise accept the alternative

$$\text{Chi-Square Model } \chi^2 = \sum \frac{(F_0 - Fe)^2}{Fe}$$

χ^2 = chi-square statistics;

$\sum$ = summation notation;

F_0 = observed frequency;
Fe = expected frequency, calculated as: RxC/N.
Where: R is row total, C is column total and N is sample size
Decision Rule: Reject H_0, if $\chi^2 > \chi^2$ tab.

III. Results and Discussion

A. Socio-economic Characteristics of Soybean Farmers

The result of the socio-economic characteristics of soybean farmers in Table 1 shows that majority (48%) and (52%) of the male and female farmers are between the ages of 41-50 years. This implies an ageing farming population which is consistent with the assertions of Ekong (2003) that farming in the rural areas of Nigeria is dominated by older farmers because of the out migration of youths to urban centres in search of white collar jobs. Majority (52%) and (64%) of the male and female farmers were married; which implies that soybean production is being undertaken by married men and women. This is closely related to the findings of Ebewore *et al*. (2013) who reported that (55%) of the farmers in his study area were married. The work of Oderhohwo (2008), Oladoja, Adedoyin and Adeokun, (2008) contented that marriage is an important factor in the livelihood of individuals in our society as it is perceived to confer responsibility on individuals.

The household size of most male farmers (48%) ranged between 11-14 persons whereas most female farmers (42%) possess household size of between 5-10 persons; meaning that males managed higher household size than their female counterparts. The high household size of the farmers may be an advantage in family labour supply for soybean production. This is true as confirmed by Edet and Effiong (2006) who opined that most farmers in rural Nigeria engage their household members in family and hired labour in order to generate income for improvement of their family welfare.

Further analysis shows that majority (32%) and (50%) of the male and female farmers attained primary education and had no formal education respectively. This shows that men were more educated than their female counterparts; and may likely adopt innovations faster and allocate farm resources more efficiently. This conforms to the work of Nwaru (2005) reported that an educated farmer all things being equal allocates farm resources more efficiently. Better education enhances productivity Okoye *et al.* (2008). Result on occupation shows that majority of male (62%) and female (50%) were full-time farmers who combined farming with other activities such as trading, civil service and handcraft. This result conforms to findings of Obo (2008) which noted that farmers in the study area combine farming with other sources of income for sustenance of livelihood.

Most of the male (48%) and female (50%) had farm size of approximately 3-4.99 and 0.2.99 hectares respectively. This shows that men possess larger farms than their women counterparts. This is true and corroborates the work of Ojo (2003) who reported that most Nigerian farmers are small scale farmers whose farmland are scattered within the community.

Majority (36%) of male and female farmers earned between ₦ 201,000-₦ 300,000 per annum. This shows that the respondents are low income earners. The low annual income of the respondents could be attributed to lack of credit facility as observed by Rhaji (2000) who observed that lack of adequate, accessible and affordable credit is among the major factors responsible for the systematic decline in the contribution of agriculture to the Nigerian economy. Analysis of the farming experience shows that majority (26%) and (36%) of the male and female farmers have been in the farming business for a minimum of 11-15 years; which shows that most of them are relatively experienced. The high level of farming experience may enable them to acquire technical competence which may enhance their resource use efficiency. This is because farming experience affects farm managerial know-how and decision making process. Omonona *et al*. (2010) observed that farmers' level of experience in the production of a particular commodity is one of the determinants of their ability to maximize output using available inputs.

B. Resources Used and Production Techniques Adopted in Soybean Production by Farmers

Resources such as land, labour and agrochemicals are crucial in agricultural production. Table 2 shows the resources used by the farmers, sources and types. The results indicates that (50%) of men and (24%) of women acquired their land by inheritance, this shows that males own more land than females in the study area and this is because in most parts of Africa, women hardly inherit land from their fathers. This is consistent with the assertion made by Tanko (1994) that, women do not get the same as men in their access to critical farm resources and services such as farm land, credit and improved inputs due to cultural, traditional and sociological factors. Labour sources were determined and the result reveals that majority (40%) of men and women used both family/hired labourand exchange labour respectively. The result also showed that majority (40%) and (30%) of men and women farmers used inorganic fertilizer for soya beans production in the study area. This reveals that the use of inorganic fertilizer has been adopted by most of the farmers which may lead to increase in productivity. Ikechukwu (1990) reported that proper application of fertilizer has been described as an essential prerequisite for the realization of increase crop yield as well as for restoration and maintenance of soil fertility.

C. Production Techniques Adopted by Soybean Famers

The result on Table 3 indicates that (90%) male and (98%) female used manual tillage while only (18%) male and (2%) female used tractorization. Majority (60%) and (70%) male and female farmers used manual weeding; while the use of agrochemicals for weeding was only adopted by (36%) and (24%) male and female farmers. Manual harvesting was adopted by all the respondents while (90%) male and (96%) female adopted manual fertilizer application. This means that majority of soybean

farmers in the study area have not adopted mechanized farming technologies in their farm production. However, more male farmers used modern farming techniques than female farmers. This may be due to high cost of procuring such equipment or that they are not suited for handling by females.

D. Efficiency of Resource-use among Male and Female Soybean Farmers in the Study Area

Gender differentials in resources-use efficiency among soybean farmers in the study area was determined using four functional forms of multiple regression analysis. Two lead equations for male and female farmers were chosen based on goodness of fit of the functional form, highest values of (R^2), signs of regression co-efficient, significance of t-values and the numerical values of standard deviations from the estimates or standard errors of the estimates.

From Table 4, the results obtained indicated that Cob Douglas production function (double-log) and exponential were most suitable for the gender analysis based on the criteria cited above. The values of their R^2 were (66.6%) and (85.1%). This shows the percentage of the total variations in output due to combine effects of the independent variables used in the regression model. It is believed that the explanatory power of the chosen models were not exaggerated; since the R^2 (0.666) and (0.851) were in numerical value closely related to the adjusted R^2 (0.612) and (0.834) respectively. This was further confirmed by the values of the overall standard error of estimate (SEE = 0.02890 and 0.135993) for male and female soybean farmers respectively, which constituted about 33.4% and 14.9% of the total variation that was not explained.

The statistical reliability of the estimates of regression coefficients was established using standard deviations from the estimates or standard errors of the co-efficient of X_1, X_2, X_3, X_4 and X_5 and (constants) for female soybean farmers were less than half of the estimates showing their statistical reliability, except X_2, X_3, and X_4 in male farmers (double-log). Most of the explanatory variables were significant at 1%, 5% and 10% levels of significance as shown in Table 4.

However, the overall significance of the regression was also confirmed by the F*values calculated (F-statistics = 22.4 and 54.5) for male and female soy bean farmers respectively. Since F* ratio is high and is greater than F*tab at 5% level of significance, the regression is statistically reliable.

The co-efficient of X_1 (farm size), X_3 (fertilizer), X_4 (Agrochemical) and X_5 (seed) were all positive; meaning that increase in their quantity would lead to increase in output, except X_2 (labour) which was negatively related to output among male soybean farmers. This implies that male soybean farmers utilized labour efficiently in the study area. But all the coefficients of the independent variables of the female farmers were all positive including labour. This shows that labour was under utilized by the female soybean farmers; since it totally deviated from economic a priori expectation.

In comparism, farm size, labour, fertilizer, agrochemicals and seed had statistical and significant effects on the farmers output while labour did not have. The result also showed that the estimates obeyed the economic a prior theory based on the coefficients they bore; but labour goes in positive direction among female and negative direction among male. All things being equal, female soybean farmers did not efficiently utilize labour in soybean production by implication. This could be because female soybean farmers were producing at the first stage of production; which is irrational stage; where labour and other productive resources are not efficiently utilized. Here, marginal productivity being very high did not reach maximum; because more output would be obtained by a unit change in input. Optimum quantity would be ensured by incremental change in input (labour). Female soybean farmers should be encouraged to employ more labour in their productive efforts to obtain higher output like their male counterparts. Male soy bean farmers are more efficient in the use of resources including labour in soy bean production in the study area.

The final estimated regression model for male is as shown below.

$Y = 1.639 + 0.0371_{0g}X_1 + -0.025l_{0g}X_2 + 0.019l_{0g}X_3 + 0.014l_{og}X_4 + 0.039l_{0g}X_5 + et$

(0.070) (0.014) (0.015) (0.019) (0.012) (0.019)

The final estimated regression model for female is shown below

$Y = 6.019 + 0.136X_1 + 0.134X_2 + 0.001X_3 + 0.087X_4 + 0.001X_5 + et$

(0.081) (0.043) (0.043) (0.000) (0.037) (0.001)

E. Constraints to Soya bean Production

Results of the mean score analysis on Table 5 shows that high cost of inputs (3.1), farm credit (3.0), diseases and pests attack (3.0) and lack of extension services (2.7) among few others were the major constraints faced by the males farmers in the study area and it implies that these constraints affected farming practices and outputs of male soya beans farmers in the study area. However, labour scarcity (3.0), high cost of inputs (3.0), farm credit (2.9) and land acquisition (2.5) were the major challenges faced by female soybean farmers in the study area which had effects in their productivity.

Test of hypotheses: A null hypothesis (Ho_1) was tested using F-test as shown below:

$H0_1$: There is no significant relationship between the resources used and output obtained in soya beans production by male and female farmers.

F – cal = 12. 33

$H0_{1A}$: The result of the analysis showed that F-cal (12.33) > F-tab (2.61) at 0.05 level of significance. The null hypothesis was rejected.

$H0_{1B}$: Results indicates that F-cal (50.19) > F-tab (2.61). Therefore, the null hypothesis was rejected.

This means that there is a significant relationship between the resources used and output obtained in soybean production by male and female farmers in the study area.

Chi-square Test

X^2 – cal = 858.79

X^2 – tab at 0.05 level of significance = 9.488

The result showed that X^2 – cal (858.79) > X^2 – tab (9.488).

Therefore, the null hypothesis was rejected. This implies that there is a significant difference between the output of male and female soybean farmers in the study area.

IV. Conclusion

The study revealed that there were gender differentials in soybean production efficiency among the farmers in the study area. But, male farmers had more access to productive resources and utilized inputs more efficiently than the female farmers. Therefore, male soybean farmers are more efficient in soybean production than their female counterparts. However, its production is influenced by factors such as diseases and pests attack, high cost of inputs, lack of credit facilities and lack of improved seeds among others.

Recommendations

Based on the findings of this study, the following recommendations were made:

- There is need to improve farmers' access to agro-technological inputs such as improved seeds, fertilizers, agro-chemicals and farm credit to enhance soybean productions.
- State Agricultural Development Programmes should be strengthened to enable them deliver effective extension services and educate farmers on modern soy bean production technologies.
- Appropriate policy initiatives should be put in place to enhance female farmers' access to farm productive resources such as land, farm credit and extension services.
- Storage and processing facilities should also be provided for proper storage of soybean and its subsequent sales at economic prices for profit maximization.

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Table 1: Percentage Distribution of Male and Female Soybean Farmers according their Socio-economic Characteristics

Variables	Male		Female	
Age(years)	**Frequency**	**Percentage**	**Frequency**	**Percentage**
10-20				
21-30	1	2.0	2	4
31-40	15	30.0	13	26
41-50	24	48.0	26	52
51-50	9	18.0	6	12
61 and above	1	2.0	3	6
Mean = 34.6				
Marital status				
Single	5	10	3	6
Married	26	52	32	64
Divorced	3	6	4	8
Widowed	13	26	5	10
Separated	3	6	6	12
Household size (number)				
1-4	2	4	12	24
5-10	20	40	21	42
11-14	24	48	16	32
15-20	4	8	1	2
Mean = 10				
Educational level (years spent in formal education)				
No formal education	10	20	25	50
Primary school	16	32	10	20
Secondary school	14	28	10	20
Tertiary school	10	20	5	10
Occupation				
Full-time farming	31	62.0	25	50
Trading and farming	7	14	10	20
Handcraft and farming	4	8	3	6
Civil service and farming	5	10	4	8
Teaching and farming	3	6	8	16

Farm size (h)				
0.2.99	21	42	25	50
3.4.99	24	48	21	42
5-6.99	4	8	3	6
7-8.99	1	2	1	2

Mean = 4.12

Annual farm income (Naira)				
1-100,	4	8	2	4
101, - 200,	17	34	15	30
201, - 300,	18	36	18	36
301, - 400	6	12	10	20
401, - 500	4	8	3	6
501, - 600	1	2	2	4

Mean = 300.417

Farming experience (years)				
1-5	2	4	6	12
6-10	12	24	10	20
11-15	13	26	13	36
16-20	8	16	5	10
21-25	4	8	8	16
26-30	4	8	3	6
31 and above	7	14	5	10
Mean = 15.5				
Total	**50**	**100**	**50**	**100**

Source: Field Survey, 2014.

Table 2: Percentage Distribution of Soybean Farmers According to Resources used and their Sources by gender

Farm resources	**Sources**	**Male**		**Female**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
Land	Inheritance	25	50	12	24
	Lease	8	16	8	16
	Purchase	12	24	10	20
	Family Owned	5	10	20	40
Labour	Family	15	30	15	30
	Labour	10	20	10	20
	Hired Labour	5	10	20	40
	Exchange Labour	20	40	5	10
	Hired/family Labour				
Agrochemicals & Fertilizers					
	Organic fertilizer	12	30	15	24
	Inorganic fertilizer	20	40	15	40
	Herbicides	8	16	10	20
	Pesticides	10	20	10	20
	Total	**50**	**100**	**50**	**100**

Sources: Field Survey, 2014.

Table 3: Percentage of Respondents According to Production Techniques adopted by gender among Soybean Farmers in the Study Area.

Production techniques	Male		Females	
	Frequency	Percentage	Frequency	Percentage
Tillage				
Tractorization	4	8	1	2
Animal tillage	1	2	0	0
Manual	45	90	49	98
Total	50	100	50	100
Weeding				
Agrochemicals	18	36	12	24
Mechanical	2	4	3	6
Manual	30	60	35	70
Total	50	100	50	100
Harvesting				
Mechanical	0	0	0	0
Manual	50	100	50	100
Total	50	100	50	100
Fertilizer Application				
Mechanical	5	10	2	4
Manual	45	90	48	96
Total	**50**	**100**	**50**	**100**

Source: Field Survey, 2014.

Table 4: Multiple Regression Results of Efficiency of Resources use by Male and Female Soybean Farmers.

Variable	Male	Female
	Coefficients	Coefficients
Constant	1.639	6.019
	(0.070)*	(0.081)*
Farm size (X_1)	0.037	0.136
	(0.014)**	(0.043)*
Labour (X_2)	-0.025	0.134
	(0.015)***	(0.043)*
Fertilizer (X_3)	-0.019	0.001
	(0.019)	(0.000)
Agrochemical (X_4)	0.014	0.087
	(0.012)	(0.37)**
Seed (X_5)	0.039	0.001
	(0.019)**	(0.001)
R^2	66.6	85.1
adjR^2	0.612	0.834
DW	1.318	1.751
SEE	0.02890	0.13593
F-ratio	12.336	50.195

* Indicates significance at 1% level
** Indicates significance at 5% level
*** Indicates significance at 10% level
Figures in parenthesis are standard error of the estimates
Source: Field Survey, 2014.

Table 5: Constraints to Soybean Production in the study area

Factors	Male	Decision	Female	Decision
	Xs		Xs	
Land acquisition	1.9	Rejected	2.5	Accepted
Labour	2.1	Rejected	3.0	Accepted
Diseases and Pests attack	3.0	Accepted	2.6	Accepted
Infertile soil	2.6	Accepted	2.3	Rejected
Weather changes	1.9	Rejected	1.9	Rejected
High cost of inputs	3.0	Accepted	3.0	Accepted
Lack of farming experience	1.9	Rejected	2.0	Rejected
Lack of market information	2.3	Rejected	1.9	Rejected
Farm credit	3.0	Accepted	2.9	Accepted
Lack of extension services	2.8	Accepted	2.6	Rejected
Technological information	2.6	Accepted	2.8	Accepted
Education	2.0	rejected	2.1	Rejected
Access to information	2.1	Rejected	2.2	Rejected

Source: Field Survey, 2014.