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Farmers' Participation in Agricultural Research and Rural Extension Programs: Empirical Evidence of Maize Producers in Sussundenga District, Mozambique

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Abstract

This study analyses the factors affecting farmers' participation in agricultural research and rural extension programs in Sussundenga district-Mozambique. We applied a questionnaire to 140 maize producers and to 18 technicians (extension agents and agricultural researchers). Fieldwork was carried out in February and March, 2018. Logit binary regression, descriptive statistics and content analysis were used to analyze the data. The results appoint that farmers' participation is considered weak, discontinuous and low. Farmers' participation is affected by the practice of off-farm activities, membership of farmers' associations, number of technological demands and the maize production purpose. Nevertheless, the institutional context interferes with farmers' willingness to participate in research and extension programs. This article brings significant contributions to the literature that discusses farmers' participation in rural development programs. In addition to farmers' characteristics, the institutions context

affects farmers' participation in the activities developed by these organizations. The promotion of farmers' participation should be thought taking into consideration that farmers are involved in several activities. Furthermore, the organizations need to offer technologies and services that help farmers finding solutions to the problems that they face.

Keywords: agriculture, bottom up, co-learning, farmers' involvement, technology co-generation

I. Introduction

The 1980s and 1990s witnessed changes of paradigms in rural development programs and public policies. These changes occurred because of the top down approaches dominating at the moment were accused for not promoting true development of the poorest and most disadvantaged communities (Ponzio et al., 2013). For example, it is widely recognized that Green Revolution increased agricultural production, productivity and improved food security in many regions of the world (Mooney, 1987; Pinstrup-Andersen and Hazell, 1985), but it failed to end hunger in many Sub Saharan African and Asian countries (Mooney, 1987). Besides it, Green Revolution have originated social exclusion, genetic erosion, soil and water contamination, pollution of underground water, human and livestock diseases and global warming (Saidur, 2015).

The main strands supporting this paradigm shift in rural development programs and policies are related to the advent of agricultural systems research, the growing recognition of the validity of local knowledge and the ability of the poor to contribute in solving their problems (Freire, 1983; Schmitz, 2010). Actor's oriented approaches were also important since they emphasize that participants of development program have different understanding of the change process in which they are involved, as well as increased concerns addressing gender issues in rural development programs (Gemechu, 2019; Chambers, 1994; Quisumbing et al, 2014). In this sense, some social scientists argued that programs and public policies aiming at solving farmers' problems should follow bottom up approach, taking people as partners and using their experiences to empower themselves (Bayissa, 2019). The same author states that the low rates of agricultural technologies adoption are associated with the lack of active farmers' participation in all stages of agricultural research projects.

Mozambique is a country where agriculture is the backbone of the economy. This activity is a source of occupation of 80% of the economically active people (MASA, 2015). However, as in many African countries, agricultural productivity in Mozambique is very low. For example, the maize yield, the most widely cultivated crop in Mozambique, is about 1.2 tons per hectare (ton/ha). Apart from this, the agriculture in Mozambique is characterized by low adoption of modern inputs. For example, only 4.5% of farmers use chemical fertilizers in Mozambique (MASA, 2015). The low adoption of technologies is associated to the low agricultural productivity (Cunguara et al, 2013).

In pursuit of strategies to improve the performance of agriculture, the government of Mozambique has designed and implemented programs to support farmers through agricultural research and rural extension. These efforts highlight the need of agricultural study and rural

extension programs to be carried out with the involvement of various stakeholders, especially farmers. The perspective is that, these organizations will leverage farmers' knowledge to co-generate technologies that meet their demands (MINAG, 2007; MINAG, 2010). The 2007-2016 Extension Master Plan points out that the First National Agriculture Program (PROAGRI-I), implemented in Mozambique between 1999 and 2004, occurred without significant farmers' participation in rural extension activities (MINAG, 2007). However, there are few studies analyzing farmers' participation in agricultural research and rural extension programs in Mozambique. Thus, this paper aims at analyzing factors affecting farmer's participation in agricultural and rural extension programs in Sussundenga district. The study is guided by three questions: 1- At what stages of the research and extension activities do farmers participate? 2- What are the typologies of farmers' participation? 3-Which factors affect farmers' participation in agricultural research and rural extension programs? The importance of the study consists of providing elements such as phases, typologies and challenges faced in the operationalization of farmers' participation in research and rural extension activities.

2. Research Methods

2.1 Study Region, Data Collection and Sampling Procedures

This study was carried out in Sussundenga district- Manica province in the central region of Mozambique. Sussundenga has a surface of 7100 km² (MAE, 2014). It is divided into four administrative posts: Sussundenga Headquarter, Muoha, Rotanda and Dombe. The district has an estimated population of 171000 inhabitants (INE, 2018). Agriculture is the main economic activity of local households, where maize, beans, vegetables and fruits are the main crops (MAE, 2014). The study covers all the administrative posts of the district because agricultural research and rural extension organizations have worked with farmers in all those regions.

Data were collected in February and March 2018. Interview was conducted to 140 maize producers and to 18 agricultural technicians (agricultural researchers, rural extension and leaders of those organizations). In the farmer's interviews, data was collected of their households' characteristics, their agricultural production plots, phases and types of farmers' participation in agricultural research and rural extension activities addressing maize crop. The focus of this study is maize because it is the main crop produced in the district. Apart from this, the cereal plays a crucial role in food security and in the economy of the local households (MAE, 2014). Data collected from the technicians are related to the ways their institutions operate farmers' participation in agricultural research and rural extension programs. However, the data was collected toward the main stages in which farmers participate in agricultural research and rural extension activities and the tools used for that purpose. It was used four stages to classify farmers' participation: problem assessment, planning activities, programs execution and programs evaluation. The definition of the participation stages was based on these authors (Van den Ban and Hawkins, 1996; Khamala, 2014; Donaldson, 2014; Neef and Neubert, 2011). Farmer level participation was defined according to the typologies of Pretty et al, (1995) and Aref (2011), as following: passive participation, provision of information, consultation, material incentives, functional, interactive and self-mobilization.

The farmers interviewed in this study are distributed among the four administrative posts in the

following proportion: 55 from Sussundenga Headquarter, 53 from Dombe, 21 from Muoha and 11 from Rotanda. The distribution of respondents based on the proportion of the population in each of the four administrative posts (MAE, 2014). 39% of the population of Sussundenga district live in Sussundenga Headquarter, 38% in Dombe, 15 % in Rotanda and 8 % in Muoha (MAE, 2014).

Apart from farmers, 18 agricultural technicians were interviewed and they were divided into different categories, 10 rural extension agents, 3 researchers, 3 heads of institutions and 2 "research assistants". These technicians work for four institutions: District Economic Activities Service (Serviço Distrital de Actividades Económicas–SDAE), Agrarian Station of Sussundenga (Estação Agrária de Sussundenga–EAS), National Cooperative of Business Association and Cooperative of Leagues of the United States of America (NCBA-CLUSA) and the Food and Agriculture Organization of the United Nations (FAO). The first two institutions are Mozambican public organizations while the others are international. In 2018, SDAE, EAS, NCBA-CLUSA and FAO had 19, 5, 2 and 1 technicians working directly on maize crop with farmers in Sussundenga district, respectively. The sample is composed by eight technicians from SDAE, six from EAS, three from NCBA-CLUSA and one from FAO. In EAS, were interviewed five researchers who work directly with maize crop and the head of the organization.

2.2 Data Analysis and Model Specification

Data of household's characteristics, stages and typologies of farmers' participation were analyzed using descriptive statistics (percentage frequencies).

Factors affecting farmers' participation were determined by using the logit binary regression model. The regression model is widely used in similar studies (Haile, 2016; Martey et al, 2014; Jamilu et al, 2015; Suvedi et al, 2017; Muhammed et al, 2017). According to Gujarati (2004), the logit regression model has the following formula:

$$logit(Y) = ln\ ln\left(\frac{p_i}{1-p_i}\right) = \alpha + \beta X \quad (1)$$

Pi is the probability (Y=event of interest |X=x, for a specific value of X)= $\frac{e^{\alpha+\beta x}}{1+e^{\alpha+\beta x}}$ (2)

Where *Pi* is the probability of the event of interest occurring, the farmer's participation; α is the intercept of y; β is the regression coefficient; *e* is the basis of the natural logarithm. In the logit regression model, the variable *x* can be categorical or continuous, but the dependent *y* is always categorical. In this study, the logistic regression model has the following formula:

$$y = \frac{e^{\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4 X_4+\beta_5 X_5+\beta_6 X_6+\beta_7 X_7+\beta_8 X_8+\beta_9 X_9}}{1+e^{\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4 X_4+\beta_5 X_5+\beta_6 X_6+\beta_7 X_7+\beta_8 X_8+\beta_9 X_9}} \quad (3)$$

Where X_1 to X_9 are the explanatory variables, ß$_1$ to ß$_9$ are the respective coefficients and α

represents the *y*-intercept. The significance of the coefficients of the explanatory variables was determined by the *t Student* test, in which the null hypothesis (h_o) is $\beta=0$ and the alternative hypothesis (h_a) is $\beta\neq0$.

The characterization of the dependent and independent variables is in table 1.

Table 1. Characterization of the explanatory variables used in the regression model

Variables	**Type and code**	**Expected effect**
Dependents		
Y_1 (The farmer participates in agricultural research or rural extension activities)	*Dummy* (1-yes and 0-no)	
Y_2 (The farmer participates in the execution phase of the agricultural tests)	*Dummy* (1-yes and 0-no)	
Independents		
X_1 (Sex of household head)	*Dummy* (1-man and 0-woman)	Positive
X_2 (Age of household head)	Continuous (years)	Indeterminate
X_3 (School level of household head)	Continuous (years of schooling)	Indeterminate
X_4 (Household size)	Continuous (number of people living in the household)	Positive
X_5 (Membership to agricultural association)	*Dummy* (1 if yes and 0 otherwise)	Positive
X_6 (At least one member of the household is involved in off-farm activities)	*Dummy* (1 if yes and 0-no)	Negative
X_7 (Technological demands)	Continuous (number of technological/information demands)	Positive
X_8 (Production purpose)	*Dummy* (1-consumption and sale and 0-consumption only)	Positive
X_9 (Main source of household income)	*Dummy* (1-agriculture and 0-other activities)	Positive

Source: Adapted by the authors

The explanatory variables were chosen based on the literature review. Several studies point to

socio-economic and demographic characteristics as factors affecting farmers' participation in agricultural development programs (Haile, 2016; Martey, 2014; Suvedi et al, 2017, Muhammed et al, 2019; Etwire et al, 2013; Mulema et al, 2019). The inclusion of off-farm activities variable is related to the fact that some authors mention that households that have their members involved in off-farm activities tend to allocate their resources (for example, time and labor) to different activities that guarantee their reproduction (Grisa and Schneider, 2008). Given that the practice of off-farm activities is common in most households in the study region, it is understood that it may have an effect on the predisposition of household members to participate in research and extension programs.

The production purpose was included as an explanatory variable because farmers with a strong connection to the market, through the sale of agricultural products, tend to participate in projects that enable the learning of new technologies that increase production and productivity. The increase of production and productivity has the potential to increase household income. However, it is assumed that the variable "production purpose" has an effect on the prediction of farmers' participation.

Some authors consider that farmers participate in agricultural research or rural extension activities motivated by material interests, such as looking for technologies or information that help to solve some problems (Bayissa, 2019; Jones et al, 2014).

The inclusion of the "main source of the household income" is justified since it is assumed that the household will give more importance to the activity that provides the major proportion of the income that satisfies its demands. If this activity is agriculture, the household will tend to participate in research and rural extension activities, as they enable the learning of new agricultural technologies, which has the potential to increase the production, productivity and household income. Data were analyzed using the Statistical Package for Social Sciences (SPSS).

It was also used Bardin's content analyses technique to analyze if the institutional context affects farmers' willingness in participate in agricultural research and extension programs.

3. Results and Discussion

3.1 Characteristics of Household'S Maize Producers in Sussundenga

The results of field work illustrate that there is no difference in the age, academical level and the size of household's (HH) head between participants and non-participants (Table 2).

Table 2. Profile of households' farmers in Sussundenga district (2018)

Variable	Parameter	Participants (n=49)	Non participants (n=91)	Significance of *t* test
Age of HH Head (Years)	Mean	44.0	40.9	.187 NS
Membership of farmers' associations	(Yes)	28.5%	0%	N.A.
	(No)	6.5%	65%	
School level of HH head (Years)	Mean	7.4	7.7	.707 NS
HH Size (Number)	Mean	6.1	6.4	.653 NS
Sex of HH Head	(Male)	29.3%	50%	N.A.
	(Female)	5.7%	15%	
Experience of HH head in agriculture (Years)	Mean	22.5	13.8	.000*

Source: Field data (2018) NS- Non Significant N.A. Non Applicable *P<.001 N=140

The Table also shows that academical level of HH head is low. Previous study illustrates the majority of HH head in Manica province has less than 7 years of education (Cavane and Donovan, 2011). The HH size of farmers in Sussundenga is similar of that of rural areas in Mozambique. According to Cavane and Donovan (2011), the average HH size of rural areas in Mozambique is 6. The HH heads whose members participate in agricultural research or rural extension activities have considerable experience in agricultural activities than those who do not participate. It is clear that the majority of HH heads in Sussundenga are male. This result was expected since the patriarchal culture, which is predominant in Africa and in other regions of the world, gives to man the role of family heading (Brumer, 2004). Table 2 also shows that it seems that there is a relationship between farmers' participation and farmers' membership to associations. The results are congruent with Jorge and Pinto (2022) and Abdallah and Rahaman (2016). The aforementioned authors say, ''farmer's associations are important platforms that enable farmers getting access to rural extension services''.

3.2 Phases and Types of Farmers' Participation

The data of this study illustrate that only 28.6% of the interviewed participate in the stage of problems identification faced by maize growers and 35% participate in the implementation of programs developed by agricultural research and rural extension organizations (Table 3).

Table 3. Farmers' participation in agricultural research and rural extension in Sussundenga

Phases of farmers' participation	**Percentage (%) ***
Problems identification	28.6
Activities planning	0.00
Programs execution	35.0
Programs evaluation	0.00

Source: Field data (2018). N = 140. * The sum can be different from 100

Farmers' participation in problems identification occurs through Participative Rural Diagnosis (PRD) and meetings between them and agricultural technicians. In addition to group methods such as PRD and meetings between farmers and technicians, technicians have been making individual visits to some of the farmers' plots. These visits are part of platform for farmers to share their problems and technological needs.

Although farmers' participation in problems identification was low, the data obtained in the field illustrate that the technicians are aware of the main limitations that maize producers face. In fact, technicians mentioned that most agricultural technologies that institutions offer to maize growers are not profitable, since the cost of inputs is high and the price of maize is low. It means that the methods used to assess the problems of maize producers allow technicians to have an overview of the issues that constrain maize production. Although technicians recognize that these technologies are not profitable, they offer them to farmers. It is seen as a paradox. However, the motivations for this situation are beyond the focus of this research.

None farmer stated to participate in the planning programs stages. The non-participation of farmer in the planning stage can cause mismatch between programs and farmer's needs, the lack of understanding of the farmers roles in the development of the programs and the non-appropriation of them (Gboku and Lekoko, 2007; Medeiros and Borges, 2007). Therefore, it can significantly contribute to the failure of research and rural extension programs in Sussundenga district.

The execution programs stage of the research and rural extension occurs with the participation of 35% of the farmers growing maize (Table 3). These farmers participate in activities related to the testing and adaptation of agricultural technologies. The main platforms for testing the technologies are Farm Field School (FFS), on-farm tests, results demonstration fields and visits of farmers' plots. These platforms are the main ways used by agricultural research and extension to offer agricultural technologies and may be mechanisms for co-learning processes.

Field data illustrate that, out of the four stages of the programs, farmers only participate in two. Therefore, participation is fragmented and it can limit the occurrence of a real co-learning environment and the subsequent co-generation of technologies. The use of bottom up

approaches in agricultural development programs is based on the premise that farmers are holders of knowledge and experiences that need to be used to generate solutions that help solve the problems they face (Hoffmann et al, 2007; Schmitz et al, 2010). Thus, their limited participation can prevent institutions from making the whole use of the knowledge and experiences that farmers have.

The low and fragmented farmers' participation in research and rural extension activities in Sussundenga district suggests that in this region it is difficult to achieve one of the main objectives of the National Agrarian Extension Program (PRONEA). One of the objectives of the Extension Master Plan (PDE 2007-2016) was to train farmers in order to increase their capacity to plan, monitor and evaluate the services provided by rural extension. Although this study has not verified whether the farmers obtained the skills foreseen in the PDE, the results of this research suggest that regardless the fact that, farmers do not participate in planning and evaluation phases of agricultural research and rural extension activities.

In addition to the farmers' participation occurring only in the problems identification and in the execution of activities, the results indicate that, according to the typologies of Pretty et al, (1995) and Aref (2011), this process occurs in a weak way. The forms of participation mentioned by maize growers in Sussundenga district are passive participation, by providing information and consultation (Table 4). It means that out seven levels of participation defined by Pretty et al, (1995), farmers participate only in tree levels. These three forms of participation are equivalent to what Aref (2011) names “non-participation” and “symbolic participation”. At these levels people have low possibility to influence the organizations’ agenda.

Table 4. Typologies of farmers' participation in agricultural research and rural extension in Sussundenga (2018)

Types of participation	**Percentage (%)***
Passive participation	33.60
Participation by providing information	29.30
Participation by consultation	32.90
Participation by material incentives	0.00
Functional participation	0.00
Interactive participation	0.00
Self-mobilization	0.00

Source: Field data (2018). N = 140. * The sum can be different from 100.

In the types of farmers' participation illustrated in Table 4, there are few expectations from institutions to give feedback to the farmers. It means that in Sussundenga, there is lack of genuine participation of farmers in agricultural research and rural extension organizations. Therefore, the actual forms of farmers' participation do not have potential to provide co-learning and co-generation of solutions to farmers' problems. Experience of Living Labs programs in South Africa illustrates that a true environment that enables co-learning and co-generation of technologies to solve community problems requires conditions where members of that community are given opportunities to influence the institutions' agenda at all stages of technology development (Habiyaremye, 2020).

The low farmers' participation of Sussundenga contradicts the recommendation of documents guiding agricultural research and rural extension activities in Mozambique, such as the PDE 2007-2016 and the Strategic Plan for the Development of the Agricultural Sector (*Plano Estratégico do Desenvolvimento do Sector Agrário*- PEDSA). However, previous studies have appointed that poor participation of farmers in research and rural extension activities is a common problem in many developing countries (Bayissa, 2019; Aref, 2011; Etwire et al., 2013; Kumba, 2003; Jan and Manig, 2008; Vargas, 2017).

3.3 Which Factors Affect Farmers' Participation?

Results of the regression model

The results of the logit regression model illustrate that the practice of off-farm activities and the production purpose influenced farmers' participation in the phases of problem identification and programs implementation (Table 5). In addition to these variables, membership of the farmers' association and the number of technological demands influenced significantly the likelihood of farmer's participation in the problem identification stage.

Table 5. Factors that influence the participation of farmers according to the regression model

Independent variables	Participation in problem identification (Y_1)		Participation in programs execution(Y_2)	
	Variable coefficients	Significance	Variable coefficients	Significance
Sex of household head (X_1)	-.460	.695	.649	.613
Age of household head (X_2)	-.039	.273	-.038	.271
Schooling of household head (X_3)	.272	.104	.158	.298
Household size (X_4)	-.124	.347	-.054	.691
Membership of farmers' association (X_5)	6.877	.000**	24.568	.997
The household practice an off-farm activity (X_6)	-4.833	.004**	-2.344	.088*
Technological demands(X_7)	.631	.099*	-.278	.395
Production purpose (X_8)	3.660	.005**	2.653	.009**
Main source of household income(X_9)	-.668	.560	-.752	.456
Y intercept	-3.125	.269	-.768	.737
Determination coefficient (R^2) of Cox & Snell	.556		.595	

Source: SPSS results obtained based on field data (2018). N=140. **p<1% and *p<10%

The minus signal of the practice of off-farm activities coefficient means that this variable affects negatively households' predisposition to participate in agricultural research and rural extension activities. The significance of this variable is explained by the fact that since maize production is not economically very attractive households may allocate a significant part of their time and labor in other activities that enable them to earn income to satisfy their diverse demands. This is consistent with the study of Suvedi et al, (2017) and with the approach of Grisa and Schneider (2008). The plus signal of the "production purpose" means that since farmers tend to sell part of maize, their interest in participating in research and rural extension activities increases. That is because in these institutions there is a possibility for farmers to acquire more knowledge and technologies to increase agricultural production and productivity. The effect of this variable is similar to the size of the production plot. Farmers who decide to

increase the area of cultivation move further away from self-consumption production, which increases their propensity to participate in development programs (Etwire et al, 2013).

Regarding farmers' association membership, previous studies have shown a significant effect of this variable on the probability of farmers to participate in rural extension activities (Martey et al, 2014; Suvedi et al, 2017; Mulema et al, 2019). It means that famers associations are important platforms that attract farmers to participate in agricultural development programs.

The significance of the "number of technological demands" on the probability of farmers to participate means that they participate in programs seeking solutions to solve problems they face in their daily lives. Our field data indicate that in Sussundenga, farmers face several problems in maize production, in agricultural products market and in surpluses storage. Therefore, it is understood that farmers have the belief that their participation in the activities developed by the institutions comprises a platform for solving the problems they face. It is worth mentioning that 23.6% of the farmers interviewed in this study mentioned that research and rural extension institutions help to solve part of the problems related to maize production, mainly through the recommendation of methods of pest control.

Sex, age, education level, household size and the source of majority part of household's income did not have a significant effect in the probability of farmers to participate in agricultural development programs. Previous studies did not show a consistence effect of these variables in the probability of farmers' participation. For example, farmer's gender was a significant variable for (Jamilu et al, 2015; Muhammed et al, 2019), but not for (Suvedi et al, 2017). Age was significant for (Martey et al, 2014; Suvedi et al, 2017). However, for Mulema et al, (2019) and Lawal et al (2019), this variable was not significant.

Does the institutional context encourage farmers' participation?

An important issue to be analyzed when investigating the *modus operandi* of the institutions regarding farmers' involvement in the activities carried out by these organizations is to capture the technician's perception toward participatory process. In this context, when the technicians were asked to comment on whether the institutional environment was favorable for farmers' participation in all activities developed by the institutions, they responded positively. However, when explaining how and where farmers' participation occurs, it was noticed that this process takes place only in fieldwork.

The operationalization of participation depends on the skills of the technicians to conduct work in this process and on their views on the effectiveness and appropriation of the process (Lilja and Bellon, 2008). This is an important point to be taken into consideration, since agricultural research and rural extension organizations will hardly operationalize genuine participation whenever technicians' understanding is incomplete.

Another issue that, in our analysis, affects farmers' participation is the low level of inter institutional coordination. According to the field data, the organizations working in agricultural research and rural extension in Sussundenga have little coordination in their activities. This situation is translated into the providing of several technologies in a short period of time to the same farmers, which is not a good scenario to promote participation, since farmers are

"overflowed" by many projects. It is difficult to understand different messages transmitted by a wide range of institutions, at the same time. In addition, the technicians state that it is so likely that the messages and objectives of the different projects are not coherent to one other. In a way, it discourages farmers from participating in agricultural research and rural extension activities.

Still on the issue of institutional coordination, the lack of a forum that, at the district level, would discuss the different issues related to agriculture that can contribute to the low and weak farmers' participation. This forum would be what PDE 2007-2016 names "forums of extension management committees" (MINAG, 2007). It is understood that the existence of this forum, which can be composed by all stakeholders (researchers, extension agents, farmers, inputs and agricultural products traders), would help in the development of an enabling environment for the full farmers' participation in defining the agenda of these institutions. This would help building agricultural extension and research aimed at offering services that really respond to farmers' needs.

Previous studies of Come, Ferreira Neto and Cavane (2021) and Marassiro and Oliveira (2022) illustrate the existence of a mismatch between the demand and supply of agricultural technologies in some regions of Mozambique. Therefore, issues related to the most important services to be supplied to farmers would be discussed in the forum, given the limitations they face in the spatial and temporal distribution of projects to avoid overlapping them. In our analysis, the mismatch between supply and demand of technologies affects farmers' participation. Farmers participate in research and rural extension activities in order to seek solutions to the problems they face in their daily lives. The fact that the institutions face difficulties to supply full solutions to improve the functioning of the agricultural market, suggests that farmers do not possibly see much relevance in participating in these activities.

4. Conclusions and Recommendations

This study aimed at analyzing the factors affecting farmers' participation in agricultural research and rural extension activities in Sussundenga district. The results point that farmer's participation in agricultural research and rural extension programs in Sussundenga is weak, discontinuous and low.

Farmer's participation is affected by membership of farmers associations, production maize purpose, number of agricultural technologies demands and the practice of off-farm activity. Thus, the creation of farmers associations can improve farmer's participation in agricultural research and rural extension activities. Since agricultural research and rural extension organizations face difficulties to offer technologies that meet maize growers, it would be a way of institutions to illustrate that farmers' participation generates material benefits. The expectation of gaining benefits galvanizes farmers' participation in development programs. It should be mentioned that farmers' participation in research and rural extension activities involves opportunity costs. Thus, they will only participate if they perceive that the benefits outweigh the costs. This is an important element to be taken into consideration, as under the current conditions, agriculture has not generated significant income in most small-scale farmers' households.

In a general analysis, functional participation should be experimented by agricultural research and rural extension organizations in order to operationalize farmers' participation. Functional participation is an active form of participation that can enable farmers to influence the agenda of local organizations. We do not advocate participation by material incentive because this typology of participation is not sustainable since without material, people tend to abandon the projects.

The institutions are suggested to delimit spaces of action and responsibilities for each actor in the participative process. However, the delimitation process needs to be participative so that each stakeholder negotiates and appropriates the responsibilities that will fall to him. This exercise is particularly relevant in planning and in evaluation phases, since, in this study, it was found that there is no farmers' participation in these two stages. Furthermore, in addition to defining the spaces and responsibilities of each stakeholder, it is crucial that careful mechanisms for the selection of participants are made in order to ensure that all strata of producers are represented. This would prevent the most disadvantaged farmers, such as women, from being excluded, a situation that would aggravate their vulnerability.

It is proposed the special need to train farmers so that they have will acquire skills to take advantages of their participation in research and rural extension programs. In fact, they will only be able to influence the institutions' agenda if they have the capacity to negotiate their interests with the organizations that provide assistance to them. Finally, it is suggested the creation of forum that, at the district level, would bring together technicians, farmers, traders, among many others, for the definition and discussion of issues related to agriculture. This forum would be coordinated by the district extension supervisor. In fact, this is a proposal that can improve the implementation of agricultural technology generation programs.

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