

Analysis of Maize Production Pattern Before and After the Boko – Haram Period in Madagali Local Government Area, Adamawa State, Nigeria

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Abstract

The study was conducted in Madagali Local Government Area of Adamawa State. It analyzed maize production pattern before and after the insurgency in the area. One hundred and sixty (160) registered maize farmers were selected using purposive and simple random sampling techniques and were served with a well – structured questionnaire through which primary data was generated for the study. Specific objectives of the study were to: describe the socio – economic characteristics of the respondents, identify production of maize pattern before and after the insurgency in the study area, and estimate cost of basic inputs used in maize production before and after the insurgency and identify maize production challenges that militate better out-put and good returns. The study concludes that maize production is control by small scale poor resource farmers before and after the insurgency in the area who are faced with dwindling resource capacity that further limited their out –put. The result revealed a reduction in farm size, use of in inorganic fertilizer and tractor respectively after the insurgency. Similar, it shows that, use of herbicides has increased after the insurgency due to reduction in use of tractor and oxen plough as a means of land preparation. The findings has raised the following salient points: further utilization of chemical herbicides might cause environmental pollution and health risk in the area, food insecurity of the households in the area could be aggravated due to observed increased in prices of herbicides, inadequate access to inorganic fertilizers and tractors, hence the study recommends that; non – governmental organization should intervene by providing supports in areas of inputs, capacity building on alternative fertilizers and appropriate tools, government should intensify security outfit to checkmate insecurity and insurgency in the area, farmers should form cooperatives and association to pool their resources together and pursue common goal (s), that might improve their out-put, productivity, food security, livelihood and minimize poverty on a sustainable basis.

Keywords: Insecurity, before, after, maize, production and pattern

Introduction

Maize (*Zea mays L.*) a member of the grass family (gramineae) and originated from South and Central America was introduced to West Africa by the Portuguese in the 10th century and is one of the most important grains in Nigeria, not only on the basis of the number of farmers that engaged in its cultivation, but also in its economic value (Oladejo, 2012). It is a major important cereal being cultivated in the rainforest and the derived savannah zones of Nigeria. It started as a subsistence crop and has gradually become a more important crop in the diet of Nigerians for centuries and even becoming a commercial crop due to it wide application. For instance, Iken and Amusa (2018), reported that, maize has now risen to a commercial crop on which many agro-based industries depend for raw materials, One

of the major tasks facing Nigerian agriculture is the provision of an adequate and well-stable food supply to meet the requirements of a growing population and one of such food crops is maize. The significance of maize to the modern society is first and foremost clearly reflected in the importance of the crop in the diet of man and animals throughout the world (Onwueme and Sinha, 2018). Abubakar (2016) for instance ranked maize as the third most important cereal after wheat and rice globally. In Nigeria, maize is produced across the country right from the mangrove region in the south to the Sahel Savannah in the North (Edache, 2016). Maize production in Nigeria has also been on the increase both in terms of hectares and production. A seven-

fold increase in production occurred between 1984 and 1994. Similarly production increased from 6,515,000.0 to 7,019,500.0 tons(7.75%) between 1999 and 2003 respectively according to Central Bank of Nigeria (CBN, 2003). The total area under maize cropping in Nigeria was estimated to be 3.0 million hectares (Lamarde, 2016).

Traditionally, production ranged from 0.4 – 1.7 tons per hectare, but with improved methods and improved inputs, the yield could be up to 4 – 5 tons per hectare (Lamarde, 2016). Maize is the most important cereal in Nigeria and is grown either as a vegetable at the backyard or on the farm (Kehinde, 2018). With adequate supply of these inputs and the provision of adequate storage facilities, the rapid expansion of maize could be sustained.

Since the 1970s, the Federal Government of Nigeria (FGN) made it a policy to increase maize production through the increased use of fertilizer, which led to the establishment of fertilizer plants as against relying entirely on fertilizer importation as the case was prior to 1976. However, the effectiveness and sustainability of these plans varies with different government regimes such that as at the moment access to fertilizer by farmers is an important input considered in the production decision and is becoming more difficult. This will have direct effect on the level of output and productivity per hectares. Nyako (2018) lamented that for agriculture to contribute meaningfully to economic development, there is need to provide effective policies that will mobilize resources and transform self-sufficient oriented maize farmers to commercial and market oriented agriculture.

Maize is the most important cereal crop produced in Nigeria and it is also the most widely consumed staple food in Nigeria with increasing production since 1965 (FAO, 2008). In Nigeria, maize is produced predominantly by smallholder resource poor farmers under rain-fed conditions (Sari, 2018). Low soil fertility and low application of external inputs are the two major reasons that account for low productivity in maize. The soils of the major maize growing areas in Nigeria are low in organic carbon (<1.5 %), total nitrogen (< 0.2 %), exchangeable potassium (<100 mg/kg) and

available phosphorus (< 10 mg/kg) (Adu, 1995, Benneh et al. 1990).

Accordingly, prior to insecurity, Maize farmers in Madagali Local Government Area of Adamawa State, were using tractors and synthetic fertilizer to cultivate and fertilized their land respectively. Observation over the years had shown that with the coming of insurgency, farmers could not have access to tractors and fertilizers and therefore, resulted to use of local farming tools like hoe, cutlass and alternative fertilizers to cultivate their crops. Also significant proportion of the farmers left their homes and farms and fled to other location for settlement and livelihood. Before the insurgency, maize farmers were cultivating 4-5 hectares, however, with the present shortage of resources at their disposal and with the activities and interventions of Non-Government Organization (NGOs), Coupled with the restriction of synthetic fertilizers especially urea to the area, the production and productivity of returnee maize farmers might have change and there is little or scanty information to understand the situation hence, the need for the study.

This study provided answers to the following research questions; what are the socio-economic characteristics of maize farmers in Madagali Local Government Area of Adamawa State before and after insurgency? What are the production pattern of maize production in Madagali Local Government Area before and after the insurgency? What are the constraints associated with maize production in the study area?

The broad objective of the study is to analyze maize production amidst Insecurity in Madagali Local Government Area of Adamawa State. The specific objectives of study were to: describe the socio-economic characteristics of maize farmers in the study area, identify production pattern of maize production in the study area before and after insurgency, and identify the constraints to maize production in the study area.

Materials and Method

Study Area

Madagali is one of the twenty-one Local Government Areas of Adamawa state. It is located between Latitudes 10°37' and 11°00' North of the Equator and between Longitudes 13°18' and 15°45'

East of the Prime Meridian Latitude, 13.63° East, and 506 meters elevation above the sea level. The Local Government shares borders with Gwoza Local Government Area of Borno State to the north, Cameroun to the east and Michika Local Government area of Adamawa State to the south. The population of Madagali is estimated at 12,919 persons according to 2006 census and 208,400 as projected in 2022 (National Population Commission NPC, 2016). Over the course of the year, the temperature typical varies from 58°F to 103°F and is rarely below 53°F or above 108°F. The major occupation of the people is farming and trading. The LGA was made up of ten political wards which are Kirchinga, Gulak, Duhu Maiwandu, Palam, SS Vapra, Madagali, Wagga Chakawa, Bebel, Hyambula and Wula Wards. The types of soil in the

study area is loamy and clay (Adebayo, 2006).

Sampling Procedure and Sampling Size

Maize famers in Madagali Local Government Area are the target population of the study. List of maize farmers was sourced from the agricultural officer of ADADP of Zone 1 in the area which serve as the sampling frame. Out of the ten (10) wards, six (6) wards were selected purposely based on the concentration of maize farmers. The selected wards are Kirchinga, Gulak, Chakawa, Duhu/Shuwa, Palam and SS Vapra with a total population of 320 maize farmers. Simple random sampling was used to select 50% of the population to serve as sample. The total population for each ward and the proportionate sample is presented below:

Table 1: Sampling distribution of respondents according to wards, population and sample size

Wards	Population of Farmers	Sample (50%)
Kirchinga	40	20
Gulak	52	26
Chakawa	80	40
Duhu/Shuwa	56	28
Palam	32	16
SS Vapra	60	30
Total	320	160

Source: Field survey, 2023

Method of Data Collection

Data for the study were obtained from primary source through the use of well -structured questionnaires administered with aid of extension assistants. The questionnaire was supplemented with oral interview.

Data Analysis

Descriptive statistics tools which include frequency distribution and percentages were used to analyze the objectives of the study.

Results and Discussion

Socio-economic characteristic of maize farmers in the study area

Table 2: Socio – economic characteristics of the respondents

Variables	Frequency	Percentage (%)
Age	15	9
20 – 30		
31 – 40	30	19
41 – 50	42	26
51 – 60	33	21
60 Above	40	25
Total	160	100
Gender		
Male	96	60
Female	64	40
Total	160	100
Marital Status		

Single	34	21
Married	65	41
Divorced	15	9
Widowed	46	29
Total	160	100
Educational background		
Primary	37	23
Secondary	73	46
Tertiary	24	15
Others	26	16
Total	160	100
Major occupation		
Farming	90	56
Traders	37	23
Civil servant	29	13
Others	13	8
Total	160	100
Farm Size		
Less than 1 hectare	30	19
1 – 2 hectares	88	55
2 – 4 hectares	27	17
Above 4 hectares	15	9
Total	160	100
Family size		
1 person	30	19
2 – 5 people	88	55
6 – 10 people	27	17
Above 10 people	15	9
Total	160	100

Source: Field survey, 2023

Age distribution of respondents

Age distribution of the respondents is presented in Table 2. It shows that majority (26%) of the respondents are between the ages of 41 – 50, while 25% are above the age of 60 years. It reveals that majority of the farmers are at their middle age. Khan (1991) stated that the age of an individual makes him or her mature and able to take rational decision. Age is a factor which can significantly affect maize productivity and profitability. The age of the farmer is important in farming because of the intensity of the labor and other activities attached to farming and agriculture at large.

Gender of respondents

The result on gender is presented in Table 2. It shows that, 60% of the farmers in the study area are male, while the remaining 40% were female. This entails that male have higher percentage in farming

activities in the study area. The reason could be farming is associated with tedious task. In some instances culture and religion do have influence on women participation in most farming activities. In Islamic communities purdah is widely practiced, where women are mostly stay indoors while in some communities women have no title to farm lands.

Marital status of the respondents

The result on marital status of the farmers is presented in Table 2. It shows that, 3.41% of the respondents were married, 29% were widowed and 21% were single. This result shows that married people are engage highly in maize production followed by the widowed comprising of males, followed by single respondents in the area which are made up of both male and female, finally, the divorced with 9% rarely engage in maize

production. This distribution shows that those that are married engage in maize farming as a source of feeding their family so also are widowed as a source of income. However, the implication of this distribution is that most of the single which comprises of male and female who do not engage in agricultural activity will remain dependants on the society.

Educational Background of the respondents

Educational background of the respondents as shown in Table 2, indicated that majority (46%) of the respondents’ attended secondary school, while 23% of the respondents attended only primary school. However, 16% did not attend any formal school. This shows that literacy rate is fair in the study area, even though educational status is not high. However, high educational level is associated with rationale thinking, decision and success in most cases. So, therefore improvement in educational level should be highly encourage among maize in the area so as to be more productive.

Occupation of the respondents

Occupational distribution of the respondents is presented in Table 2, shows that majority (56%) of the respondents in the study area were engage in maize farming as their major occupation, while 8% engage in other activities. The table also shows that 13% of the respondents are civil servants with 23% into trading as occupation. This result implied that maize farmers are many in the study area

Average Farm Size

Results on farm size of the respondents from Table 2 shows that majority (55%) of the respondents cultivate 1-2 hectares. This reveals that, most the farmers are subsistence farmers who cultivate mainly for their household and very little for sale. The table also shows that 9% of the farmers cultivate more than 4 hectares which indicates that some of the respondents cultivate medium farm size. It further shows that only few (15%) of the farmers cultivate more than 4 hectares. This implied that majority of the maize farmers in the area are poor – resource.

Maize Production Pattern before and after the insurgency in the study area

Source of farm land

Table 3: Distribution of farmers according to farm land ownership

Ownership of farm land	Frequency	Percentage (%)
Purchase	30	19
Rented/Leased	88	55
Gift	27	17
Inherited	15	9
Others	0	0
Total	160	100

Source: Field Survey, 2023.

Farm land ownership by the farmers is presented in Table3. Findings revealed that majority (55%) obtained their farm land through rent/leasing, (19%) obtained their land through purchase, while some (17%) of the respondents obtained their farm land as gift and (9%) inherited from their parents. It result

implies that most of the farmers got their farms through rent/lease with only 19% through purchase. This shows selling of farm land is not rampant in the area. Since land lease is allowed, this would give opportunity for those that don’t have land to cultivate crops.

Purchase /rental value of farm land

Table 4: Distribution of farmers according cost of land purchased / rented

Farm Size	Frequency	Percentage	Amount
Purchase	30		150,000
Rented/Leased	88		30,000
Gift	27		0
Inherited	15		0

Others	0	0
Total	160	180,000

Source: Field Survey, May 2023.

Table 4 present result sells /rental value of farm land. It shows that, (19%) shows that about 19% of the farmers who bought land averagely cost them N150,000 while those that rent averagely cost them N30,

000 per annum. This shows that the cost of purchasing farm land and lease is not too expensive in the study area.

Maize Enterprise Practice by Farmers

Table 5: Distribution of farmers according to enterprise

Crops	Frequency	Percentage (%)
Sole Maize	40	25
Maize Rice	38	24
Maize Beans	60	37
Maize Groundnut	11	7
Other crops	11	7
Total	160	100

Source: Field Survey, 2023.

Result on distribution of farmers according to the type of maize enterprises practiced in the area is presented table 4. It shows that majority (37%) of the maize farmers practiced maize – beans enterprise, followed by (25%) which practiced sole

maize, followed by (24%) that practiced maize – rice enterprise. However, this shows that maize, beans and rice are the dominant crops cultivated in the area due to the nature of the soil, climate and rainfall

Labor utilization

Table 6: Distribution of farmers according to utilization of family labor

Opinion	Frequency	Percentage (%)
Yes	121	76
No	39	24
Total	160	100

Source: Field survey, 2023.

Result on utilization of family labour on the farm as presented in Table 6, shows that majority (76%) of the respondents used family members labour in their

maize farm while (24%) respondents' did not use family members. The result shows family is highly utilized on their far

Type of farming tools/machinery used before insurgency

Table 7: Distribution on types of farming tools/ machines used prior to insurgency period

Tools/ Machines	Frequency	Percentage (%)
Tractor	46	29
Zero/min tillage	20	12
Hand hoe	16	15
Oxen plough	78	44
Total	160	100

Source: Field Survey, 2023.

Table 7 presents results on types of tools/machines utilized by maize farmers before insurgency, it indicates that majority (78%) oxen plough to tilt the land before planting while 29% of the respondents indicated tractor machines as their best method. However, the table also indicates that 15% of the farmers prefer using hand hoe and only 12% result to minimal /zero tillage.

The methods that are in common use can have impacts on the environment, for instance using zero /minimal tillage will require chemical herbicides

often which may affect the health status of the farmers using it. The impact on the environment may include killing of beneficial organisms, leaching of the soil and soil erosion among many. The positive impacts include increase in availability of food, decrease in the cost of food. The impacts on health may include bioaccumulation and bio magnifications on human body, river blindness, cancer, headache, fatigue, dizziness, and skin and eye irritation. Therefore, there is need for integrated or alternate use of these methods to strike balance on the farming ecosystem.

Table 8: Distribution on types of farming tools/ machines used after insurgency period

Tools/Machines	Frequency	Percentage (%)
Cutlass	24	15.00
Tractor	20	2.50
Hand Hoe	30	18.75
Zero/ min /Chemical	50	31.25
Oxen	36	22.50
Total	160	100

Source: Field Survey, 2023.

Result on the type of tools / machines used for land preparation after insurgency is presented in table 7. It shows that much proportion (31%) of the respondents utilized minimal tillage methods, 23% used oxen-plough while 18.78%, used hand hoeing,

with only 12% that used tractor machine. This shows that level of tractor machine usage dropped compared to before insurgency period. While the level of minimal /zero tillage increased as compared to before insurgency period.

Utilization of Fertilizer before the Insurgency

Table 9: Utilization of chemical fertilizer among maize farmers before the insurgency period in the study area

Opinion	Frequency	Percentage (%)
Yes	121	76
No	39	24
Total	160	100

Source: Field survey, 2023.

Result on chemical fertilizer utilization before the insurgency is presented in table 9. It shows that majority (76%) used chemical fertilizer before the

insurgency to cultivate maize. With only 24% using alternative fertilizers.

Utilization of Fertilizer after the Insurgency

Table 10: Utilization of chemical fertilizer among farmers after the insurgency period in the study area.

Opinion	Frequency	Percentage (%)
Yes	40	25
No	120	75
Total	160	100

Source: Field survey, 2023.

Result on chemical fertilizer use after the insurgency is presented in table 10. It shows that only 25% of the maize farmers used chemical fertilizer to cultivate maize after the insurgency. It shows that

the level of using chemical fertilizer by maize farmers dropped after the insurgency. This could be associated with fact that, it is difficult to access fertilizer and it is expensive.

Production scale of maize farmers in the study area before the insecurity

Table 11: Distribution on farm size of the respondents before insecurity period in the study area

Farm size in hectares	Frequency	Percentage (%)
Above 10 hectares	15	9.4
6 – 10	23	14.4
2 – 5 hectares	35	21.9
Less than 2 Hectares	87	54.4
Total	160	100

Source: Field Survey, 2023.

Table 11 presents results on farm size in production of maize in the area. It indicates that only (10%) of the respondents cultivate more than 10 hectares in the area. Majority (54%) of the respondents cultivate

less than 2 hectares so they are predominantly small – scale farmers. Similarly, 9.4% of the respondents cultivate more than 10 hectares, implying they are moving towards large scale operation.

Production scale of maize farmers in the study area after the insecurity

Table 12: Distribution on farm size of the respondents after insecurity period in the study area.

Farm size in hectares	Frequency	Percentage (%)
Above 10 hectares	10	10
6 – 10	23	15
2 – 5 hectares	35	21
Less than 2 Hectares	92	58
Total	160	100

Source: Field Survey, 2023.

Result on farm size cultivated by maize farmers after the insurgency in the area is presented in table 12. It shows that, majority (58%) of the maize farmers cultivate less than 2 hectares after the insurgency while 10% cultivate more than 10 hectares. This result implies that, the farm sizes of most of the returnee farmers reduced, while the size of the large

operators has increased. This could mean because some farmers could not put more land into cultivation because of their financial base, it gives room for those that have resources to take over their farm probably through farm land rent/lease since it is allowed and practiced in the area.

Production output of maize farmers in the study area before the insecurity

Table 13: Distribution of maize production output in tone's before insecurity period size of maize in the study area

Output (tons)	Frequency	Percentage (%)
Above 10 tons	40	25.0
6 – 10 tons	10	6.25
1– 5 tons	70	43.8
Less than tons	40	25.0
Total	160	100

Source: Field Survey, 2023.

Table 13 presents result on maize out-put of farmers in the area. It shows that, majority (44%) of the respondents on the average obtained between 1 – 5 tons of maize as their output, about 25% and another 25% obtain less than 1 ton and more than 10 tons as

their output respectively, as their out-put before the insurgency. This shows that most of the maize farmers operate as small to medium scale farmers before the insurgency with only few as large scale operators.

Production output of maize farmers in the study area after the insecurity

Table 14: Distribution of maize production output in tones after insecurity period

Output (tons)	Frequency	Percentage (%)
Above 10 tons	20	12.5
6 – 10 tons	10	6.25
2 – 5 tons	30	18.75
Less than 1 ton	100	62.5
Total	160	100

Source: Field Survey, 2023.

Result on average out – put of maize farmers after the insurgency in the study area is presented in Table 14. It shows that, majority (62.5%) of the farmers obtain less than I ton on the average, while about 19% obtain between 2 to 5 tons, similarly, 12.5% obtain more than 10 tons. This implies that, maize output on the average has declined after the

insurgency in the area. This could be as a result of decrease use of chemical fertilizer and tractor machine in improving soil nutrition and soil pulverization which may enhance aeration and improve the texture and structure. The decrease in farm out- put is critical to food security and economic growth.

Some Inputs Used in Maize Production and their average estimated cost in naira before and after the insurgency

Table 15: Inputs use for maize production

Inputs	Unitcost before insurgency 2009 - 2013	Unit Cost after insurgency 2019 – 2023	Difference in Value	Percentage Change rank
Tractor (ha)	15,000	45,000	25,000	62.5
Ox – plough (ha)				6
Cutlass	10,000	20,000	10,000	50.0
Hoe	500	1000	500	50.0
Seed per kg	400	900	500	55.6
Planting per hectare	200	600	400	66.7
Fertilizer per 50kg NPK	5,000	15,000	10,000	66.7
Urea	7,000	25,000	18,000	72.0
SSP	9,000	30,000	21,000	70.2
Fertilizer Application/bag	5,000	22,000	17,000	77.3
Herbicides per litre	1,000	2,000	1,000	50.0
Round up				
Paraquat	1,500	3,000		50.0
Altrazine	1,200	2,500	1,500	52.0
	2,000	4,000	1,300	50.0
Sprayer 16 litres			2,000	
Spraying per 16 litres	3,000	12,000	9,000	75.0
	100	250	150	60.0

- (a) **Cutlass** is a tool used for clearing, cutting down of trees and shrubs, weeding, harvest and planting. The cutlass averagely cost N500 before insurgency and rose to N1000 after revealing a percentage change (increase) of about 50%
- (b) **Hoes used for wedding:** These kinds of hoe are usually smaller in size compared to the bigger ones used for planting. Some of the smaller hoes are sometimes known as African hoe or bent cutlass (referred to as 'Agor') in the study area. The weeding hoe averagely costs about N400 and rose to N600 after, revealing a percentage of 56%.
- (c) **Seeds:** This is preserved and treated maize seeds for the purpose of planting. Averagely seeds cost about N200 before the insurgency and rose to N600 per kg after the insurgency, indicating a percentage change of 67%. The life span is one year.
- (d) **Fertilizers:** These are inorganic compound used to boost the soil fertility. Different types of fertilizers exist but the NPK compound fertilizer are the most commonly used fertilizer in the study area. On the average NPK fertilizer cost about N7, 000 before insurgency and rose to N25, 000 after. Urea averagely cost N9, 000 per 50 kg bag before the insurgency and rose to 30,000 after the insurgency while SSP on the average cost 5,000 before the insurgency and rose to 22,000 per 50kg bag after the insurgency. Averagely there was a percentage change (increase in cost of fertilizers by at least 70%. This shows it is the highest ranking it terms of cost. Similarly, fertilizer application rose from 1,000 per bag to 2,000 before and after the insurgency respectively.
- (e) **Bags:** These are of different types-the fertilizer bags, poultry bags and salt bags. They are of 50kg in size and are used for easy conveyance of maize from farm to place of sale or need. Their cost ranges from N80.00 to N150.00.
- (f) **Herbicides:** This are commonly known as weed killers. Herbicides are chemicals used to kill unwanted plants/weeds. Selective herbicides Kills specific targets, while leaving the desired crops relatively unharmed. It act by interfering with the growth of the weed and are often synthetic "imitation" of plant hormones. There are different types such as round up, paraquat and atrazine. Averagely, a litre of round up cost 1,500 before insurgency and rose to 3,000 after. Paraquat 1, 200 per litre before the insurgency and rose to 2,500 after the insurgency. While atrazine cost N2, 000.00 before the insurgency and rose to 4,000 after the insurgency, indicating a percentage change in price by at least 50% across all the herbicides.
- (g) **Sprayer (Calibrator):** This is an accurately calibrated tools used for the application of liquid fertilizer, herbicides, pesticides. It is a four-gallon backpack and it is very light weighted but durable. Average a cheap 16 litres sprayer cost N3, 000 before the insurgency and rose to N12, 000.00 after the insurgency, revealing a 75% percentage change. Making it the most in terms of percentage change. While the average cost of spraying using a 16 litres sprayer was 100 before the insurgency rose to average of 250 after the insurgency.

Conclusion

The study concludes that, majority (44%) of maize farmers in Madagali Local Government Area (LGA) of Adamawa State before insurgency produced between 1-5 tons in the study however, after the insurgency majority (63%) produced less than 1 ton. This could be as a result of inaccessibility and high cost of production inputs such as fertilizer and tractor machine in the area as a result of insurgency and insecurity that affected the area.

Following the result of this study, appropriate recommendations are made that might improve

maize production amidst insecurity in the study area:

- i. Non – governmental organization should intervene by providing supports in areas of inputs, capacity building on alternative fertilizers and appropriate tools for farming maize.
- ii. Government should intensify security outfit to checkmate insecurity and insurgency in the area.
- iii. Farmers should form cooperatives and association to pool their resources together and pursue common goal (s), that might improve their out-put, productivity, food security, and livelihood and minimize poverty on a sustainable basis.

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