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Risk Management Strategies Perceived by Tomato Producing Smallholder Farmers the Case of Dugda District, East Shewa Zone, Oromia, Ethiopia

Genemo Fitala Feyissa[1*] and Gemechu Mulatu (PhD)[2]
1.Bale Zone Inland Revenue Authority Oromia Regional State Email: Genemofitala476@gmail.com
2.Department of Economics College of Business and Economics Madda Walabu University
Email: geme.chu@yahoo.com

Abstract
Managing risk is an important part of farming and its management is a concern for those governments which include this as one of their agricultural policy objectives. For effective risk management strategies to be taken, farmers' perception on risk management strategy in agriculture is important. Farmers have to find ways of risk management strategies and protecting themselves from the uncertainties of the future. This study analyzed the perceived important risk management strategies of tomato producing smallholder farmer using data collected from 167 tomato producing smallholder farmers from four kebeles of Dugda district of the East Shewa zone, central rift valley of Ethiopia, analyzed (using Descriptive statistics, likert scale and Principal component analysis) of primary data collected from 167 tomato producing smallholder farmers from four kebeles of Dugda district. Principal component analysis was used in data reduction to identify a small number of components related to important risk management strategies perceived by the surveyed smallholder farmers in the study area. Results show that using principal components analysis, important risk management strategies were identified. Principal Components (PCs) explained that 58.2% of the variations were extracted. Pest and disease management, alternative market, income diversification and training risk management strategies were perceived as important risk management strategies by the surveyed smallholder farmers.
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Introduction

A number of studies in recent decades have assessed risk management in agricultural activities Hardaker, Huime and Anderson, (1997) noted that risk management means identifying a risk and a range of options, then evaluating, selecting and implementing an action.

Risk management strategies start with decisions on the farm and the household: on the set of outputs to be produced, the allocation of land, the use of other inputs and techniques, including irrigation and the diversification of activities on and off-farm. Farmers can also manage risk through market instruments which include insurance and futures markets (OECD, 2009).

Risk management is the implementation of action to reduce the probability of occurrence of an adverse event or the process whereby decisions are made to accept a known or assessed risk (Cheng, Yip & Yeung, 2012).

Borges and Machado (2012) by their research on risks and risk Management Mechanisms: on analysis of the perceptions of producers of agricultural commodities, suggested that risk management deserves attention due to its importance in organizational management

Risk management strategies involve the use of specific methods as noted in the study of Akcaoz, Kizilay, Ozcatalbas (2009) in dairy farming: A case study in Turkey.

As noted in Ayinde, Omotesho and Adewumi (2008) the crops are subjected to high price and quantity risks with changing consumer demands and production conditions Due to perishable nature and biological nature of production process. Unusual production or crop disease can influence badly the marketing system. Hence, knowledge crop producers' perception towards risk is important in designing strategies and formulating policies for agricultural development.

According to EEA (2012) the economy of Ethiopia remains highly dependent on agriculture, which contributes about 41 percent of GDP, 83 percent of employment and 90 percent of exports.

The past studies in Ethiopia Belanieh and Drake (2003) have analyses risk management strategies of smallholder farmers based on data from two woredas in the eastern highlands of Ethiopia show that diversification strategies pursued by smallholder farmers is important management strategies perceived by smallholder farmer.

Tomato is one of the most important and widely grown vegetable in Ethiopia. Fresh, processing and cherry types are produced in the country. Smallholder farmers' produces the bulk of fresh market tomatoes. It is an

important cash-generating crop to producing smallholder farmers' and provides employment in the production and processing industries.

Tomato production is a widely practiced activity in Dugda District of East Shewa Zones of Oromia, lying in the belt of the Great Rift Valley of the Horn of Africa. In this area tomato production is undertaken by smallholder farmers' and some large-scale commercial farming private investors and various vegetables have been produced in the area two times throughout the years. The area has a plain topography, with favorable weather conditions, better availability of water, and an advantageous location for tomato production and a large amount of tomato products are supplied to different markets in the area and to different parts of the country (Feyera, 2013).

The aim of this research was to identify perceptions of important risk management strategies based on the perception of tomato producing smallholder farmer in the study area. Although, several studies have identified perception of risk management strategies, While these studies have established show how farmers behave under uncertainty under risky environment and their approach to it means there are few useful practical insights for policymakers, researchers, extension officers and advisers, less work has been done to identify how farmer perceive important risk management strategies. The relative lack of information about perception of important risk management strategies of smallholder farmers, Therefore: This paper aimed to identify perception of important risk management strategies of tomato producing smallholder farmers' of Dugda district, East Shewa zone in Ethiopia

Material and Methods

Research Design

In order to identify the tomato producers perceived risk management strategies, the researchers adopted community based cross-section research design.

Target Population

All smallholder farmers living in four kebeles and have been engaging in tomato production was taken as the entire population for our study. In number there are exactly 296 smallholder farmer who are active and accustomed to it in their day to day work.

Sample Size Determination

To determine the sample size scientifically, Kothari (2004) sample size determination formula was used. This formula is employed under which when the population is size is finite. Thus, the equation is given by:

$$n= \frac{Z^2 pq.N}{e^2(N-1)+Z^2.p.q} = \frac{1.96^2(0.5)(1-0.5)(296)}{(0.05)^2(296-1)+(1.96)^2(0.5)(0.5)} = \frac{284.6}{1.7} = 167.4 \approx 167$$

Where, n - desired sample size
Z - Values of standard variant at 95% confidence interval (Z = 1.96).
N= 296 Total number of tomato producing smallholder farmers.
P - Estimated proportion of tomato producing smallholder farmers
As the exact proportions of smallholder farmers participate in tomato production is not known a *prior*, P= 0.5 was used to obtain maximum number of sample household heads.
e=Margin of error considered is 5 % for this study

Sampling and Sampling Methods

The study was conducted in Dugda District of East Shewa zone, Oromia Regional State, Ethiopia. The area is known by vegetables production mainly tomato next to onion. To select study participants, the researchers were employed two stage sampling methods. For instance, together with District Agriculture and Rural Development Office the potential tomato producing Kebeles/ village was identified. Accordingly, in the study area, there are 36 rural kebeles of which the householders of 17 kebeles are taking part on tomato production. Then, four kebeles were randomly selected namely Shubi Gamo, Walda Kelina, Bekele Girisa and Korke Adi. Likewise, the researchers took 167 farmers proportionally via simple random sampling technique.

Instrument of Data Collection

At first, we reviewed the work of past researchers on the area to identify what has already been done and not. As a result, the researchers were got an opportunity concerning the overall methods that many scholars employed particularly the kind of tools used to receive data from smallholder farmers. To this end, were identified that questionnaire was found to be an ideal tool to achieve the intended objective.

Consequently, the item has two parts. The first one is about tomato producers socio-demographical information such as educational status, age, land size, sex, access to different credit services, being membership

of association like '*Eqqub*' and '*Eddir*' and access to extension services.

The second one is question asks tomato producers perception on the main risk management strategies. An item was arranged in five-point Likert scale as 1=not important at all, 2=not important, 3=average, 4= important and 5=very important ranging from 1-5 respectively. To check its reliability, pilot test was conducted on five percentages of farmers and correction was made sooner than later. More importantly, all questions were translated to local language the mother tongue of participants by two language experts and also translated back to English language by the same individuals for the purpose of analysis.

Method of Data Analysis

To summarize their findings and identify the perceived risk management strategies, researchers were computed descriptive statistics such as frequency distribution, mean and standard deviation.

On the other hand, the information on the perception of important risk management strategies perceptions obtained from the respondents using a five-point Likert scale were analyzed in two steps. First, principal component analysis (PCA) was used to capture the information on the interrelationships among the set of variables. The central idea of principal component analysis (PCA) is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set. This is achieved by transforming to a new set of variables, the principal components (PCs), which are uncorrelated, and which are ordered so that the first few retain most of the variation present in all of the original variables.

This technique enabled the researchers to manage and reduce the number of original variables into a smaller group of new correlation components, which are linear combinations of the original variables.(Kaiser 1960) The Kaiser-Meyer-Oklin (KMO) method measured the appropriateness for component analysis of data sets. The KMO index varies from 0 to 1, with results of 0.6 or greater suitable for component analysis. The latent root criterion (eigenvalue > 1) was used to determine how many components to retain in each data set to extract.

After the numbers of components were identified, the varimax rotational method was performed in order to minimize the number of variables that have high loadings on each component. A component loading of ± 0.3 was employed as a cut off criterion to determine the inter correlation among the original variables accepted in this study.

Results and Discussion

Socio-economic characteristics of tomato producing smallholder farmers

Socio-economic characteristics of tomato producing smallholder farmers are discussed as follows. Average age of smallholder farmers is 34.29 and education level of the household is 5.82 years. Average family size is 4.84 people. Farming experience of Tomato producer household is 9.11 years in tomato production. The average farm sizes of the smallholder farmers were 0.67 hectares and the annual off farm income of the tomato producing smallholder farmers in the study area was 56,108.9 ETB annually.

Smallholder farmers surveyed in this study were mainly smallholder farmers with an average land holding of 0.67 hectares. The average distance to main market was 4.95 Kilometers from the market place .the average years in tomato producing of the smallholder farmer was 9.11.

Majority (94.61 percent) of the smallholder farmers sampled were male headed. Results show that 56.89 percent of the household heads belonged to *eqqub* member and 66.47 percent belong to *eddir* member.

Farmers Perception Of the Important Risk Management Strategies

Tomato producer smallholder farmers were asked to rate the importance of each risk management strategy on a five point likert scale. The likert scale was graded as follows: 1= not at all important, 2= not important, 3= average, 4= important and 5=very important.

Table 1: Smallholder farmers perceptions of the important risk management strategies

Risk Management strategies	Mean	Std. Dev.
Apply pests and disease program	4.41	0.57
Obtaining market information on prices forecast	3.72	0.68
Spreading sale over several time period	3.35	0.74
Salaried employment	3.14	0.76
Invest Off-farm activities	3.99	0.73
Fertilizer provision by Government	2.82	1.03
Borrowing (cash or gains)	3.56	0.97
Advice from extension Officers	3.27	1.00
Shipment co-operation	2.70	0.89

Source: Own computation result based on survey data (2019)

According to Table 7, applying disease and pest program, Invest Off-farm activities, and Obtaining market

information on prices forecast had the highest mean of 4.41, 3.87 and 3.72 respectively. This means that majority of the respondents rated the above risk management strategies as very important strategies. Fertilizer provision by Government and Shipment co-operation, strategies had the lowest mean score which had mean of 2.82 and 2.70 respectively. This suggests that majority of the respondents perceived these strategies as not important.

Following the descriptive analysis of the important risk management, a component analysis was performed, as shown in Table 3. The Bartlett test of sphericity was significant at 0.0000. The null hypothesis was therefore rejected indicating that the variables are correlated and component analysis is appropriate for the data. The result of the KMO test was 0.617, validating the adequacy of the present sample which is considered as mediocre by (Field, 2009) indicating that the data is suitable for component analysis. Regarding commonality, no variables were excluded.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.617
Bartlett's Test of Sphericity	Approx. Chi-Square	153.19
	Df	60
	Sig.	.000

Source: Own Survey result (2019

The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.617 is greater than 0.5, which is supported the use of principal component/factor analysis (Kaiser, 1974). The eigenvalues measures the amount of the variation explained by each PC and is largest for the first PC and smaller for the subsequent PCs. Accordingly, proportion of variance explained by the first 4 components is 58.2% from Table 3.

Table 3: Principal-component components of risk management in tomato production

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.967	0.791	0.219	0.219
Comp2	1.176	0.089	0.131	0.349
Comp3	1.087	0.084	0.121	0.470
Comp4	1.004	0.056	0.112	0.582
Comp5	0.948	0.077	0.105	0.687
Comp6	0.871	0.123	0.097	0.784
Comp7	0.747	0.097	0.083	0.867
Comp8	0.650	0.102	0.072	0.939
Comp9	0.549	.	0.061	1.000

LR test: independent vs. saturated: chi^2 (153) = 468.50 Prob>chi^2= 0.000
Number of parameters = 93
Number of observation = 167
Retained components = 4

Source: Own computation result based on survey data (2019)

Principal component analysis was conducted and 4 components were retained. The number of component to be retained was guided by the most commonly used Kaisers criterion which requires that only those components with an eigenvalue greater than 1 should be retained (Kaiser, 1960). These 4 components were defined and named considering the variables with greater loads (Hair, Black, Babib, Anderson & Tatham, 2006). The components labeled are as follows: (1) production risk management strategies, (2) Alternative market risk management strategy, (3) income diversification, risk management strategies, and (4) training management strategies. Varimax rotation with Kaiser Normalization was used to facilitate interpretation of the component matrix.

Component 1 accounted for 21.9 percent of the total variance. Based on the variables that loaded highly on component 1, it was interpreted as production risk management strategies. The variables that loaded highly on this component is apply pest and disease among variables loaded on this component such as Obtain market information, Invest off farm and shipment cooperation. Production risk management was perceived as an important risk management strategy by the tomato producing smallholder farmers, though it was ranked higher by the surveyed smallholder farmers. Production risk management helps farmers' financing ability, during production and harvest periods. This result is consistent with the findings of Borges and Machado (2012) as noted in their study on: risks and risk management mechanisms: An Analysis of the perceptions of producers of agricultural commodities.in Brazil, identify that prevention of crop diseases were the most important risk management strategies.

Spreading sale over several time period and Fertilizer provision loaded highly on component 2 therefore this component labeled as Alternative market risk management strategy. This component explained 13.1 percent of the total variance. Farmers store their farm produce until the prices are high so as to get higher prices, thus more farm income. Alternative market risk management strategy helps smallholder farmers to know the best

management practices in order to manage risk resulted from uncertain market price.

Component 3 termed as' income diversification, risk management strategies accounted for 12.1 percent of the total variance. Salaried employment, invest off farm and Borrowing in cash loaded highly on this component. Salaried employment loaded highly on component 3 Component 3 was therefore interpreted as income diversification risk management strategies. Income diversification strategies would enable smallholder farmers to reduce variability in income. It has to be noted that income diversification is boosts smallholder farmer income in the study area. Hence the role of income diversification in managing risk was perceived as important among tomato producing smallholder farmer in the study area. This result is consistent with the findings of Belanieh and Drake (2003) for Eastern highlands Ethiopian smallholder farmers.

Component 4 was interpreted as training management strategies with two variables loading on this component and accounted for 11.2 percent of the total variance. These variables are: advice from agricultural extension officers and obtaining markets information Training helps farmers to know the best management practices to adopt in order to enhance productivity and the trainings can be done by agricultural extension officers. The trainings should also be designed to educate farmers on the best risk management practices within the agricultural sector since risk management perceptions were found to be important. This will enable the smallholder farmers have better access to information on how to manage risk in tomato production through training from agricultural extension officers.

Table 4:Varimax rotated result of principal component analysis for risk management strategies

Risk Management strategies	Component loading			
	1	2	3	4
Apply pests and disease program	0.811			
Obtaining market information on prices forecast	0.348			-0.538
Spreading sale over several time period		-0.800		
Salaried employment			-0.667	
Invest Off-farm activities	0.392		0.589	
Fertilizer provision by Government		0.709		
Borrowing (cash or gains)			0.631	
Advice from extension Officers				0.777
Shipment co-operation	0.657			

Source: Own computation result based on survey data (2019)

Note: The correlation was suitable for component analysis Ch^2 (153) =468.5; P<0000, Therefore the results answer the research question that household perceive the following to be the most important risk management strategies 'production risk, 'Alternative market', 'income diversification' and 'training' strategies are perceived of risk management strategies among tomato producing smallholder farmers in study area.

Conclusion and Recommendations

The mean score results of smallholder farmers' perception on important risk management strategies indicated that Production risk management, alternative market, income diversification and training were the most important risk management strategy component that were the common risk management strategies perceived by tomato producing smallholder farmers in the study area. Therefore, to assist smallholder farmers to earn good return from production, it is necessary to know the important risk management strategies perceived by smallholder farmer in the tomato production.

The study demonstrated the training risk management strategies help the smallholder farmers to get information on how to use agricultural extension. This will increase tomato producing smallholder farmers' knowledge on risk management strategies which will consequently increase farmers' use of the important risk management strategies. Therefore In order to improve specialization on tomato production: strategy could be available to support education and training initiatives which would enable smallholder farmers to use risk management mechanisms.

Based on the finding of the study the policy makers can facilitate better risk management through improved Pest and disease management, alternative market, income diversification and Training strategies thus ensuring that the tomato producing smallholder farmers are able to benefit from these risk management strategies.

These recommendations would help the tomato producing smallholder farmer in managing risk which would lead to higher and more stable incomes as well as improved agricultural output.

Conflict of Interest

This work is our original work therefore; there is no conflict of interest as far as this research is concerned.

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