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A Gendered Analysis of Perceived Risks of Commercial Oriented Smallholder Vegetable Farmers in Kilifi County, Kenya

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Abstract
This paper examines the relationship between gender and perceived risks of commercial oriented smallholder farmers in Kilifi County. A sample of 332 smallholder vegetable farmers was selected from the study area. A 5-point Likert scale and factor analysis approaches were used to rank and analyze risks encountered by farmers. Thereafter, a chi-square test was used to evaluate the mean scores of risks across gender. Gender was categorized – based on who manages the vegetable farms – into male managed (37%), female managed (24%) and joint-management (39%). Results from the study show that marketing risks are more frequent for male farmers while the joint-management group mostly experience financial risks. Additionally, severity of financial risks is greater for male farmers as compared to female farmers. The study concludes that female farmers were not prone to financial and marketing risks which implied that financial availability and marketing opportunities are still scarce to empower women in the vegetable sector. The study recommends implementation of policies that will help in minimizing the gravity of financial risks that affect both male and female farmers. Policies that are tailor-made to address gender specific financial constraints, more so in the informal sector, should be implemented in order to promote access to affordable financial support. Additionally, female empowerment programs should be implemented in order to increase their participation in domestic and high value markets.
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1. Introduction

Agricultural enterprises are faced with shocks that constitute risks (Niane & Burger, 2012). Li (2014) defined risk as a precarious event that could exhibit undesirable outcomes. Contemporary farming decisions made by households are majorly governed by how farmers comprehended risk, and their capacity to deal with that risky situation (Hagos & Geta, 2016). Smallholder vegetable farmers are subjected to various kinds of risks. Hazards encountered in vegetable production can be classified into different categories of risk. According to the Organization for Economic Co-operation and Development (OECD) (2009) handbook on holistic approach on risk management in agriculture, risks are broadly classified into production risks, marketing risks, financial and institutional risks. Production risks are nature related as they also include ecological conditions of the crops; from unpredictable weather patterns, climate change to changes in production technologies and pests and diseases infestation in crops, resulting into low yields (OECD, 2009; Hardaker *et al.,* 2015).

Marketing risks, also referred to as price risks are influenced by price fluctuations and unstable foreign exchange rates. Prices of both inputs and output determine the quality and magnitude of production (OECD, 2009; Ayinde, 2016). Inconsistency in prices and foreign exchange rates influence future decision making on inputs allocation. Additionally, institutional risks arise from changes in agricultural policies that directly affected farmers (Hardaker *et al.,* 2015; Campenhout *et al*., 2016). For instances changes in taxation could deter farmers from optimal production of vegetables for both domestic and export markets. Inadequate institutional sustenance, insufficient market information and impoverished market involvement of farmers generate transaction costs that increased overall production costs (Okoye *et al.,* 2016). Finally, financial risks emanate when farmers seek capital required for vegetable production. Access to finances from credit institutions subjected farmers to inflationary effects on interest rates that could cripple them in payment of loaned funds plus interest rate in full (Hardaker *et al.,* 2015; Cochrane & Thornton, 2017).

In Kenya, agriculture accounts for 26 percent of the total Gross Domestic Product (GDP), as it offers employment to over 80 percent of the rural labor force (Ministry of Agriculture, Livestock and Fisheries, MoALF, 2017). Vegetable farming is mostly subsistence in nature because farmers in rural areas lack productive resources that help in minimizing vegetable risks. As a result, agriculture, more so vegetable farming, continues to lag behind in developing countries (Todaro & Smith, 2015). The African cultural setting views female farmers as major providers of farm labor and men as main decision makers. Even though vegetable farming is considered a female domain enterprise, men have begun to shown interest, with profit-motivation in mind (Muriithi, 2015). As major providers of labor, female farmers recognize production risks as major barriers to vegetable. On the other hand, profit-oriented male farmers recognize marketing risks as major inhibitors to vegetable farming (Murage *et al*.,

2015; Kiratu *et al.,* 2016).

Vegetable farming in Kilifi county is an upcoming enterprise however, crop failure has been on the rise. Consumption of vegetables has exceeded production in the county such that, nearly all food crops are obtained from the neighboring Mombasa and Taita-Taveta counties (Oyugi *et al*., 2016). Even though irrigation farming is practiced, vegetable farming is still limited. A myriad of risks in production and marketing of vegetables could partly explain this tendency. Information regarding how male and female farmers perceive these risks; and also, the link between gender and perceived risks is scarce in the empirical literature. As such it remains unclear whether there are gender discrepancies in terms of the risks that smallholder farmers encounter in vegetable farming. The present study aims to fulfill this knowledge gap by determining the relationship between gender and perceived risks of commercial oriented farmers.

This paper contributes to the pool of knowledge on gender and vegetable risks of commercial oriented farmers, as it provides an insight on the type and magnitude of vegetable risks that affect male and female smallholder farmers' decision-making in the household. Descriptive statistics are used to differentiate socio-economic and institutional factors across gender while making inferences about the population from the sample. Thereafter, factor analysis is used to verify whether the risk constructs are a true indication of the nature of risks that farmers face in vegetable farming. Findings from this study might be vital in formulation and implementation of policies that address gender-specific vegetable risks that inhibit vegetable farming.

Subsequent stages of the paper are organized as follows: methodology, which is the second section, comprises of an overview of the study area, sampling technique and data management. Thereafter, the third section covers the analytical framework, followed by section four which gives a detailed presentation and discussion of the results. Finally, section five gives a summary of the findings and policy recommendations.

2. Methodology

2.1 Study Area

This research study is conducted in Malindi Sub-County, Kilifi County in the coastal region of Kenya. The Sub-County is located in a semi-arid area where vegetable commercialization is an upcoming enterprise by smallholder farmers, as a means of improving their livelihood. The presence of river Galana greatly benefits farmers for crop irrigation, since rainfall is unreliable in this part of the country. The Sub-County comprises of five wards namely; Jilore, Kakuyuni, Ganda, Malindi Town, and Shella. Figure 1 shows the location of the study area in Kilifi County. Temperature ranges between 23.3˚C during cold months and 29.9˚C in hottest months. The Sub-County receives rainfall amounts between 119.9mm and 230.0mm annually, with two rainy seasons during April-June and October – December (KNBS, 2015). However due to climate change, delays in rainfall, long periods of drought and floods are frequent. Horticultural crops are majorly cultivated under irrigation along River Galana, which drains its water in the Indian Ocean. They include Tomatoes, Green Bell Chilies, Okra, Bananas, Leaf Amaranthus, Eggplant and African night shade (Oyugi *et al.,* 2016).

2.2 Research Design, Sampling and Data Management

Multistage sampling procedure was employed in selection of respondents for the study. First, Malindi Sub-County was purposively selected due to the presence of river Galana where irrigation of horticultural crops was highly practiced. Secondly, within the Sub-County, Jilore and Kakuyuni wards were purposively selected for the study due to high concentration of horticultural farmers. Then a transect walk method was employed where respondents were randomly chosen along a transect line (Pollard, 1977), in this case, farmers with farms along the river shore. Two source lists were generated for the two wards with the help of extension officers in the respective areas. Linear systematic random sampling method was used to arrive at the desired sample size of 332. A random name was selected at the top of each list to choose the first farmer who initiated the data collection process. Thereafter, every seventh name that was selected qualified for the interview. The sample size was distributed across gender, depending on who managed the vegetable farms. Equal distribution of questionnaires across the three gender categories (male, female and joint-management) was the goal, but female farmers were fewer than expected. As a result, 124 male farmers, 80 female farmers and 128 joint-management farmers were interviewed for the study. Both male and female respondents under joint-management were interviewed together.

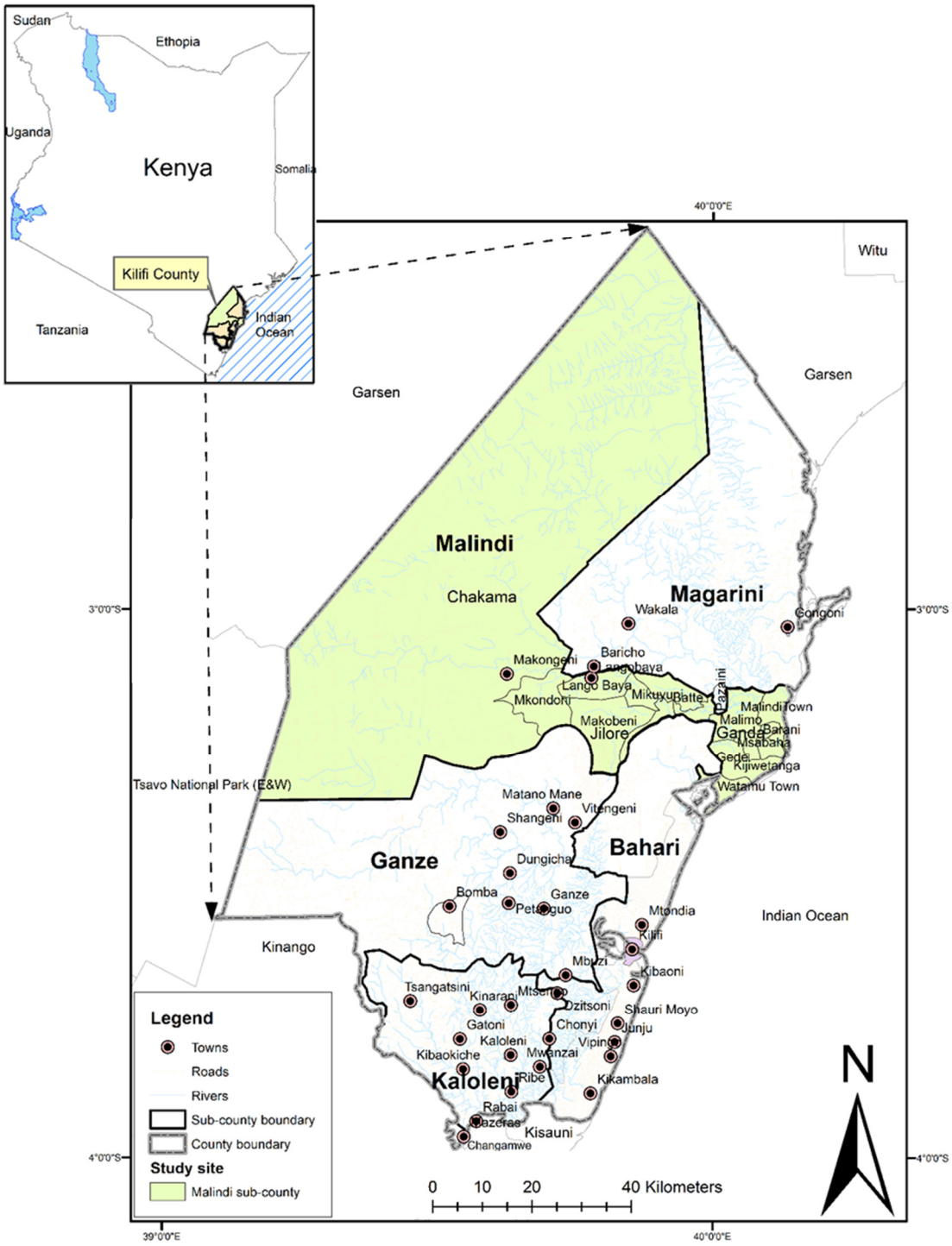

Figure 1. Location of study site in Kilifi County, Kenya.

The study used both primary and secondary data. Primary data was obtained through a semi structured questionnaire distributed to the horticultural farmers, with the assistance of well-trained enumerators. A Pretest of the questionnaire was conducted on 10 households prior to the survey, to assess the questionnaire's viability as well as smallholder farmers' understanding of the topic under study. Results from the pretest were used to perfect the final tool. Secondary data was sourced from Ministry of Agriculture reports, books and journals. Information collected in the questionnaires includes: general information of the farmer, socio-economic and institution factors and identification and ranking of vegetable risks encountered by farmers on a Likert scale. Collected data was managed and analyzed using STATA statistical and data analysis software, version 14.

3. Analytical Framework

Both male and female farmers were presented with a Likert scale to rank risks that they often encounter in vegetable farming. The Likert scale was use to rank the frequency and severity of risks, in order to determine weighted scores. The scale ran from 1-5 for the frequency measurement (where 1 meant not at all and 5 meant most frequent) and severity measurement (where 1 meant not at all and 5 meant most severe). Ranking was done according to the farmer's self-judgment. It was expected that farmers have varied perceptions on the types and magnitude of risks. Factor analysis was performed so as to confirm the internal uniformity and convergence of the constructs (Olsen *et al.,* 2017), that is, to verify whether the risk constructs were a true indication of the nature of risks that farmers faced in vegetable farming. Three constructs were used to categorize vegetable risks into production risks, marketing risks and financial risks. Thereafter, an F-test was used to analyze the relationship between gender and mean scores of vegetable risks. The results from descriptive statistics are fundamental in describing, comparing and making inferences about the population from the sample.

4. Empirical Results and Discussion

4.1 Descriptive Statistics

Table 1 and 2 present summary statistics for smallholder vegetable farmers sampled for this study. Thirty seven percent of the vegetable farmers were male, 24 percent were female whereas 39 percent constituted farmers under joint-management. The mean age of smallholder vegetable farmers was 39 years. Female respondents were relatively older compared to their male counterparts, while joint-management farmers reported the highest value of farm assets (KES 150,787.70), with female farmers having the lowest value (KES 71,968.38). This coincides with the narrative that female farmers are usually resource constrained. Additionally, results from the study show that farmers were generally illiterate with a mean of five years in schooling. Female farmers were the most illiterate with a mean of two. Farmers under joint-management had more contact with extension agents at a mean of three. Smallholder farmers were asked to rate their monthly involvement in decision making concerning group activities in a scale of one to ten, one being no involvement in decision making, while ten being highly involved. Female farmers had the highest mean level in group decision making at 2.5. Generally, a level below five on the scale indicated minimal involvements in group decision making. Farmers who received additional income from off-farm activities were 44 percent while those who did not engage in off-farm activities were 56 percent. Joint-management had the highest percentage (47 percent) of respondents who engaged in off-farm activities, followed by male farmers (36 percent) with female respondents reporting the lowest percentage (18 percent). Lastly, group heterogeneity was used to measure the degree of diversity of group members that enabled them to create meaningful social networks. Respondents under joint-management had the highest group heterogeneity at 65 percent while female respondents had the lowest group heterogeneity at eight percent.

Table 1. Mean values of continuous socio-economic and institutional variables

Variable	**Gender of vegetable plot manager**				
	Pooled	Male	Female	Joint-management	F-value
Age	39.60	38.46	42.13	39.13	0.77**
Household size	7.00	7.00	7.00	7.00	1.11
Farm size	2.13	2.16	1.70	2.36	1.19
Farm assets ('000 KES)	123.09	127.49	71.97	150.79	1.2**
Number of school years	5.07	6.31	2.14	5.70	4.27***
Number of contacts with extension agents	2.43	2.00	1.60	3.36	3.00***
Number of household members attending same group as respondent	1.00	1.00	1.00	1.00	0.82
Decision making in group activities	1.82	1.54	2.26	1.82	0.01**
Trust for members in group	1.80	1.65	2.46	1.51	0.22

Note: ***, ** = Denote significant at 1% and 5% level, respectively.

Table 2. Chi-square results of categorical institutional variables (%)

Variable	***Gender of vegetable plot manager***			
	Male	*Female*	*Joint-management*	χ^2 *value*
Access to credit				
No	*30.84*	*13.64*	*55.52*	*4.50*
Yes	*20.83*	*29.17*	*50.00*	
Participation in off-farm activities				
No	*38.71*	*29.03*	*32.26*	*8.83***
Yes	*35.62*	*17.81*	*46.57*	
Group heterogeneity				
Low	*31.92*	*20.21*	*47.87*	*13.33****
High	*27.78*	*7.64*	*64.58*	

Note: ***, ** = Denote significant at 1% and 5% level.

4.2 Characteristics of Vegetable Risks Encountered by Smallholder Farmers

Table 3 and 4 presented the factor loadings, Cronbach alpha values, Kaiser-Meyer-Olkin (KMO) values and average variance extracted (AVE) results of vegetable risks using factor analysis. The kaiser's criterion for identification of factors to retain, was adopted, where factors that had eigenvalues of above and equal to one were chosen (Yong & Pearce, 2013). Factor loadings of above 0.5 were considered substantial enough to ascertain the least loading required to comprise a construct (Sen & Antara, 2018). All the factor loadings were above 0.5 (0.506 – 0.702). Table 3 and table 4 present factor analysis results of the frequency and severity of vegetable risks, respectively.

Sampling adequacy was measured using Kaiser-Meyer-Olkin (KMO), developed by Kaiser (1974). According to the author, KMO values of more than 0.5 were acceptable, above 0.5 to 0.7 were considered as average, above 0.7 to 0.8 were seen as commendable, above 0.8 were considered marvelous and above 0.9 were seen as spectacular. KMO values from the analyses ranged from 0.500 to 0.712 indicating that separate and consistent factors were estimated (Yong & Pearce, 2013). Furthermore, Cronbach alpha values were estimated to measure the internal consistency reliability. Alpha values of above 0.7 were considered as better values that indicated adequate dependability among items in the factors (Yang & Wu, 2016). All the alpha values in both tables were above the 0.7 threshold thus signified moderate reliability. Lastly, estimate values of Average Variance Extracted (AVE) for all the factors (0.725 to 0.988) were above the 0.5 threshold, indicating that each construct was highly associated to its respective items (Yang & Wu, 2016). The results of the confirmatory factor analysis for frequency of vegetable risks (LR test: independent vs. saturated: chi-square= 552.39; *df*= 45 and p-value= 0.0000) and severity of vegetable risks (chi-square= 701.50; *df*= 45 and p-value= 0.0000) indicated a good fit with data.

Table 3. Factor analysis for profiling frequency of vegetable risks constructs

Vegetable Risks	**Items**	**Factor loadings**	**KMO**	**CR**	**AVE**
Production Risks (OECD, 2009; Hardaker *et al.,* 2015)	Unpredictable weather patterns	0.654	0.705	0.747	0.911
	Pest and disease infestation	0.571			
	Technological changes (production technology, methods of farming, certified inputs, etc.)	0.544			
	Changes in horticultural regulations by the government	0.506			
Marketing/Price Risks (Hardaker *et al.,* 2015; Campenhout *et al*., 2016)	Changes in vegetable input prices	0.656	0.694	0.709	0.725
	Changes in vegetable output prices	0.622			
Financial Risks (Hardaker *et al.,* 2015; Campenhout *et al*., 2016; Cochrane & Thornton, 2017)	Sudden rise in interest rates	0.702	0.712	0.787	0.988
	Limited access to financial services	0.693			

Note: chi-square= 552.39; *df*= 45; p-value= 0.000; KMO: Kaiser-Meiyer-Olkin; CR: composite reliability; AVE: average variance extracted.

Table 4. Factor analysis for profiling severity of vegetable risks constructs

Vegetable Risks	Items	Factor loadings	KMO	CR	AVE
Production Risks (OECD, 2009; Hardaker *et al.,* 2015)	Unpredictable weather patterns	0.550	0.662	0.727	0.949
	Technological changes (production technology, methods of farming, certified inputs, etc.)	0.607			
	Changes in horticultural regulations by the government	0.633			
Marketing/Price Risks (Hardaker *et al.,* 2015; Campenhout *et al*., 2016)	Changes in vegetable input prices	0.528	0.619	0.712	0.803
	Changes in vegetable output prices	0.553			
	Pest and disease infestation	0.605			
Financial Risks (Hardaker *et al.,* 2015; Campenhout *et al*., 2016; Cochrane & Thornton, 2017)	Sudden rise in interest rates	0.663	0.500	0.702	0.816
	Limited access to financial services	0.666			

Note: chi-square= 701.50; *df*= 45; p-value= 0.000; KMO: Kaiser-Meiyer-Olkin; CR: composite reliability; AVE: average variance extracted.

4.3 Profiling Mean Scores of Vegetable Risks across Gender

Table 5 presents mean scores of vegetable risks characterized according to frequency and severity and disaggregated by gender. The average score of frequency of occurrence of marketing risks was 2.61. Marketing risks that farmers encountered include; changes in vegetable input and output prices, pests and disease infestation. It was unexpected that pests and disease infestation was clustered in marketing risks, however, cost of inputs such as herbicides and pesticides accrue with increase in vegetable pests and diseases, which directly affects marketing (pricing) of vegetables. The findings indicate a significant difference in the frequency of marketing risks by gender at one percent level of significance.

Table 5. Mean scores of frequency and severity of vegetable risks by gender

Variable	***Gender of vegetable plot manager***				
	Pooled	*Male*	*Female*	*Joint*	*F-value*
[1]*Frequency of Production risks*	*2.40*	*2.43*	*2.25*	*2.47*	*1.21*
[2]*Severity of Production risks*	*2.43*	*2.46*	*2.32*	*2.486*	*1.11*
[1]*Frequency of Marketing risks*	*2.61*	*2.73*	*2.23*	*2.65*	*1.83***
[2]*Severity of Marketing risks*	*3.53*	*3.61*	*3.52*	*3.45*	*0.98*
[1]*Frequency of financial risks*	*0.97*	*0.96*	*0.80*	*1.08*	*1.97****
[2]*Severity of financial risks*	*1.15*	*1.13*	*1.08*	*1.21*	*1.61***

Note: ***, ** = Significant at 1%, and 5% level.

[1]Frequency: 1=not at all, 2=less frequent, 3=frequent, 4=more frequent, 5=most frequent

[2]Severity: 1=not at all, 2=less severe, 3=severe, 4=more severe, 5=most severe

Basically, all the farmers in the three classifications of gender encountered marketing risks less frequently, which meant that prices of inputs and vegetable produce were relatively volatile from one season to the next. As a result, farmers were moderately concerned about marketing risks. Female respondents had the lowest mean of 2.23, followed by 2.65 for joint-management. Male farmers had the highest mean in frequency of marketing risks at 2.73. Male farmers encountered more marketing risks compared to female farmers, probably because male farmers were mostly involved in marketing of vegetables, thus more prone to marketing risks as compared to female farmers who were confined in the production of vegetables. Duhan (2017) found that frequent marketing risks, such as price fluctuations, could have adverse effects on vegetable marketing, leading to a decrease in production, and overall decline in incomes. Also, Muriithi (2015) reported that male farmers handled the marketing part of vegetables while women were involved in its production, as they were the major providers of farm labor.

The frequency of financial risks was significantly different by gender at one percent level. Financial risks encountered by farmers were sudden rise in interest rates and limited access to credit services. The mean value of frequency of financial risks was 0.97. In general, all farmers were not at all affected by financial risks, however joint management had the highest mean (1.08), when compared to male (0.96) and female (0.80) farmers. The reason behind this could be because joint decision making is done in joint-management households, where both male and female farmer source for financial support. Female farmers had no problem in accessing loans in informal institutions, because the type of loans they sought were smaller in amount and short term. On the other hand, the male household head owned agricultural resources which could be used as security for accessing loans. Therefore,

availability of credit services could have increased the frequency of access to loans. However, with increase in access to loans and volatile interest rate charges in informal financial institutions, loan repayment might have been a burden to both farmers, thereby hindering vegetable farming. Sarwosri, *et al.* (2016) found that female farmers had no challenges in accessing short term loans, whereas male farmers were well endowed with resources including access to financial support (Mishra *et al*., 2017) In addition Duhan (2017) found that vegetable farmers were faced with financial risks related to borrowing credit, which hindered vegetable farming.

Furthermore, there exists a significant relationship between severity of financial risks and gender of vegetable farmers, at five percent level of significance. Financial risks were less severe, with a mean value of 1.15. Male and Jointly-management farmers had a mean of 1.13 and 1.21 respectively, while female farmers had the lowest mean of 1.08. The severity of financial risks was greater for male as compared to female farmers probably because male farmers could easily access loans from informal financial institutions, given that they owned agricultural resources which could be used as security. Since informal institutions provided less stringent conditions for loan access, male farmers could have borrowed substantial amounts which could have been diverted to other non-agricultural activities, crippling vegetable farming. Inflationary interest rates from informal institutions could have burdened male farmers in loan repayment, increasing the gravity of financial risks. Cochrane & Thornton (2017) found that access to financial support from credit institutions subjected farmers to volatile interest rates that crippled them in repayment of loaned funds plus interest rate in full.

5. Conclusion and Policy Recommendations

The study concludes that farmers under joint-management experience financial risks more frequent due to increase in loan access, while severity of financial risks was greater for male farmers. Volatile interest rates from informal financial institutions burdened farmers in loan repayment since most smallholder farmers relied on informal lending institutions, despite government interventions in provision of financial support. Marketing risks were more frequent for male farmers due to their involvement in marketing of vegetables, while female farmers were confined to production activities. Overall results from this study conclude that female farmers were not prone to financial and marketing risks, which implied that financial availability and marketing opportunities are still scarce to empower women in the vegetable sector. As a policy implication, there is need for implementation of policies that will help in minimizing the gravity of financial risks. Programs that are tailor-made to address gender specific financial constraints, more so in the informal sector, should be implemented in order to promote access to affordable financial support. For instance, implementation of a policy that is geared towards enhancing farmer's access to credit institutions to provide alternative credit source to both men and women. This could be through group insurance and advocacy. Additionally, there is need for policies that will increase female participation in domestic and high value vegetable markets, thereby empowering women who have always been labor providers.

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