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Research Application Summary

Understanding Gender Risk Behaviour: Panacea to Adoption of Innovations and Technology for Mitigating the Effect of Climate Variability

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Abstract

Innovative research aimed at mitigating the effect of climate variability on farmers output must be adopted before the desired outcome can be achieved. Adoption of any innovation, which is deeply rooted in risk behaviour and may differ according to sex and social role, has been reported low. We used both pooled and disaggregated data to investigate gender risk behaviour to Stress Tolerant Maize variety; an innovation aimed at mitigating the effect of climate variability in Africa. Using a randomized data from 360 household sampled across Derived Savannah zone of Nigeria, we specifically investigate the socio-economic characteristics of men and women farmers, the differences in men and women risk behaviour and the determinants of these risk behaviours from gender perspectives. The result showed that gender is an important factor to be considered by policy if farmers must take the risk in adoption of innovation. The result also specifically showed that for women farmers to take risk and adopt any innovation, the innovation must meet their labour demand while that of men farmers showed that the innovation must have effect on the area of land available to farmers. We therefore recommend that aside other issues that affect adoption of innovation, the issue of risk behaviour of farmers should be captured in policy aiming at fostering innovation adoption and specifically men and women risk behaviour given proper attention

Keywords: Climate Variability Mitigation, Gender, Innovation and Technology, Risk behaviour, STMA

Résumé

Les recherches innovantes visant à atténuer l'effet de la variabilité climatique sur la production des agriculteurs doivent être adoptées avant que le résultat souhaité puisse être atteint. L'adoption de toute innovation, qui est profondément ancrée dans le comportement à risque et qui peut différer selon le sexe et le rôle social, a été signalée comme faible. Nous avons utilisé des données regroupées et désagrégées pour étudier le comportement à risque des hommes et des femmes face à la variété de maïs tolérante au stress, une innovation visant à atténuer l'effet de la variabilité climatique en Afrique. En utilisant des données aléatoires provenant de 360 ménages échantillonnés dans la zone de Derived Savannah au Nigeria, nous avons spécifiquement étudié les caractéristiques socio-économiques des agriculteurs et agricultrices, les différences dans le comportement à risque des hommes et des femmes et les déterminants de ces comportements à risque dans une perspective basée sur le genre. Le résultat a montré que le genre est un facteur important à prendre en compte par les politiques si les agriculteurs doivent prendre le risque d'adopter une innovation. Le résultat a aussi montré spécifiquement que pour que les agricultrices prennent des risques et adoptent une innovation, celle-ci doit répondre à leur demande de main-d'œuvre, tandis que pour les agriculteurs, l'innovation doit avoir un effet sur la surface de terre disponible pour les agriculteurs. Nous recommandons donc qu'à part d'autres questions qui affectent l'adoption de l'innovation, la question du comportement à risque des agriculteurs devrait être prise en compte dans les politiques visant à encourager l'adoption de l'innovation et que les comportements à risque des hommes et des femmes reçoivent une attention appropriée.

Mots clés : Atténuation de la variabilité climatique, genre, innovation et technologie, comportement à risque, STMA.

Introduction

The general consensus in literature indicate that climate variability will impact agriculture (Zilberman, et.al., 2018; Rosegrant *et al*., 2014). Agricultural sector is also one of the greatest contributors to climate variability through emissions of Greenhouse gases. Most climate modelling literature projects that the current agricultural practices in most developing countries is insufficient in reducing household vulnerabilities (Rosegrant *et al*., 2014). Sub-Sahara Africa will be among the worst hit regions of the world where food security is already problematic and populations are vulnerable to shocks (Asadi-Zarch *et al*., 2014; Touma *et al*., 2015). In agreement to the finding of (de Jong *et al*., 2016), innovation and technologies holds core place in mitigating the effect of climate variability. Understanding the role of innovation in minimizing the impacts of climate variability is a not a new concept. In fact, there has been quite a number of studies examining the progress and success of Government programs established to facilitate the development and diffusion of climate mitigation technologies (Haselip *et al*., 2015; Dhar and Marpaung, 2015). Literature agree that climate variability will have differentiated effects on actors (Pearse, 2016). Literature also agrees that the effect of climate variability will vary across gender and women will be more vulnerable (Beuchelt and Badstue 2013). These findings suggest that there is need to ensure that innovation and technologies aimed at combating household vulnerabilities are gender-sensitive. This sensitivity must include the risk behaviour of men and women to adoption of innovations. The report of Bee *et al*. (2013) emphasised that policy makers who are developing and implementing adaptation policies and strategies need to consider gender relations and their effects in order to fully explore the role of innovation and technologies in mitigation.

In Nigeria, agricultural productions are largely weather-sensitive and hence, vulnerable (Dinar, et.al., 2006). The evidences of climate variability in Nigeria has been reported in literature, Brown (2006) reported that the Sudan Sahel region of Nigeria has suffered a 3–4% decrease per decade in rainfall since the beginning of the 19th century. Further report of Onyekuru and Marchant, (2014) found that the southern part of Nigeria has experienced increased amount of irregular rainfall while the north is experiencing dryer weather. To mitigate the effect of climate variability on farmers, there is need to explore how innovation contribute to adaptation of farming households across gender. Stress Tolerant Maize varieties represent a major innovation aimed at combating the effect of climate variability in Nigeria. The Stress Tolerant Maize for Africa (STMA) project is aimed at addressing these challenges by developing improved multiple Stress Tolerant varieties that effectively address emerging and future climate variability challenges. However, Long *et al*., (2016) reported that socio-economic barriers; such as gender roles and responsibility hinder technology adoption.

Literature on investigation of climate variability across gender categories in Nigeria (Amusa et.al., 2015; Arimi, 2014) failed to investigate the gendered effect of climate variability on risk behaviour to agricultural technology and innovation. Using the case of adoption of Stress Tolerant Maize variety, we explore the risk behaviour of men and women farmers. We contribute to discussions on the role of innovation and technologies in adaptation by probing the intrinsic linkage between farmers risk behaviour to adoption of innovations aimed at combating the effect of climate change from gender perspective. We further explore the factors that influence each gender behaviour to the adoption of innovation and technology in Nigeria. We believe that examination of gender-specific differences in behavioural response to adoption of innovation and technologies aimed at mitigating the effect of climate change will improves understanding of the underlying issues, and can contribute to efforts to reduce gender-blindness in policy formulation.

Literature review and conceptual framework

We premise the concept of this research on the innovation-growth cycle which is not a new concept in economics. It started relatively with the work of (Solow, 1956). Since then, many studies and works have provided support and empirical evidence of this concept (Freeman, 2002; Bayarçelik and Taşel, 2012; Bektas *et al*., 2015). However, distinguishes innovations and technologies that facilitate economic growth. Sunding and Zilberman (2001), categorized them depending on their impact on inputs and outputs (capital saving, labour saving, quality improving, and risk reducing innovations). According to their form; technological, managerial, and institutional innovations. Technological innovations can also be embodied in new machinery (mechanical), biological (STMA seeds), and chemical (fertilizers) innovations. Managerial innovations are not embodied in physical capital, but rather are described by better practices while institutional innovations may include new organizational forms like cooperation between every actor which cut across gender roles and responsibility. The goal of economic growth through innovation according to Freeman, (2002), is to ensure no serious damage is done to the environment. In the field of agriculture, the link between improved technology, gender, agricultural production, its impact on the environment is inseparably linked with feedback running in all directions. Most agricultural actor, innovation and technologies have direct or indirect climate linkages. Lybbert and Sumner, (2012) reported that most new technologies change the way farmers use farm inputs, often in ways that alter the impact of weather on production, and of production on carbon emissions. Lybbert and Sumner, (2012) also reported that, the nucleus of innovation as a mitigation and adaptation tool to the impact of climate change in agriculture is to ensure; greater productivity, using fewer resources, under unpredictable production conditions, and net reductions in agricultural contribution to climate change.

According to the World Bank, increasing agricultural productivity and subsequently economic development requires technological advances in crop yields (World Bank, 2009). In contrast to developed counties, which have seen dramatic yield gains in the past century through investments in agricultural innovation and operate close to the technological frontier, much of developing country agriculture is far from this frontier. Thus, the greatest latent productivity potential resides in developing countries and especially Sub-Saharan Africa, which has cereal yields that are half or less of the rest of the world. In these places, profitable adaptation and farmer adoption of suitable varieties and crops could spark substantial yield gains (World Bank, 2009). In addition to increasing productivity generally, several new varieties and traits offer men and women farmers greater flexibility in adapting to climate change, including traits that confer tolerance to drought, stress, and early maturation in order to shorten the growing season and reduce farmers' exposure to risk of extreme weather events (Karaba *et al*., 2007). The Stress Tolerant Maize Variety (STMA) which our research focused on represent one of the emerging technologies aimed at improving the productivity of farming households with little or known contribution to climate change. STMA varieties were developed by International Institute of Tropical Agriculture (IITA) in connection with CIMMYT with the aims of facilitating the production and use of 54,000 MT of multiple Stress Tolerant Maize seed in Nigeria and other 7 target countries in Sub-Sahara Africa (IITA, 2017).

Theoretical framework

The theoretical background of this research is built on the theory of household risk choice. According to Singh *et al*. (1986), it is often difficult to predict the effect of agricultural policies because of the complex behavioural pattern and characteristics of individual farming household in rural economies. This complexity is heightened by gender norms, roles and responsibilities. Agricultural household models are designed to capture and understand these relationships that exist between household behaviour and policy stimuli in a theoretically consistent fashion (Taylor and Adelman, 2003). We built on the theoretical explanations of farm household behaviour which assume that farming households have an objective function to maximize profit with a given set of constraints (Dillion, 1971) by agreeing to the work of (Taylor and Adelman, 2003; Mendola, 2007), we view the farming household as a unit whose behaviour maximize utility through consumption of all available commodities (home produced goods, market purchased goods and leisure) subject to many constraints which include climate change. We viewed, the risk behaviour of men and women farmers to a new technology as a decision problem that exists when men and women farmers have more than one choice available to them. In such decision problems, as implied under theory of farm household, the choices of men and women farmer is an important thing to consider in policy.

Following the works of Udry (1996), this study seeks to relax the tenets of the unitary model by considering the intra-household decision dynamics. According to Duflo and Udry, (2004), this study understands that there are other members of the household who make separate decisions on plots management but focus is placed on the men and women of selected households who are plot managers since they have management access. Our study assumed these plot managers operate based on a safety-first framework-using behavioural rule and their expected utility. They primarily endure survival by avoiding any risk that may lead income to fall below a certain minimum threshold (subsistence level), and then make choice from available alternatives based on their expected utility. Thus, when faced with a choice between two alternative (modern technologies versus traditional), in the face of climate variability, we expect men and women plot managers to be risk taking and adopt the new one only if it is the safest option and the utility expected from its use exceeds that of the traditional technology. Our work seeks to understand the actions of men and women with respect to this theoretical proposition since such decision may vary as a result of social role, access to resources and other institutional characteristics.

Mathematically, considering that each men and women farmer who manages a given plot under this study has two alternative outcomes; STMA varieties denoted by "I" and other traditional maize varieties "T", the probability (Pr) that either of them is chosen can be given by:

$$\Pr(IT) = \Pr(U_{DN} = \max(U_{D,} U_N) \quad (1)$$

Hence, the probability of each case being selected depends on the maximum utility (U) derived. Therefore, the probability that each household will choose STMA varieties can be given by:

$$\Pr(I > 0) = \Pr(U_D > (U_N) \quad (2)$$

The utility that each men and women plot manager derives from either of the choices (IT) subject to farm internal and external factors can be given as:

$$U_{DN} = f(h, i, nh) + \varepsilon \quad (3)$$

where, U represents utility, h, represent the components of the household (which include income, food security, etc.) i represent the individual characteristics of men and women (including assets, social connections etc.) and nh non-household-specific characteristics respectively influencing risk decision to improve varieties or not; I and T are notations as indicated earlier, and ε is the error term. Defining Equation (2) in terms of equation (3) above we have,

$$\Pr(I > 0) = \Pr\ [\ (\omega I f(h,i,nh)\ +\ \varepsilon I > \omega T f(h,i,nh)\ +\ \varepsilon T)] \quad (4)$$

$$=\ \Pr\left[(\varepsilon I - \varepsilon T) > \ \left(\omega T - \omega I\right)\left(f\left(h,i,nh\right)\right)\right] \quad (5)$$

$$= \Pr[v > f(\beta X)] = F\ (X\beta) \quad (6)$$

where, ω is weight associated with each choice, v = (εI- εT), β = (ωT-ωI), X includes h, i, nh and F(Xβ) refers to cumulative distribution function which assumes a cumulative normal distribution when the error term is normal. Similar pattern of choice based on expected utility framework can be applied to categorical dependent variable with more than two choices. The decision maker opts for an alternative that can maximize his/her expected utility over all other possible specified choices. The approach will group the risk behaviour of men and women according as; risk averse, risk neutral, and risk loving (Ayinde *et al.*, 2012)

Materials and Methods

Study area and sampling. We used gender-disaggregated surveyed data from 360 households in the Guinea Savannah Region of Nigeria. The region surveyed occupied the North Western part of Nigeria that is prone to drought and other climatic stress. The region is also a major hub where the Stress Tolerant Maize variety technology have been planted by farmers. To better understand the risk behaviour of men and women farmers, the sampling was equally drawn across gender randomly from four groups of communities; the experimental communities, near-neighbour non-experimental communities, non-neigbour non-experimental communities and formally experimental communities. We combined the use of Focus Group Discussion (FGD), literature and household survey to ensure that variables which are necessary to understanding the risk behaviour of farmers were captured. The FGD were used to identify the community perception regarding changes in climatic patterns and how they responded to these events in terms of farm management practices. From each community, farmers 360 households were randomly drawn which represent the total sample for this study. Data collected were analysed using Descriptive statistics, risk elicitation procedure using the safety-first criteria and linear regression were used to examine the determinants of risk behaviour.

Definition of Variable

Age: The age of the plot manager who is also the major decision maker for the farm
Cost of Labour (CL): Amount paid for labour usage (in Naira)
Income from other activities (IO): Income from other activities from Farming (in Naira)
Seed Cost (SC): Cost of STMA seeds (in Naira)
Farm Size (FS): The total size of farm available for maize farming (ha)
Household size (HS): This measures the total number of members of the household (number)
Estimated Annual Income (EAI): This capture the total income of the respondent for a year
Drought Effect (DE): This variable is captured by asking the farmers if they perceive that drought has affected their farm in the last cropping season.
Gender: The sex of the plot manager and decision maker

Analytical modelling. We used the safety-first criterion in line with the work of (Moscardi and de Janvry, 1977; Olarinde *et al*., 2007; Ayinde *et al* 2012) to assess the risk behaviour of farmers.

According to Olarinde et.al., (2007) and Ayinde et.al, (2012), investors have some disaster level in their minds and try to optimize or minimize the disaster level. The safety-first criterion is used to assess farmer's management ability to mobilize his/her productive resources and choosing among technological options depends on the security of generating returns large enough to cover subsistence needs. This risk behavioural tool has been used in a number of studies (Dillion and Scandizzo,1978; Lindley, 1985; Lichenstein, Fisch-off, and Philip, 1982; Fackler 1991; Van Lenthe 1993).

We modelled that farmers will make decisions to take the risk of adopting STMA varieties if it satisfies the condition of greater output and efficient use of the most important input in the production cycle. Therefore, we formulate a model based on input-output relationship to understand the most significant input that probably determine the major risk decision of farmers (Equation 7). The result was used to construct a risk behaviour of farmers using equation (8)

$$Y = f(X1, X2, X3, X4, U) \quad (7)$$

Where Y = output (kg); X1 = Quantity of STMA seed planted (kg); X2 = Quantity of labour (man/day); X3 = Quantity of pesticide (litre); X4 = Farm size (ha); U = Error term. Then,

$$K(s) = 1/ø\ [1-(PiXi/\ PyfiUy)] \quad (8)$$

$$\theta = \partial y/\mu x$$

Where ∂y is standard deviation, μy is the mean of the risk situation, θ is the coefficient of variation F1 is elasticity of production of the ith output, Ks is the risk aversion parameter estimated by percentage. K(s) provides a measure of risk aversion that will be derived for each farmer from the knowledge of production function, the coefficient of variation of yield, product and factor prices and observed levels of factor use. The risk aversion parameters K(s) was used to classify farmers into three distinct behavioural groups;

Risk preferring – low risk – ($0 < K(s) < 0.4$)
Risk neutral – intermediate risk – ($0.4 < K(s) < 1.2$)
Risk aversion – high risk – ($1.2 < K(s) < 2.0$)

Regression model. Ordinary Least square regression function was used to determine the socio-economic characteristics that are responsible for farmers' risk behaviour to STMA variety. We first modelled the determinants by adding pooling the data together and include sex as a variable into the equation to investigate if the sex variable influence risk behaviour. After which we disaggregated the data to see the unique determinants of risk behaviour according to gender.

The function for pooled data is given as: Y= f(X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, U) (9)
Where Y= Estimated risk parameter (Ks), X1 = Age, X2 = Gender, X3= Income from other activities, X4= Seed cost, X5= Farm size (ha), X6= Household size, X7= Estimated annual income, X8= Drought Effect on Farm (Dummy), X9= Cost of labour, U= Error term.

The function for disaggregated data is given as: Y= f(X1, X2, X3, X4, X5, X6, X7, X8, X9, U) (9)
Where Y= Estimated risk parameter (Ks), X1 = Age, X2 = Cost of labour, X3= Income from other activities, X4= Seed cost, X5= Farm size (ha), X6= Household size, X7= Estimated annual income, X8= Drought Effect on Farm (Dummy), U= Error term.

Results and Discussion

Gender disaggregated socioeconomic characteristics of farmers. The gender disaggregated result of the socioeconomic characteristics of farmers showed that majority of the men and women farmers (58.59% and 57.50%) are at the productive stage of their life. For the male respondents, 85.56% are married while 84.17% of the female respondents are married with male average household size of 9 and female household of 6. This indicate that these farmers have responsibilities and mouth to feed. This is expected to influence their risk behaviour to STMA innovation. Majority of the farmers have farm size of less than 5ha (88.33% for male, 98.89% for female). Even though majority of the farmers have less than 5ha of land, the result showed that women are more in this category compared to men. Access to resources such as input is considered a major factor in production decision making. As a result, we expect that farm size will influence the risk behaviour of farmers. The result of the analysis also showed that for the female headed household, labour used for production is mostly hired while family labour represents the major labour usage by male-headed households.

Table 1. Gender disaggregated socioeconomic characteristics of farmers

	Male		Female	
Age	**Frequency**	**Percentage**	**Frequency**	**Percentage**
≤ 30	25	6.94	52	14.44
31 - 50	212	58.89	207	57.50
51 – 70	123	34.17	101	28.06
Total	360	100	360	100
Marital Status	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Single	31	8.61	11	3.06
Married	308	85.56	303	84.17
Divorced	0	0.00	12	3.33
Widowed	21	5.83	34	9.44
Total	360	100	360	100
Household Size	**Frequency**	**Percentage**	**Frequency**	**Percentage**
1 – 6	119	33.05	212	58.89
7 – 12	203	56.39	142	39.44
≥ 13	38	10.56	6	1.67
Total	360	100	360	100
Farm Size (ha)	**Frequency**	**Percentage**	**Frequency**	**Percentage**
≤ 5	318	88.33	356	98.89
6 – 10	40	11.11	4	1.11
11 – 15	2	0.56	0	0
Total	360	100	360	100
Family Labour	216	60.00	62	17.22
Hired Labour	78	21.67	285	79.17
Family and Hired Labour	66	18.33	13	3.61
Total	360	100	360	100
≤ 50000	22	6.11	119	33.06
50,001 – 250,000	123	34.17	203	56.39
250,001 – 500,000	194	53.89	23	6.39
≥ 500,000	21	5.83	15	4.16
Total	360	100	360	100

Gender-disaggregated risk behaviour of farmers. We used the production function estimation to model the behaviour of farmers (Table 2). Assuming that farmers will consider adopting an innovation if it satisfies the most important production conditions. For the women farmers, Quantity of seed represent the most significant input in the production process. While Labour represent the most important input for the women farmers. The result also mirrored the socioeconomic characteristics of farmers where women use more of hired labour for the production process. The implication of these means that they spend more on labour as compared to other production inputs. Therefore, the result showed that if the innovation will not be labour intensive, the women farmers are likely to adopt the STMA innovation. We used the result to Model farmers risk behaviour, after the modelling, we generated an index to rightly categorize men and women farmers based on their risk behaviour we found that majority of the male-headed farming household are risk loving (55.89%) while majority of the female farmers are risk neutral (82.5%). The implication of these is that any policy that will put adoption of innovation (especially the STMA variety) must uniquely consider the differences in the risk behaviour of men and women farmers in order to formulate a holistic policy. The women farmers have little access to resources; therefore, it is not unusual for them to want to play safe. The men on the other hand have more access to productive resources, to take risk may not be too difficult for the them considering they may have ample asset to hedge against the influence of risk

Table 2. Result of the Disaggregated Production Function

	Male Respondents				Female Respondents			
Variables	B	Std Error	t	Sig.	B	Std Error	t	Sig.
(constant)	2.403	2.836	0.801	0.002	1.204	1.801	0.244	0.214
Quantity STMA seed	2.608***	0.0897	46.502	0.000	1.141**	0.312	22.140	0.021
Labour	0.765	0.580	3.216	0.408	0.451***	2.121	23.10	0.000
Quantity of pesticide	2.127	0.618	1.853	0.863	0.245	0.339	0.710	0.127
Farm size (ha)	0.337**	0.261	0.512	0.040	0.031	2.120	8.221	0.091
	R2 = 0.695;	*** - significant at 1%, ** - significant at 5%						

Table 3. Disaggregated Risk Behavioural Categorization

		Men		Women	
Risk Behavioural Grouping		Frequency	Percentage	Frequency	Frequency
Risk Loving	$0<K(s)<0.4$	212	55.89	40	11.11
Risk Neutral	$0.4<K(s)<1.2$	114	31.67	297	82.5
Risk Averse	$1.2<K(s)<2.0$	34	9.44	23	6.39
Total		360	100	360	100

Factors affecting risk behaviour. We pooled the data together to investigate the determinants of risk behaviour, the variable of interest in this analysis is Gender. (Table 4) The result showed that gender is one of the significant variables that affect risk behaviour of famers to adoption of agricultural innovation (Ayinde et.al., 2012). We therefore disaggregate the data to see the specific determinants of gender risk behaviour (Table 5)

Gender Disaggregated Determinants of Risk Behaviour. The gender disaggregated result of result of the factors that determine risk behaviour of farmers is presented in Table 4. The result revealed that income from other activities are central to the decision of men and women farmers to adopt new innovation. Business diversification has been identified in Literature as one of the tools to edge against climate risk. Male farmers who have other sources of income and are generating income have the likelihood of increasing adoption by 11.021% while women farmers in this same category have the likelihood of increasing their possibility to take risk and adopt new innovation by 19.52%.

Table 4. Disaggregated determinants of risk behaviour

Dependent Variable (Risk Behaviour)	POOLED		
Variables	B	Std Error	Sig.
(constant)	35.104	86.223	0.993
Age	3.672	2.456	0.418
Gender	11.879***	7.139	0.000
Income from other activities	18.101***	62.534	0.005
Seed cost	22.13	34.213	0.645
Farm size (ha)	6.201**	12.102	0.037
Household size	20.342**	45.103	0.021
Estimated annual income	20.723	60.123	0.435
Perceived Effect of Drought (Dummy)	14.008***	46.285	0.006
Cost of labour	30.634**	46.287	0.049
***Significant at 1%, *Significant at 5%			

Specifically, for the women, labour represent one of the core needs before taking risk to adopt STMA variety. This suggest that there is a difference in women concern and needs in the innovation adoption process. If the innovation will not offset the labour burden of women, the possibility of adopting the innovation will be low. The result showed that increase in labour cost will reduce the decision to take risk to adopt STMA innovation by 25.13%. For the men, increase in farm size will increase the possibility of taking risk. Farm land represent a major asset. The male farmers have more than one wife and the socioeconomic result showed that household labour is readily available for them to use. Therefore, the higher the farm size, the more willing the male farmer's decision to take risk in adopting STMA innovation Increase in Household size

Table 5. Disaggregated Determinants of Risk Behaviour

Dependent Variable (Risk Behaviour)	MEN			WOMEN		
Variables	B	Std Error	Sig.	B	Std Error	Sig.
(constant)	23.001	45.129	.911	29.101	62.113	0.672
Age	0.227	0.155	0.174	0.34	0.223	0.261
Cost of labour	23.110	36.13	0.134	-25.172**	28.219	0.019
Income from other activities	11.021***	28.201	0.002	19.521***	39.413	0.000
Seed cost	14.210	22.121	0.342	13.118	24.121	0.231
Farm size (ha)	4.120**	16.823	0.041	0.271	1.231	0.256
Household size	1.056***	13.092	0.002	20.023**	32.043	0.015
Estimated annual income	23.019	89.218	0.238	12.034	56.198	0.125
Perceived Effect of Drought (Dummy)	0.795**	3.141	0.026	0.831**	2.351	0.014
***Significant at 1%, *Significant at 5%						

Household size is another significant variable that influence risk behaviour, for the male, an increase in the household member by one will increase the possibility to taking risk to adopt STMA innovation by 1.06%. This may be as a result of having more hand to use in Labour. For the women to, an increase in the number of household member will possibly increase the possibility of taking risk in adoption of STMA innovation by 20.02%. However, it must be stressed that the household member in consideration here must not be dependent but rather someone that can contribute to the production process.

Drought is one of the major climatic factor that influence farmers decision to take the risk associated with innovation aiming at mitigating the effect of climate change. Both men and women farmer's result showed that increase in drought will increase the possibility of farmers to take risk to adopt innovation associated with it by 79% and 83.1% respectively. The characteristics of innovation matters to both men and women. If the innovation can solve other challenges that confront farmers, the possibilities of taking the risk associated with adopting it will increase by both men and women farmers.

Conclusion

Mitigating the effect of climate variability using innovation and technologies is the most feasible means of mitigation for farming households. In this research, we used gender-disaggregated data to investigate whether gender is an important variable to consider in risk behaviour to adoption of innovation aimed at mitigating the effect of climate variability. We use the STMA variety as the case study of innovation. To the best of our knowledge, this particular empirical evidence for the STMA variety has not been reported in literature. We started by pooling the data together and the result showed that, gender is an important variable that influence risk behaviour. We further disaggregate the data to see the unique factors that affect each gender risk behaviour. The empirical result presented in this article showed that if farmers will take the risk of adopting the STMA variety, there will be need to capture gender needs in policy. Aside other significant variables such as characteristics of innovation, droughts, income from other sources than farming and household size, policy maker must ensure that the innovation meets the labour need of women who have little or no access to productive resources such as labour as compared to their male counterpart. For the men, increase in land ownership will increase the possibility of taking risk.

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