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Journal of Development and Agricultural Economics

Full Length Research Paper

Income contribution and adoption potential of apple based agroforestry on homestead farms in West and North Shoa zones of Ethiopia

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To reduce the local people high reliance on the remnant forest, the then Forestry Research Center and GTZ introduced and provided Apple tree seedlings for selected residents in the West and North Shoa Zones of Ethiopia two decades ago. However, despite the provision of such variety of seedlings, a study that assessed the contribution of the fruit trees to the household economy improvement, and the various determinant factors that limit the adoption of the technology was lacking. Therefore, this study was initiated to estimate and compare households' income from apple based agroforestry system and identify factors that influence its adoption by smallholder farmers in both West and North Shoa Zones of Ethiopia. From three Woredas of the two zones, four potential Kebeles were purposefully chosen, and from which 600 households were randomly selected. The results showed that in both study areas, the aggregated adopter household mean annual gross income from vegetable + apple fruit was 24,337.22ETB $ha^{-1}yr^{-1}$ and mean annual gross income of non-adopters from vegetables was 7480.53ETB $ha^{-1}yr^{-1}$. The income obtained from apple contributes 16.84% to the income of agri-horticultural system. The agri-horticulture system contributed three-fold higher gross revenue for adopters in addition to its nutritional value. However, adoption of apple-based agroforestry systems was significantly influenced by formal educational levels (+), a Market problem (-), Disease and Pest to maximize the benefits from the system, interdisciplinary research needs to be conducted to reduce the problem of marketing and disease and pest.

Key words: Agri-horticulture system, apple tree adoption, household income.

INTRODUCTION

Fruit-tree-based agroforestry involves intentional, the simultaneous association of annual or perennial crops with perennial fruit-producing trees on the same farm unit. Trees grown on farms for their non-timber forest products such as fruits, nuts, and spices constitute the basis for many vibrant and sustainable farming systems. Because of a high market value of their products and the contribution of fruits to household dietary needs, fruit-tree-based agroforestry enjoys high popularity among resource-limited producers worldwide (Korwar et al., 2014). Farmers prefer fruit-producing species to other trees for on-farm planting and appreciate the dual

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contributions of food for consumption and the potential for income generation (Meseret, 2015). Fruit trees are considered advantageous because of the relatively high returns to labor resulting from low labor inputs (compared with annual crops); moreover, fruit tree-based systems also offer a more uniform distribution of income throughout the year than annual crop systems.

Most examples of fruit-tree-based agroforestry have developed over long periods of time in response to interactions between agro-ecological conditions, plant diversity, and farmer resources and needs. Because of this, the system performance at any given location will depend to a great extent on several site-specific features. Nevertheless, the system performance also follows some typical characteristics such as their potential benefits and limitations that are applicable to wider regions (Abhisherk, 2014). An understanding of such typical characteristics of these systems is helpful for adaptation and extension of the system to other highland areas with similar production environments. Successful establishment of fruit-based agroforestry system in the highland areas can increase farm household income, enrich their diets with essential minerals, vitamins and increase varieties of fruits available in the local markets (Gideon and Verinumbe, 2013). However, the relatively "free" availability of forest-based timber- and fuelwood products in some areas are seen as disincentives for growing tree species for those purposes (Meseret, 2015).

Promotions of on-farm tree/shrub plantings could also greatly relieve the pressure on the remnant natural forest by providing the variety of forest products (Sisay and Mekonnen, 2013). In order to minimize farmers pressure to the forest and improve the livelihood of the people the then Forestry Research Centre (FRC) in 2007, and GTZ in 2008, introduced and provided four apple varieties namely, Anna, Crispin, Dorset-golden, and Princesa, to the dwellers of North and West Shoa Zones of Ethiopia. This study is based on the premise that farmers in land-scarce situations can directly benefit by incorporating fruit trees into an agricultural landscape with few other trees and this also relieve the people pressure to the natural forest.

Since, fruit trees enjoy great popularity among subsistence farmers and provide tangible benefits in short time frames (Rankoana, 2017). Despite the provision of such variety of apple tree seedlings to the farmers in the area, knowledge of critical factors that can lead to the adoption of these systems as a land management alternative is yet to be identified. Thus, the objective of this investigation was to assess the income contribution and potential for adoption of apple-based agroforestry by smallholder farmers in an area similar in many respects to other highly-populated highland areas. We hypothesized that fruit-tree-based agroforestry would be of interest to smallholder farmers, but that potential differences in adoption rates could be explained by various socioeconomic factors.

MATERIALS AND METHODS

Study area

The study was conducted in West and North Shoa Zones of Oromia region. Dendi Woreda is one of the 19 Woredas in West Showa zone of Oromia region and consists of 48 Kebeles. It is about 78 km west of Addis Ababa along the Addis Ababa-Nekemte highway. The Woreda lies within the coordinates from 8° 43’ North to 9° 17’ North Latitude and 37° 47’ East to 38° 20’ East Longitude, by relative location, the Woreda shares boundaries with other seven Woredas: Jaldu and Ilfeta Woredas in the north, Dawo and Walliso Woredas in the south, Ejere and Ilu Woredas in the east and Ambo Woreda in the west (Dendi Woreda Agricultural and Rural Development Office (DWARDO), 2017). Among the 48 Kebeles, the study was conducted in two Kebeles of Dendi Woreda, namely Gare Area and Bejiro Kebeles’. The major fraction of Gare Arera Kebele is covered by Chilimo National Forest.

From the North Shoa Zone, Degem and Hindbu Abote Woredas were selected. Degem Woreda, lies between 9° 47 ‘29” - 9° 47’ 13’’ N latitude and 38° 31’ 09” - 38° 32’ 50” E longitudes about 125 km North of Addis Ababa. The Woreda covers a total land of 67,020 ha with a widely varying altitudinal range of 1500 - 3450 m.a.s.l., accordingly; 30% of the total land area lies in high land, 38% mid high land and 32% low land. The area receives a mean annual rainfall of 1157 mm, a mean maximum temperature of 20°C and a mean minimum temperature of 8.7°C (DWARDO, 2017). Degem woreda has eighteen peasant associations from this the dominant Apple based agroforestry producer is Ali doro kebele (DWARDO, 2017) (Figure 1).

Sampling

Dendi, Degem and Hindbu Abote Woredas were selected based on the productivity of apple-based agroforestry system. Before the selection of appropriate Kebeles, consultation with the expertise of the Woreda agricultural office was made to get information related to potential fruit producer Kebeles. Consequently, four Kebeles namely, Gare Area, Bejiro, Alidoro and Yaya Dakabora were purposefully selected based on high fruit production and accessibility.

Several rules-of-thumb have been suggested for determining the minimum number of subjects (households) required to conduct multiple regression analysis. For this study, a rule-of-thumb that $N \geq 50 + 8$ m, where N is the minimum number of households and m is explanatory variables, was used (Bonett and Wright, 2014). The explanatory variables hypothesized to influence the adoption of apple-based agroforestry in this study were fourteen. Thus, a total of 600 farm households were randomly selected from the purposively selected four Kebeles. In each selected apple growing Kebeles, two groups of farmers were identified as adopters and non-adopters using adoption category as stratification criteria. From each strata using simple random sampling technique, proportional to the population of Kebeles identified, study sample respondents were selected randomly from the list of household heads. Accordingly, from all selected Kebeles a total of 85 adopters and 515 non-adopters were randomly identified.

Source and methods of data collection

Both primary and secondary data were collected to address the objectives of the study. Primary data were collected from sampled household heads by conducting the formal survey using a structured questionnaire. In addition, information collected using structured questionnaire was supplemented with group discussions

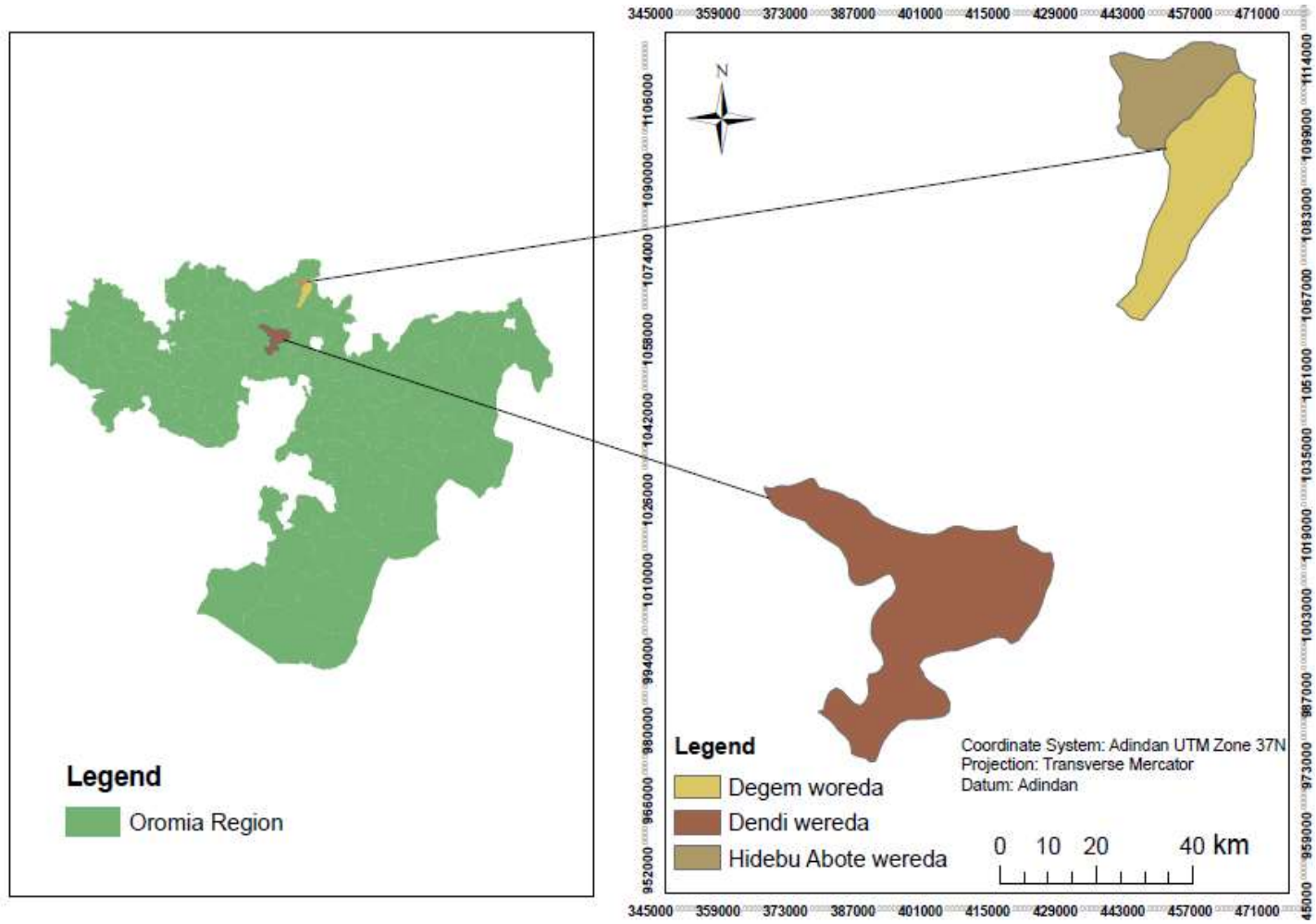

Figure 1. Map of the study area.

(GDs). The discussion was conducted to confer specific issues related to the purpose of the study by forming small groups with a homogeneous composition. Hence, eight GDs were held with selected farmers in the specific Kebeles and the researcher thoroughly investigated the advantage that adopters achieve and the various determinant factors that limit the adoption process. Secondary data that were important for supporting the primary data have been from the relevant Zonal and Woreda offices.

Method of data analysis

To meet the objectives of the study, both descriptive and econometric analysis was employed. To answer the question of factors influencing the adoption of apple-based agroforestry system, a binary logistic regression model was used. The model used to describe the relationship between dependent variable and a set of independent variables. The dependent variable was binary or dichotomous and had only two groups: adopters and non-adopters, whereas, the explanatory variables could be continuous, categorical or dummy. The logistic function was used since it represents a close approximation to the cumulative normal distribution and is easier to use than other types of model (Gujarati, 2004). Logistic regression model has been used by most of agroforestry adoption studies to analyze dichotomous adoption decisions in which the dependent variable is binary: 1 if household head is the adopter, 0 otherwise.

Variables used in the empirical model and hypothesized effects

Dependent variables: In this study, adoption of apple-based AF system used as a dependent variable.

Independent variables: It is hypothesized that farmers' decision to adopt or reject new technologies at any time is influenced by the combination of various factors. This includes both dummy and continuous variables such as: household characteristics, socio-economic characteristics and institutional characteristics in which farmers operate. In this study fourteen explanatory variables were considered as the determinant factors for the adoption of the system (Table 1).

The data obtained from all respondents 600 were considered in the model. The above explanatory variables (X_i) were included in the logit model as EDU, LABSHO, TLAHOLD, OFFFARMIN, CREDIT, EXTEN, MARPROB, DWATER, LONPROPER, AGE, LOWAWA, LACKACCESS, EXPENS, DISEPES.

Table 1. Definition of independent variables, which were included in the econometric model and expected sign.

Variable code	Description	Unit of measurements	Expected sign
ADOPTION	Apple fruit adoption	1=adopter, 0=non adopter	
EDU	Education level of the Household head	The level of formal education	+
LABSHO	Labor Shortage	Minimum number of available labor	-
TLAHOLD	Total Land Holding	Size of Land	+
OFFFARMIN	Off-Farm Income	Amount of money	-
CREDIT	Access to credit	1=Yes, 0=No	+
EXTEN	Access to Extension	1=Yes, 0=No	+
MARPROB	Market Problem	1=Yes, 0=No	-
DWATER	Distance from source of water	1=Yes, 0=No	-
LONPROPER	Longer production period	1=Yes, 0=No	-
AGE	Age of household head	Measured in years	-
LOWAWA	Low awareness about management	1=Yes, 0=No	-
LACKACCES	Lack access to Apple seedling	1=Yes, 0=No	-
EXPENS	Expensiveness of apple tree seedling	1=Yes, 0=No	-
DISEPES	Disease and pest	1=Yes, 0=No	-

RESULTS AND DISCUSSION

Production and income from apple based agroforestry system

In selected districts, sampled household heads mainly depends on crop and livestock production. Among the total sampled households in Degem districts, about 87.5% of Adopters and 97.1% of non-adopters rely on crop production. Besides, in Dendi District 76.8% of adopters and 77.6% non-adopters relays on crop production. Farmers in the study area plant various vegetables solely or in integration with apple tree and use the product for household consumption and/or as an income source. The mean annual production (in Quintal) and income from vegetables and apple fruit (in ETB) are summarized in Tables 2 to 10.

Cabbage (*Brassica oleracea*): Annual cabbage production of adopters and non-adopters was 1.33 and 14.41 quintal ha^{-1} yr^{-1}, respectively. The gross financial return for adopters was 500 ETB ha^{-1} yr^{-1} and for non-adopters 4412 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, non-adopters' income from the cabbage production exceeds adopters 9 times.

Potatoes (*Solanum tuberasum*): Annual cabbage production of adopters and non-adopters was 59.55 and 13.53 quintal ha^{-1} yr^{-1}, respectively. The gross financial return for adopters was 23,818 ETB ha^{-1} yr^{-1} and for non-adopters 5445 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, adopters' income from the potato production exceeds non-adopters 4 times.

Tomato (*Lycopersicon esculuntum*): Annual Tomato production of adopters and non-adopters was 0.56 and 3.56 quintal ha^{-1} yr^{-1}, respectively. The gross financial return for adopters was 279 ETB ha^{-1} yr^{-1} and for non-adopters 1633 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, non-adopters' income from the Tomato production exceeds adopters 6 times.

Enset (*Ensete ventricosum*): Annual Enset production of adopters and non-adopters was 122.20 and 24.73 number ha^{-1} yr^{-1}. The gross financial return for adopters was 11245 ETB ha^{-1} yr^{-1} and for non-adopters 2317 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, adopters' income from Enset production exceeds non-adopters 5 times.

Non-adopters' annual income from the whole produced vegetables were 6768.69 ETB ha^{-1} yr^{-1} and adopters obtained 29,277.75ETB ha^{-1} yr^{-1} (Table 3). An independent sample t-test was carried out to compare the mean gross annual income of adopters and non-adopters. There was a positively significant gross annual income difference between adopters and non-adopters, p = 0.001 (two-tailed).

Adopters' annual income from the whole produced vegetables and apple fruit were 39525.250ETB ha^{-1} yr^{-1}, and non-adopters obtained 6768.69ETB ha^{-1} yr^{-1} (Table 4). An independent sample t-test was carried out to compare the mean gross annual income of adopters and non-adopters. There was a positively significant income difference between adopters and non-adopters, p = 0.001 (two-tailed). Apple fruit contributes 35% of the income for the agri-horticultural system.

Potatoes (*Solanum tuberasum*): Annual cabbage

Table 2. Households total annual income from vegetable productions in the homestead farmland in Degem district.

Vegetables	Adopters (n = 16)		Non-adopters (n = 284)		t-value
	Mean	Std. Dev	Mean	Std. Dev	
Cabbage	500.00	489.89	4411.85	4800.68	-1.98*
Potato	23818.46	54766.04	5445.46	5981.76	4.61***
Carrot	1156.50	1650.93	3026.40	2920.81	-1.19
Tomato	279.17	110.02	1632.95	1511.81	-2.16**
Chili	242.67	140.93	2284.93	4061.14	-0.86
Onion	1041.67	1264.49	1375.00	1124.21	-0.46
Garlic	492.00	209.57	4685.71	5254.66	-1.76
Leeks	50.00		275.00	318.19	-0.56
Beetroot	367.50	467.17	1388.00	1297.73	-2.16**
Gesho	4125.00	3944.93	1452.38	1588.26	2.38**
Enset	11245.45	15387.093	2317.81	2860.40	4.35***

***, ** Significant at 1 and 5% probability level; Mean values with different superscript letters along the same rows are statistically different.
Source: Own survey.

Table 3. Mean household heads total annual income from vegetable in Degem District (North Shoa Zone).

Adoption	Mean	Std. Dev	t-value
Adopters	29277.7500	49461.83272	6.465***
Non-adopters	6768.6937	7902.64453	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

Table 4. Mean household heads total annual income from Apple fruit + vegetable in Degem District (North Shoa Zone).

Adoption	Mean	Std. Dev	t-value
Adopters	39525.250	72483	7.08***
Non-adopters	6768.69	7902.64	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

production of adopters and non-adopters was 26.86 and 12.86 quintals ha^{-1} yr^{-1}, respectively. The gross financial return for adopters was 10639 ETB ha^{-1} yr^{-1} and for non-adopters 5136 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, adopters' income from the potato production exceeds non-adopters 2 times.

Enset (*Ensete ventricosum*): Annual Enset production of adopters and non-adopters was 100 and 39 number ha^{-1} yr^{-1}. The gross financial return for adopters was 8973 ETB ha^{-1} yr^{-1} and for non-adopters 3791 ETB ha^{-1} yr^{-1}. The income difference was statistically significant (P<0.01). Hence, adopters' income from Enset production exceeds non-adopters 2 times.

Adopters' annual incomes from the whole produced vegetables were 18869.86 ETB ha^{-1} yr^{-1} and non-adopters obtained 8356.13ETB ha^{-1} yr^{-1} (Table 6). An independent sample t-test was carried out to compare the mean gross annual income of adopters and non-

Table 5. Households total annual vegetable productions in the homestead farmland in Dendi district.

Vegetable	Adopters (n = 69)		Non-adopters (n = 231)		t-value
	Mean	Std. Dev	Mean	Std. Dev	
Cabbage	1730.00	1619.95	1371.02	1116.17	1.35
Ethiopian Cabbage	2860.00	5123.28	925.45	2369.75	1.06
Potato	10639.22	16652.98	5136.60	5601.43	3.543***
Carrot	2655.00	6206.73	1795.00	1540.40	0.64
Tomato	5466.67	4387.86	4127.27	4784.16	0.44
Chili	1422.22	1277.48	1983.33	4522.40	-0.36
Onion	4810.00	5953.40	1378.57	632.98	2.240**
Garlic	4453.33	5439.66	5660.78	9688.39	-0.72
Leeks	193.18	221.39	233.50	222.13	-0.48
Beetroot	1206.94	1371.02	1584.68	1167.49	-1.02
Gesho	2050.00	1533.10	1755.43	1806.23	0.70
Enset	8973.17	9859.16	3791.52	3267.04	4.256***

***, ** Significant at 1 and 5% probability level; Mean values with different superscript letters along the same rows are statistically different.
Source: Own survey.

Table 6. Mean household heads total annual income from vegetable in Dendi District (West Shoa Zone).

Adoption	Mean	Std. Dev	t-value
Adopters	18869.86	20823.84	5.402***
Non-adopters	8356.13	11515.64	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

Table 7. Mean household heads total annual income from Apple fruit + vegetable in Dendi District (West Shoa Zone).

Adoption	Mean	Std. Dev	t-value
Adopters	20697.1	20737.87	6.38***
Non-adopters	8356.13	11515.68	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

adopters. There was a positively significant gross annual income difference between adopters and non-adopters, p = 0.001 (two-tailed).

Adopters' annual income from the whole produced vegetables and apple fruit were 20697.1 ETB ha^{-1} $yr^{-1}$and non-adopters obtained 8356.13 ETB ha^{-1} yr^{-1} (Table 7). An independent sample t-test was carried out to compare the mean gross annual income of adopters and non-adopters. There was a positively significant gross annual income difference between adopters and non-adopters, p = 0.001 (two-tailed). Apple fruit contributes 8.83% of the income for the agri-horticultural system.

The aggregated analysis was conducted to determine households' annual income from the homestead farmland. Adopters' annual income from the whole produced vegetables and apple fruit were 24337.22 ETB ha^{-1} yr^{-1} and non-adopters obtained 7480.53 ETB ha^{-1} yr^{-1} (Table 10). An independent sample t-test was carried out to compare the mean gross annual income of adopters and non-adopters. There was a positively significant gross annual income difference between adopters and non-adopters, p = 0.001 (two-tailed). Apple fruit

Table 8. Households total annual vegetable productions in the homestead farmland in both district (North and West Shoa Zones).

Vegetables	Adopters (n = 85)		Non-adopters (n = 515)		t-value
	Mean	Std. Dev	Mean	Std. Dev	
Cabbage	1525.00	1557.17	2819.04	3724.45	-2.044**
Ethiopian Cabbage	2860.00	5123.28	1444.62	2927.01	0.746
Potato	13316.25	28634.88	5316.35	5819.97	4.828***
Carrot	2155.50	5079.63	2157.18	2074.81	-0.002
Tomato	2008.33	3398.29	2464.39	3174.62	-0.377
Chili	1127.33	1214.53	2171.83	4194.73	-0.849
Onion	3396.88	4951.13	1376.79	895.23	2.114**
Garlic	4003.18	5269.78	5579.52	9381.79	-1.031
Leeks	181.25	215.09	237.27	222.74	-0.709
Beetroot	948.65	1222.87	1496.88	1219.87	-1.892*
Gesho	2326.67	2037.36	1660.46	1734.62	1.655
Enset	9453.85	11114.85	3131.96	3167.60	6.170***

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

Table 9. Mean household heads total annual income from vegetable in North and West Shoa Zones.

Adoption	Mean	Std. Dev	t-value
Adopters	20828.99	28366.44	8.18***
Non-adopters	7480.53	9713.30	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

Table 10. Mean household heads total annual income from Apple fruit + vegetable in North and West Shoa Zones.

Adoption	Mean	Std. Dev	t-value
Adopters	24337.22	36611.07	8.77***
Non-adopters	7480.73	9713.38	

*** Significant at 1% probability level; Mean values with different superscript letters along the same rows are statistically different (P<0.01).
Source: Own survey.

contributes 16.84% of the income for the agri-horticultural system. Results of the present study agree with the findings of the study that was conducted in Pakistan to assess the economic comparison of Agriculture (sugarcane cultivation) with Agroforestry (sugarcane cultivation in combination with trees). The result showed that the benefit cost ratio of sugarcane system was computed as 2.16 whereas net present worth was found as Rs. 149810.2. Beside Benefit cost ratio of sugarcane in combination with trees was computed to be 2.28 whereas net present worth found to be Rs. 151098.5 (Anjum et al., 2011). Furthermore, income obtained from apple contributes 17% of the total income from an agri-horticultural system. Ndalama (2015) reported that in the rural household communities of Balaka, Malawi, adoption of agroforestry contributed 51.7% of the farm households' income.

Determinants of apple tree adoption

Fourteen explanatory variables were identified to explain

Table 11. Maximum likelihood estimate of the binary logit model for Adoption determinant factors in Degem District.

Explanatory variable	B	S.E.	Wald	P>|z|	e^{β}
Education	1.62*	0.979	2.749	0.097	5.068
Labor shortage	-0.23	1.004	0.050	0.823	0.799
Total Land Holding	0.46	0.894	0.267	0.605	1.588
Off-farm income	2.08	1.112	3.510	0.061	8.030
Access to Credit	-19.61	25164.028	0.000	0.999	0.000
Extension Service	-1.94	1.294	2.250	0.134	0.144
Market Problem	-2.78***	0.916	9.196	0.002	16.086
Water Distance	-0.29	0.224	1.677	0.195	0.748
Longer production period	1.67	1.054	2.525	0.112	5.336
Age of Household head	1.09	1.160	0.886	0.347	2.980
Low awareness	-0.84	0.877	0.917	0.338	0.432
Lack Access	0.64	1.142	0.315	0.574	1.899
Expensiveness	-1.12	0.896	1.548	0.213	0.328
Disease and pest	-5.94***	1.571	14.295	0.000	380.010
Constant	1.21	50328.057	0.000	1.000	

Log-likelihood (χ^2) = 68. 29, Wald Chi-square=55.29***, Correctly predicted percent = 94.8, N= 300; *, ** and *** represents statistically significant at 10, 5 and 1% level of significance, respectively.

factors influencing the adoption of apple tree-based agroforestry system in North and West Shoa Zones. The effects of the independent variables on the log odds of adopting apple based agroforestry system are reported as odds ratio alongside the parameter estimates. For independent variables, the odds ratio (e^{β}) represent the amount by which the odds favoring the decision to adopt apple based agroforestry system (adopter =1) changes for a change in that independent variable (Tables 11 to 13).

Out of fourteen explanatory variables included explaining the dependent variable, three were found to be significant. Formal educational level of the household head, market problem and the problem of pest and disease were significant independent variables.

The formal education level of the household head as expected had a positive influence in the adoption of apple-based agroforestry system. Keeping other factors constant, the odd ratio indicated that increase in educational level by one year increase the favor of adoption by a factor of 5.008. The endpoints of a 95% confidence interval (CI) of the odds ratio is (2.495, 10.050). However, the finding is against the study carried out by Mwema et al. (2012) who found out that a higher level of formal schooling is associated with less collection and dependency on fruit producing trees. A higher level of education provides a wider range of employment opportunities and as a result alternative sources of income.

The market problem was statistically significant ($p < 0.01$) and had the negative relationship with the adoption of apple-based agroforestry system. Keeping other factors constant, the odd ratio indicated that as apple fruit market problem increase the favor of adoption decrease by a factor of 4.746. The endpoints of a 95% confidence interval (CI) of the odds ratio is (2.406, 9.361). Because the marketing aspects are also important to the farmer, they need to have access to information about the market (e.g. prices, demand and supply, expectations). A farmer will not decide to change their production system unless they see the security of marketing possibilities. Farmers are not likely to be interested in producing commodities if transport costs are high. They will also be reluctant to make or continue investments in AF if prices fluctuate widely. Knowledge of market is critical, as it can help identify whether agroforestry interventions have the possibility of saturating them and therefore bringing prices down. During the Group Discussion that conducted in Bejiro Kebele farmers stated that the demand for apple fruit is very low and a majority of the people did not even know what Apple is. Besides in Degem Woreda, farmers stated that to sell apple fruit they travel to Addis Ababa, which is about 125 km far from their residence because the people there well know the fruit's nutritional values. Considering the serious market problem, non-adopters becomes reluctant to plant the apple tree, and one farmer among the group discussant stated "why do you bother us to plan apple fruit; what tangible benefits did adopters obtain? It helps us if we plant vegetables in the homestead farmland rather than taking space through planting apple fruit tree."

Disease and pest were statistically significant ($p < 0.01$) and has negative relationship with the adoption of apple-based agroforestry system. Keeping other factors constant, the odd ratio indicated that as apple fruit

Table 12. Maximum likelihood estimate of the binary logit model for Adoption determinant factors in Dendi District (West Shoa Zone).

Factor	B	S.E.	Wald	df	Sig.	Exp(B)
Education	1.728***	0.497	12.081	1	0.001	5.628
Labor shortage	-0.173	0.508	0.115	1	0.734	0.842
Total Land Holding	-1.109***	0.404	7.548	1	0.006	0.330
Off-farm income	-1.178	1.401	0.707	1	0.400	0.308
Access to Credit	-0.864	1.381	0.391	1	0.532	0.422
Extension Service	0.961*	0.422	5.184	1	0.023	2.614
Market Problem	-1.005**	0.460	4.778	1	0.029	2.731
Water Distance	-0.048	0.417	0.013	1	0.909	0.954
Longer production period	-0.872	0.655	1.771	1	0.183	0.418
Age	-0.217	0.794	0.075	1	0.785	0.805
Low awareness	-0.011	0.115	0.009	1	0.926	0.989
Lack Access	-0.764*	0.445	2.945	1	0.086	0.466
Expensiveness	0.961	1.029	0.872	1	0.351	2.615
Disease and pest	-3.859***	0.633	37.174	1	0.000	47.407
Constant	-4.063	2.217	3.359	1	0.067	0.017

Log-likelihood (χ^2) = 182.922, Wald Chi-square=80.31***, Correctly predicted percent = 85.9, N= 300; *, ** and *** represents statistically significant at 10, 5 and 1% level of significance, respectively.

Table 13. Maximum likelihood estimate of the binary logit model for Adoption determinant factors in Dendi and Degem District (North and West Shoa Zone).

Factor	B	S.E	Wald	df	Sig.	Exp(B)
Education	1.611***	0.355	20.544	1	0.000	5.008
Labor shortage	-0.039	0.408	0.009	1	0.924	0.962
Total Land Holding	-0.370	0.332	1.241	1	0.265	0.691
Off-farm income	-0.235	0.701	0.112	1	0.738	0.791
Access to Credit	-1.443	1.093	1.742	1	0.187	0.236
Extension Service	0.102	0.152	0.446	1	0.504	1.107
Market Problem	-1.557***	0.347	20.188	1	0.000	4.746
Water Distance	-0.017	0.172	0.010	1	0.919	0.983
Longer production period	0.272	0.431	0.398	1	0.528	1.313
Age	0.072	0.605	0.014	1	0.905	1.075
Low awareness	-0.082	0.081	1.043	1	0.307	0.921
Lack Access	-0.393	0.341	1.333	1	0.248	0.675
Expensiveness	-0.079	0.494	0.026	1	0.873	0.924
Disease and pest	-3.020***	0.409	54.462	1	0.000	20.500
Constant	-4.860	2.002	5.892	1	0.015	0.008

Log-likelihood (χ^2) = 311.675, Wald Chi-square= 229.736***, Correctly predicted percent = 89, N= 600; *, ** and *** represents statistically significant at 10, 5 and 1% level of significance, respectively.

infestation increase the favor of adoption decrease by a factor of 20.5. The endpoints of a 95% confidence interval (CI) of the odds ratio is (9.191, 45.723). During the field observation, the problem was high in West Shoa Zones as compared to West Shoa. One model farmer that lives in Gare Kebele stated that "I used to get much money from apple fruit during the first production period, but recently apple pest and disease discourages me most and makes effort irrelevant. Mostly I decided to throw away the fruit tree but I lose my confidence to do so because it supports my family while it was productive."

From the result discussed above, it can be inferred that adopters of apple-based agroforestry system obtained higher gross annual income than non-adopters. Among

vegetables that provided the highest income for adopters in all study sites were potato, onion, and Enset. While, for non-adopters, more income was obtained from cabbage and beetroots. The mean gross income of adopters from vegetables + apple was 3.8 times higher than the income of non-adopters from vegetables. The mean annual gross revenue of adopters from solely apple fruit production constituted about 16.84% of the total income obtained from vegetable + apple.

Conclusion

In the study area, apple-based agroforestry system had both nutritious supplement and monetary value. However, adoption of the system was significantly influenced by different factors, that is, formal education levels (+), the market problem (-), and apple fruit and tree disease and pest (-). The current study proved that in the presence of determinant factors that limit the adoption process, apple-based agroforestry system provides the significant economic advantage for adopter as compared to non-adopters. Thus, the promotion of agroforestry technologies is important because it offers the prospect of increasing production and hence raising farmers' income. Sustainable development through AF can be achieved through concerted effort to actively and continuously encourage farmers' involvement in AF activities. Recognizing and tackling main factors that determine the participation of farmers in AF practices affects an AF project to successful local involvement. These findings are relevant to the adoption of agroforestry technologies involving economic, social and economic considerations.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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A study on prisoner population and food demand in Malawi prisons

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While Malawi's per capita cereal production may be higher than her per capita cereal consumption, Malawi is a net cereal importer and thus food insecure. The food situation is much worse in Malawi's prisons because inmates generally eat one meal per day. The general objective of this study was to project prisoner population and food demand for ten years, from 2015 to 2025. Using structured questionnaires in face to face interviews, the study collected data from 1000 prisoners and 30 officers-in-charge from all prisons in the country. The data was analysed using Excel employing demand projection models. Results from the analysis showed that Malawi prison food demand was going to grow by 32% from 5,046 tonnes in 2015 to 6,648 tonnes in 2025, while prisoner population was projected to grow from 12,598 prisoners in 2015 to 16,605 prisoners in 2025. This huge growth in food demand as well as prisoner population would call for drastic strategic management policies.

Key words: Malawi's prisons, Malawi's prison population growth, Malawi's prison food demand projections.

INTRODUCTION

Politically, Malawi is divided into four regions, these being the Northern, the Central, the Eastern and the Southern regions. There are six prisons with a prisoner population of 1,717 in the Northern region. In the Central region, there are eight prisons with a prisoner population of 3,784. The Eastern region has eight prisons with 4,072 prisoners, while the Southern region has 3,025 prisoners in eight prisons. There were 12,598 prisoners in Malawi's 30 prisons in 2016 when this study was conducted.

The focus of this paper was on projecting the growth in Malawi's prisoner population and associated food demand for the period 2015 to 2025, based on food items commonly eaten in Malawi's prisons. Theories relating to food acquirement, utilization and nutrition were outside the scope of this study.

The food situation in Malawi

The Millennium Development Goals (MDGs) through the medium term development strategy, the Malawi Growth and Development Strategy (MGDS), identified nine key priority development goals (Malawi Government, 2010). The first of these development goals is to eradicate

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extreme poverty and hunger. To achieve this, the Government's target was to halve, between 1990 and 2015, the proportion of people who suffered from hunger. One of the indicators for monitoring hunger was the proportion of the population living below the minimum level of dietary energy consumption of 2,100 kilocalories per person per day (Ecker and Qaim, 2008).

Malawi is an aggregate net exporter of food. The bulk of the food exports, however, are non-cereals such as tea and sugar and so although the country is a net food exporter, it remains a net importer of cereals and thus food insecure. Maize is the staple food in Malawi (De Graaff, 1985; Kidane et al., 2006; World Bank, 2008; Food and Agriculture Organization (FAO), 2010, 2015).

The food situation in Malawi's prisons

It is a requirement of the United Nations that every prisoner should be provided, by the administration at the usual hours, with food of nutritional value adequate for health and strength, of wholesome quality and well prepared and served (Medecins Sans Frontieres, 2009). The Malawi Prison Act Cap. 9:02, (1983) provides a dietary schedule for prisoners belonging to various categories of prisons (Malawi Government, 1983). Despite these legally binding dietary guidelines, the practice on the ground is different. The African Commission on Human and Peoples' Rights (2002) observed that Malawian prisoners receive only one meal per day and that meals are not balanced as prisoners eat the same food every day. The report also observed that the meals comprise of maize (*nsima*) and boiled beans and sometimes pigeon peas or vegetables. Neither meat nor fish was provided but salt was available in all prisons. This is a typical case of food insecurity.

Statement of the problem

Although Malawi is generally food insecure, it is common in Malawi that most people consume three meals per day. What differs is mainly the quality, quantity and variety of the food that they eat. Inmates in Malawi's prisons, however, generally eat one meal per day (African Commission on Human and Peoples' Rights, 2002; Penal Reform International, 2005). These reports mention food issues as observations made in relation to health and human rights. None of these studies specifically studied Malawi's prison population growth nor food demand projections for any future period.

Justification of the study

The overall objective of the Food and Nutrition Security Policy is to significantly improve the food and nutrition security of the Malawi population (Malawi Government, 2005) while the specific objective of the Food Security Policy, is to guarantee that all men, women and youth in Malawi have, at all times, physical and economic access to sufficient nutritious food required to lead a healthy and active life (Malawi Government, 2006a, b, c; Malawi Government, 2012). Since prisons accommodate about 0.08% of the Malawi population, it is important that prisons are food secure and that every prisoner has access to not less than the minimum meal requirement. Given the Malawi Government's commitment to ensuring food security, it was important that this study be carried out so that the growth in prisoner population and future food demand levels in Malawi's prisons could be ascertained. It was important to study and understand these economic parameters in order to lay the foundation upon which efforts to improve and re-engineer the food situation in Malawi's prisons could be based. This would enable policy makers and prison management to take appropriate policy and budgetary measures regarding prison subvention, strategic resource allocation, food production or procurement, and food demand and consumption levels to accurately address the problem and ensure prison food preparedness and improve prison food security. Also, since no study has been conducted in this area, it was important to conduct this study so that the existing knowledge gap could be filled.

Objectives of the study

The general objective of this study was to project prisoner population and prison food demand for ten years. The specific objectives were to project prisoner population for the period 2015 to 2025, and to project prisoner food demand for the period 2015 to 2025.

MATERIALS AND METHODS

Data collection techniques

Both primary and secondary data were collected using questionnaires, one administered to prisoners, and the other to prison officers-in-charge. A total of 1,000 male prisoners from all the 30 prisons were randomly selected and interviewed using questionnaires administered in face to face interviews. Secondary data were collected from official records obtained from the Malawi Prison Service Headquarters and the various prisons that were visited.

Data analysis

Data were entered and analysed in Excel. The output from the analysis was reported using descriptive statistics such as means, proportions and percentages.

Sampling methods

All prisons in Malawi formed the field of study and every inmate, except those that had been in prison for less than four weeks, was

an eligible interviewee. The four week requirement is a normal procedure followed by the USAID-funded Food and Nutrition Technical Assistance (FANTA) project which developed a questionnaire (Maxwel and Frankenberger, 1992; Swindale and Bilinsky, 2006) upon which the questionnaires used in this study were based. In order to select respondents from the population of inmates, the stratified random sampling and simple random sampling methods were used. The stratified random sampling method was applied to select *n* units out of *N* sub-populations called strata. In this case, each prison was a strata and from each strata *n* number of inmates were selected using simple random sampling in order to give each prisoner an equal chance of being selected (Bryars, 1983; Agresti, 1996; Zikmund, 1997; McGill et al., 2000). In order to select participating inmates, tables of random numbers (Magnani, 1997) were used. In selecting prison officers for the interview, the purposive sampling method was used.

Sample size

For more precision on sample size calculation, when population size and population proportions are known, the formula given below is used (Kothari, 2004).

$$n = \frac{z^2}{e^2}\frac{p.q.N}{(N-1)+z^2.p.q} \quad (1)$$

where n = sample size, z = 1.96 = z-value yielding 95% confidence level, p = proportion of the population of interest, $q = 1 - p$, N = 12,598 = the population of interest, e = 5% = absolute error in estimating p.

The population proportion for each prison was calculated as in Equation 2.

$$\text{Prison proportion, } p = \frac{\text{Number of prisoners at a given prison}}{\text{Total prisoner population in Malawi}} \quad (2)$$

In 2016, the total number of both convicted and un-convicted inmates in Malawi's prisons was 12,598 (Malawi Government, 2012), while the population of Malawi as given by the UNDP in its 2011 Human Development Report was 15,380,900 (UNDP, 2011). Following the reasoning articulated above and applying Equation (1), the value of *n,* the sample size, was found to be 1418. However, only 1,000 inmates were interviewed because of the study limitations.

Data were collected by three trained interviewers using a questionnaire that had been reviewed by a group of key informants, refined by eight prisoners that were representative of the survey population but who were not part of the survey sample, and pretested on fifteen prisoners through a preliminary survey. Data collected were subjected to regression and correlation analysis and results summarized.

Limitations of the study

There were two major limitations to the study. The first was that all interviewees were male. This was because, for security reasons, the research team was only allowed to access prisoners that committed less serious offenses. Such prisoners were allowed to go out for farming activities because they were considered a lower security risk. The research team was advised to interview the sampled ones as they carried out their farming chores. The second limitation was that no female prisoners were in this category, not necessarily because they committed serious crimes, but because female prisoners were not allowed to go out for farming duties and the research team was not allowed to enter into the female side of the prison. As a result of these two limitations only 1000 prisoners, instead of the required 1418 prisoners were interviewed.

Model specification

Trends and projections of demand and supply of various important food items help policy makers to make informed policy decisions relating to the food security and food sufficiency situation of a country (Mittal, 2012). The basic model for making demand projections may take the form given in Equation 3:

$$d = \beta + \mu y + z \quad (3)$$

where d is annual rate of change in consumption, β is annual rate of change in population, μ is income elasticity, y is annual rate of change in per capita income, and z is the annual trend factor. This model can be applied to aggregate consumption in a given base year, and it is expressed as shown in Equation 4:

$$D_t = D_0\ (1 + d)^t \quad (4)$$

where $D_t$is total consumption in year t, D_0 is total consumption in base year, and t is the number of years after the base year. A growth rate model based on estimated expenditure elasticity (Mittal, 2006; Kumar et al., 2009) is as shown in Equation 5.

$$D_t = d_0 * N_t\ (1 + y\ e)^t \quad (5)$$

where D_t is total demand for the food item in question, d_0 is prisoner per capita demand for the food item (Kumar et al., 2009) in base year, y is growth in national per capita income, e is national expenditure elasticity of demand for the food item, and N_t is the projected prisoner population in year t. But in this study, the law imposed a constraint and the legal quantities provided in Table 1 needed to be observed. Therefore, in order not to deviate negatively nor positively at any one time period from the provisions made in the prison Act, $d_0$for each food item was fixed to the legally provided quantity as provided in Table 1. For the legal constraint to be upheld, $(1 + y\ e)^t$ needed to be normalized to 1. This was achieved by reasoning that since the legal quantities shown in Table 1 were not time dependent, t in Equation 5 was irrelevant and therefore zero.

The projected prisoner population, N_t,was given as Equation 6:

$$N_t = N_0 * (g + 1)^t \quad (6)$$

where N_t is prisoner population in year t, N_0 is base year prisoner population, and g is growth rate in prisoner population.

The foods commonly eaten in Malawi prisons were maize (eaten as *nsima*), beans and salt which were consumed practically every day in all prisons in the country. Other foods, for example, meat and vegetables, were consumed rarely. The rest of the foods provided in Table 1 were either not eaten at all or were eaten only once in a long while and in extremely rare occasions in certain prisons. As such, these foods were excluded from the study. Demand projections of the commonly eaten foods were made based on the quantities legally provided in the Malawi Prison Act (Cap. 9.02) as shown in Table 1.

Quantities provided in Table 1 were used as constants so that projected food quantities should not deviate negatively nor positively from provisions made in the law. This was done despite that the practice on the ground was that food provisions made to prisoners were far below the legally recommended quantities. The base year was 2015. The base year prisoner population, N_0, was 12,598. Figures for prisoner population and total food demand were computed using Excel.

Table 1. Malawi prison dietary provision.

Ordinary diet	Daily issues per prisoner
Maize Meal	680 g
or Rice	454 g
or Cassava Meal	680 g
or Millet Meal	680 g
Peas or Beans	113 g
Fresh Vegetables	170 g
or Fresh Peas or Beans	57 g
or Sweet Potatoes	284 g
Chillies or Peppers	4 g
Dripping	14 g
or Groundnut Oil	7 g
or Groundnuts (shelled)	28 g
or Red Palm Oil	4 g
Salt	21 g
Fruit (in season)	113 g

Ordinary diet	Daily issues to class I and class II prisons
Meat	113 g
or Fresh Fish	227 g
or Dry Fish	113g
Cocoa or Coffee	7 g
Sugar	7 g
Unlimited Water	

Penal diet	Daily issues to class I prisons
Maize Meal	454 g
or Cassava Meal	454 g
or Millet Meal	454 g
Unlimited Water	

Reduced diet	Daily issues to class I prisons
Maize Meal	340 g
or Cassava Meal	340 g
or Millet Meal	340 g
Fresh Vegetables	170 g
or Fresh Peas or Beans	57 g
or Sweet Potatoes	284 g
Peas or Beans	57 g
Dripping	14 g
or Groundnut Oil	7 g
or Groundnuts (shelled)	28 g
or Red Palm Oil	4 g
Salt	21 g
Unlimited Water	

Source: Laws of Malawi, Prison Act (Cap. 9:02).

RESULTS AND DISCUSSION

Prisoner population is estimated to grow from 12,598 prisoners in 2015 to 16,605 prisoners in 2025. As a result of this, demand for prison food is also expected to grow. During the same period, annual maize demand is

Table 2. Annual prisoner population and food demand projections for all prisons in Malawi from 2015 to 2025.

Years	Base Year (2015) Prisoner Pop. Size (N_0)	Prisoner Pop. In Year t $\{N_t=N_0(g+1)^t\}$	Total Maize Demand in Year t $\{D_t=d_0*N_t(1+Y*e)^t\}$ Tonnes	Total Meat Demand in Year t $\{D_t=d_0*N_t(1+Y*e)^t\}$ Tonnes	Total Beans Demand in Year t $\{D_t=d_0*N_t(1+Y*e)^t\}$ Tonnes	Total Veges Demand in Year t $\{D_t=d_0*N_t(1+Y*e)^t\}$ Tonnes	Total Salt Demand in Year t $\{D_t=d_0*N_t(1+Y*e)^t\}$ Tonnes
2015	12,598	12598	3127	520	520	782	97
2016	12,598	12951	3214	534	534	804	99
2017	12,598	13313	3304	549	548	826	102
2018	12,598	13686	3397	564	564	849	105
2019	12,598	14069	3492	580	580	873	108
2020	12,598	14463	3590	597	597	897	111
2021	12,598	14868	3690	613	613	923	114
2022	12,598	15285	3794	630	630	948	117
2023	12,598	15713	3900	648	648	975	120
2024	12,598	16152	4009	666	666	1002	124
2025	12,598	16605	4121	685	685	1030	127

estimated to grow from 3,127 tonnes to 4,121 tonnes; demand for meat and beans will each grow from 520 tonnes to 685 tonnes; vegetable demand from 782 tonnes to 1,030 tonnes and salt demand will grow from 97 tonnes to 127 tonnes. Aggregate food demand is, therefore, estimated to grow by 32% from 5,046 tonnes in 2015 to 6,648 tonnes in 2025. Table 2 shows 10 year demand projections for food items commonly eaten in Malawi's prisons.

The growth in food demand was big, so big that it would be almost impossible for the prison service to meet it. Although the projected food demand was worked out from recommended food quantities provided for in the Prison Act, the actual quantities given to prisoners were much less. This was an indication that the prisons could not afford the recommended quantities. It was not hard, therefore, to see that if the prisons could not afford 5,046 tonnes in 2015, they would possibly not afford 6,648 tonnes in 2025. The failure to purchase the required quantity of food would be because prisons run on government subvention, just like all other government departments, and subvention to departments as a percentage of GDP has been declining over the years (Ministry of Finance, Economic Planning and Development, 2014). Government subvention to Malawi prisons, for example, dropped by 37.2% between 2009 and 2014 and this resulted into a precarious food and health situation in the prisons (Jali, 2016). A possible government policy intervention could be to make it a requirement that every prison in the country owns and operates a farm where, using prisoner labour, crops and animals are produced as food for the prisoners. Normally, own-produced food is cheaper than procured food.

In 2015, with 12,598 prisoners, prisons in Malawi were over-crowded. In 2025, there is likely to be 16,605 prisoners in the prisons. A deliberate policy to build more prisons could arrest the situation. The Malawi Prison Service (MPS), however, does not seem to have plans to build more prisons. In the absence of additional prisons, this growth in prisoner numbers will put serious pressure on the existing facilities.

The problems discussed above could possibly also be reduced or put under control if government allowed entrepreneurs to own and operate private prisons alongside government prisons. A private prison or for-profit prison is a place in which individuals are physically confined or incarcerated by a third party that is contracted by a government agency (Goyer, 2001). Private prison companies typically enter into contractual agreements with governments that commit prisoners and then pay a monthly rate, either for each prisoner in the facility, or for each place available, whether occupied or not (Le Vay, 2015). Some countries that have a private prison policy are the United Kingdom, Australia, Canada, The United States of America, Brazil, Chile, Greece, Jamaica, Japan, Mexico, New Zealand, Peru, South Africa and Thailand (Biron, 2013). Because of funding problems, private prison operation in Malawi would have to be negotiated and funded

differently from the way it is done elsewhere. The objective of this study was to project prison food demand for ten years from 2015 to 2025. The research hypothesis was that demand for food in Malawi Prisons was going to increase annually in the ten years. Based on the study findings as presented in this paper, this hypothesis was accepted.

Conclusion

The findings of the study showed that prisoner population was to grow from 12,598 prisoners in 2015 to 16,605 prisoners in 2025. During the same period, aggregate food demand was to increase by 32% from 5,046 tonnes to 6,648 tonnes. This huge growth in food demand would call for drastic strategic management policies. Possible interventions would include prisons producing their own food from prison farms, government building more prisons to ease congestion, and allowing entrepreneurs to build and operate private prisons as the case is in some countries.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Assessment of the factors affecting the performance of micro and small scale enterprise: The case of Wolkite town, Guraghe zone, Southern Ethiopia

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Currently, the Ethiopian government gives a great emphasis on the growth of micro and small-scale enterprises. Besides, some empirical studies were conducted to identify the factors affecting the performance of micro and small-scale enterprises in this town. For the sake of achieving this goal most important primary sources of data were collected through survey questionnaire from samples of 30 peoples by means of the random sampling technique. Moreover, face to face interview was also conducted with the coordinator of micro and small-scale enterprises in Wolkite town. Data collected using the questionnaire were analyzed using descriptive and econometric model (ols). This paper focuses on determining the influence of factors like age, sex, family size, access to business information, access to, access to financial services and access to managerial skills on the performance of micro and small-scale enterprises. Especially, access to infrastructure and low-level education are the main factors that are affecting the performance of micro and small-scale enterprises in this town. This implies that mainly due to this factors most of the enterprise in this town was at the initial growth stage and their performances were decreasing from time.

Key words: Micro and small scale enterprises, Wolkite Ethiopia.

INTRODUCTION

Micro and small-scale enterprises are important both to the individual and to the nation. To the individual, they provide employment and raise the standard of living of both employers and employees. To the nation, they complement large-scale modern sector enterprises, they utilize agricultural and other raw materials that warrant only small-scale production, they mobilize resources otherwise left out of the mainstream formal mobilization channels and they provide the necessary platform for takeoff into large-scale modern production by many indigenous Ethiopians. Micro and small-scale enterprises contribute more enormously to the socioeconomic development of once country. According to Ministry of MSME (2014) of India , the micro and small sector alone

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accounts for more than 95% of the industrial units and contributes 45% of the manufacturing output and 40% of the total export. Micro and small-scale enterprises are the main sources of employment in developed and developing countries and especially in helping the industrialization of rural and for those backward areas. Micro and small-scale enterprises play an important role in one country economy and it is increasingly viewed as an important engine for employment creation and economic growth.

Micro and small-scale enterprises can also face many obstacles their limit their long-term survival and development that reduces the performance of the enterprises. A study conducted by International Finance Corporation (IFC, 2013) based on responses of more than 45,000 firms in developing countries found that the top obstacles to the operations of micro and small-scale enterprises are a poor investment climate. Especially, the study found that red tape, high tax rates, and competition from the informal sector are main challenges and also inadequate infrastructure, especially an insufficient or unreliable power supply. Whereas informality is a major hindrance of micro and small-scale enterprises in middle-income countries are an inadequate power supply is the most important challenge for companies in low-income countries. Typically, micro and small-scale enterprises also face higher transaction costs than larger enterprises in obtaining credit (Saito and Villanueva, 1981). Poor managing and accounting practices have in a weak position to the ability of smaller enterprises to raise finance. This leads to lack of adequate information which is associated with lending to micro and small-scale enterprise borrowers have restricted the flow of finance to smaller enterprises. In spite of the longstanding supply-side credit policies, the share of credit flow to small enterprises appears to be deteriorating, as economic liberalization proceeds. For example, according to the ministry of finance of India, the cost and availability of credit is a major issue facing and challenging the small enterprises in India (Ministry of Finance, 2013).

Researchers also identified lack of access to external finance and weak capital base, inexperience in the field of business, particularly lack of technical knowledge plus inadequate managerial skills, lack of planning and lack of market research as causes of micro and small-scale enterprises failure (Murphy et al., 1991). Sufficient financial resources are also required for the firms to make a continuous investment in terms of employee training and education, and to initiate any innovation process in an effort to sustain their competitive advantage (Dyer et al., 2014). It is said that the performance of enterprise depends on the type of industry and country it operates (Lampadarios, 2016). The contribution of micro and small-scale enterprise to development are generally acknowledged.

Bloch and Bhattacharya (2016) concludes that small businesses tend to have a higher failure rate as compared to large organizations, although they are commonly perceived as an engine of a country's economy. For example, in Malaysia, it was found that higher number of small and medium-sized enterprises (SMEs) indicated a worse performance in the first quarter of 2016 as compared to 2015 (SME Corp, 2016). Many failure stories of SMEs reveal that their characteristics which include reactive, fire-fighting mentality, resource limitations, informal strategies, flexible structures, and lack of strategic planning processes may have contributed to their failures (Gnizy et al., 2014).

Moreover, inadequate resources issue can often influence these firms to focus on short-term rather than long-term goals, inhibit them from further development and exploitation of opportunities existing in the environment. There are also various empirical studies verifying strategic importance of technological usage is well acknowledged in the literature as a factor that could enhance business success (Chatzoudes et al., 2015). Firms that utilize the latest technology tend to capture customers more than their competitors (Valacich and Schneider, 2014). Specifically, small firms that have timely access to technical, industry knowledge, and insights into the latest technological breakthrough will be more successful. By adopting information and communication technologies, this can ease collaboration between small enterprises and their supply chain partners (Greene et al., 2015).

Other study also shows that, scholars reported internal resources and capabilities including but not limited to management skills, marketing skills, and technological capabilities (Bouazza et al., 2015). According to Chen and Zhang (2015), mainly, technological factors were responsible for enterprise success. Other studies have also shown the significant role of government supports through policies, financial, market access, technical, and infrastructure in enterprise success (Rantšo, 2016) and furthermore, a study conducted by Chowdhury et al. (2013) concludes that, lack of conducive business environment restricts the development and growth of enterprises.

The solution for solving the problem of economic growth in developing countries often resides in the performance of micro and small-scale enterprise industries. Micro and small-scale enterprises are widely recognized for their role in social, political and economic development. Their importance is apparent in its ability to provide reasonably priced goods, services, income and employment to the number of peoples. Consequently, the efficiency of micro and small-scale enterprises is closely associated with the efficiency of the country. The intention of this paper is also to scrutinize factors affecting the performance of micro and small-scale enterprises. Since, micro and small-scale enterprise in Ethiopia, in Guraghe zone, Wolkite town also employs a huge population, there positive performance can bring hope to the problem of unemployment in the zone.

Statement of the problem

Guraghe zone is endowed with many micro and small-scale enterprises. Wolkite town is also one of the towns which is endowed with this sector in this zone.

In addition to this, there is good weather condition which is favorable for many youth and entrepreneurs who want to engage in this enterprise. But, the growth and performance of micro and small-scale enterprises are neither documented and nor conducted by other researchers in this area before. Status of the nature of micro and small-scale enterprises in the area will determine major problems and possible solutions will be identified and concrete information will be identified and gathered and can also be documented for improvements of the performance of micro and small-scale enterprises highly.

The growth entrepreneurship in Wolkite town will be lead to increase in the number of micros and small-scale enterprise in the town. Micro and small-scale enterprises play a key role in economic development and contribute to the large extent to employment and poverty reduction in the town. The statement of the problem was mainly, to identify the factors that affect the performance of micro and small-scale enterprise in this zone in case of Wolkite town and the role of micro and small-scale enterprises in economic development in case of this town.

Objective of the study

General objective

The general objective of the study is to assess the factors affecting the performance of micro and small scale enterprises in Guraghe zone, in cases of Wolkite town.

Specific objective

(1) To identify factors affecting the performance of micro and small scale enterprises in Wolkite town.
(2) To identify the role of micro and small scale enterprises in economic development of the town.

Significance of the study

Based on this title, the overacting purpose of the research is to enhance our understanding of micro and small-scale enterprises performance. This research was thus intended to identify key challenges affecting the enterprises and to make an appropriate condition for readdressing and method of eliminating of them. The finding of the study will help policy maker and target groups to see the need to support the enterprises, which will create employment for the youth and also equip them with modern infrastructure and for groups, to have solutions to some of the problems.

The study will be beneficial to the following parties

Entrepreneur and manager

For the purpose of policy formulation that will create a suitable environment for micro and small-scale enterprise to increase business growth and the consequent social standard improvement.

Zone administration of Guraghe zone

The research will assist zone administration of Guraghe zone when formulating policies on planning so as to assist them to build holistic policies that will include all members in the zone of micro and small-scale enterprises

Future researchers

The study is much significant to research institutions, students, and other researchers and they will get the useful findings in their investigation in the area of study.

Scope of the study

In Wolkite town, there are many micro and small-scale enterprises operating and each of them faces some challenges, which normally prevent them from growing and also to contribute to the economy effectively. With the context, this study focus on factors affecting the performance of micro and small-scale enterprise in Wolkite town which will go a long way to represent the challenges facing micro and small-scale enterprises in the town. Looking at the limitation of this study, the researcher focuses on selected micro and small-scale enterprises, like manufacturing, construction, trade and the service sector. The research will be limited to the factors affecting the performance of micro and small-scale enterprises in Wolkite town. This study will have abundant to fail.

Limitations of the study

The characteristics of this study will have a certain limitation in the applicability of the findings. First, a more detailed questionnaire with more specific questions could be more helpful to gain a better description of the factors affecting the performance of micro and small-scale enterprises. Second, related to time, funds, infrastructure

and logistics constraint, which limited the intensity of the spread or area of coverage study. Third, since the researcher chooses the participants for the purpose of the interview. This may have biased the data in such a way that only the view of the individual in the population is represented and ignores the views of other members. Some respondents to fail to complete questionnaire given then and this limited the number of responds who were involved in the study despite the researchers' efforts and approaches to explain the potential benefits of the study to them. However, the research aims to overcome this limitation to a great extent by supplementing interviews with focus group discussion and observation.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Ethiopia, southern nation, nationalities and peoples, in Guraghe zone, Wolkite town. Wolkite town is located at 158 km from the capital city of Ethiopia Addis Ababa; its astronomical location is 070 10'08'' north latitude and 370 37' 50'' east longitude. The town has an elevation of 1,910 m (6,270 ft), which means an elevation between 1910 and 1935 m above sea level. The town was surrounded by Kebena woreda and it was part of former Goro woreda. According to CSA (2014), this city has a total population of 20,866 by whom 15,074 are men and 13,752 are women and out of this 167 were engaged in micro and small-scale enterprises.

The major activity of the town and the major investment opportunity in the town are oil factory, agro-industry, and standardized hotels. According to CSA (2014), economic activity rate in town was 95%. The town gets agricultural input manufacturing and commercial product and construction materials from Addis Ababa and gets grain products like livestock's supply natural resources and labor from the surrounding town. The major or dominant soil type in the town is that black cotton and the annual temperature is 19 to 21°C, and the annual rainfall of the town is 1294 mm and the prevailing wind direction is from east to west. The society has an interesting culture which takes as an example like preparing and constructing house design that expresses society's culture and surrounding.

Sample and sampling technique

This section discusses the sampling techniques and how the sample size is arrived at. The sampling design refers to the sampling method used to arrive at the sample size. According to Mugenda and Mugenda (2003), a sample of 10 to 30% is good enough if well-chosen and if the elements in the sample are more than 30. But, in this research, sample of 30 people was chosen, from the whole population those involved in micro and small-scale enterprises. So that the population is fairly representative. The sample was drawn from the population with the enterprise. The sampling frames were, therefore, the list of the population that is found in Wolkite town registered on micro and small-scale enterprise in the town.

Sampling technique

In sampling design, the characteristics of the population to be studied must be clearly indicated. The study adopted the quota and purposive sampling method. Quota sampling was employed to specify certain percentages to each member in an enterprise which will be done based on the member of people in each enterprise. Primarily, when there were limited members of people who have expertise in the area of study, then after allocating percentages to each group, purposive sampling was used to choose respondents who were thought to be relevant to the data needed. With the purposive sampling, not everybody can give accurate information so, head or deputy of the enterprise was interviewed.

Data source and collection

The researcher visited the various micro and small-scale enterprises and credit officers and other concerned bodies to establish the relationship with them. The researcher administered the questionnaire to the relevant respondents in an effort to achieve the necessary information. The entrepreneurs and officers of the enterprises sometimes feel reluctant to give vital information especially when it concerns the negative effects of the operations of the enterprise. The questionnaires were provided to the respondents to fill it either by themselves (if they could read and write in English) in case of micro and small-scale enterprises and staff or helped to do so. The study has applied a series of data collection tactics that included, interview and observations structured questionnaire with a closed and open-ended question that was used to collect primary data. Face to face interview was also applied to make observations. Secondary data was collected from journals, article, websites, and other relevant information.

Data collection instruments

The tool that was used for the collection of primary data is the interview schedule and questionnaires and also direct observation. Questionnaire captured closed and open-ended questions. The close-ended question deals with sex, age, access to finance, or credit services, etc. The open-ended question was included to get respondents views about the actual problems they face and how they think those problems can be solved. Through secondary data, the researcher has used websites, journals, different reference books, media and the like.

Method of data analysis

Various methods of analyzing data were used on the raw data collected to make it meaningful. Data analysis was both qualitative and quantitative. Qualitative data analysis consisted of examining, categorizing, tabulating and recombining pieces of evidence to address the research question. Quantitative analysis will be grouped into meaningful patterns and themes that were observed to help in the summarizing and organization of the data. This involves the identification, examination, and interpretation of patterns and themes in an effective manner. Quantitative analysis was done using descriptive statistics, that is, frequency counts percentages. Data from the field was edited and coded appropriately to make meaning out of them. Descriptive statistics was the medium used for analysis. It includes factors like frequency table and percentages were generated and their interpretations were explained through the real world examples.

RESULTS AND DISCUSSION

In the course of this study, 83 questionnaires were distributed to micro and small scale enterprise

Table 1. Percentage of age of respondents.

Age		Frequency	Percent	Valid percent	Cumulative percent
Valid	17-24	7	23.3	23.3	23.3
	25-35	16	53.3	53.3	76.7
	36-45	7	23.3	23.3	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 2. Percentage of sex of respondents.

Sex		Frequency	Percent	Valid percent	Cumulative percent
Valid	Female	6	20.0	20.0	20.0
	Male	24	80.0	80.0	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

participants. Overall, the contribution was obtained from micro and small-scale enterprises respondents in Wolkite town.

Discussion of frequency table for demographic characteristics

Age of the respondents

The percentage of age of the household by analysis is shown in Table 1. This result indicated that about 23.3, 53.3 and 23.3% of sample lies between 17-24, 25-35, and 36-45, respectively. Therefore, from this, it can be concluded that most the participants of micro and small-scale enterprises were those who are in working ages.

This indicates that the largest portions of the respondents are found between 25 and 35 ages which are 53.3%.

Sex of the respondents

The percentage of sex of the respondent by the analysis is shown in Table 2. This result indicated that 20 and 80% of the samples are female and male, respectively. This indicates that the largest portions of the respondents are male.

Marital status of the respondents

The percentage of marital status of the respondents by the analysis is shown in Table 3. This result indicated that 43.3, 53.3 and 3.3% of the samples are married, unmarried and separated, respectively. This indicates that the largest portions of the respondents are unmarried.

Family size of the respondents

The percentage of family size of the respondents by the analysis is shown in Table 4. This result indicates that 56.7, 26.7, and 16.7% of the samples has no family, 1 to 3 families, and 4 to 6 families, respectively. This indicates that the largest portions of the respondents are those who have no family/children.

Educational level of the respondents

The percentage of educational level of the respondents by the analysis is shown in Table 5. This result indicates that 70, 16.7, 10 and 3.3% of the samples are primary education, zero level, and diploma and graduate, respectively. This indicates that the largest portions of the respondents are primary education.

Discussion of frequency table for actual determinants

Access to business information

The percentage access to business information to the respondents by analysis is shown in Table 6. This result indicates that 53.3% of the respondents have accessed business information whereas 46.7% of the samples have not accessed business information. This indicates that more than half of the respondents had accessed business information.

Table 3. Percentage of marital status of respondents.

Marital status		Frequency	Percent	Valid percent	Cumulative percent
Valid	Married	13	43.3	43.3	43.3
	Unmarried	16	53.3	53.3	96.7
	Separated	1	3.3	3.3	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 4. Percentage of family size of respondents.

Family size		Frequency	Percent	Valid percent	Cumulative percent
Valid	No family	17	56.7	56.7	56.7
	1-3	8	26.7	26.7	83.3
	4-6	5	16.7	16.7	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 5. Percentage of educational level of respondents.

Educational level		Frequency	Percent	Valid percent	Cumulative percent
Valid	Primary education	21	70.0	70.0	70.0
	Zero level	5	16.7	16.7	86.7
	Diploma	3	10.0	10.0	96.7
	Graduate	1	3.3	3.3	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 6. Percentage of access to business information of respondents.

Access to business information		Frequency	Percent	Valid percent	Cumulative percent
Valid	No	14	46.7	46.7	46.7
	Yes	16	53.3	53.3	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Access to infrastructure

It is widely accepted that small enterprises often face shortages of infrastructure especially, with a lack of resources and this forces them to operate under severe financial and expertise constraints (Zucchella and Siano, 2014). According to the research, the percentage of access to infrastructure to the respondents by analysis is shown in Table 7. This result indicates that 50% samples had accessed and 50% of the respondents do not get access to infrastructure, respectively. This indicates that the respondents in an enterprise that had accessed infrastructure and not accessed are equal in the ratio based on the sample selected.

Access to financial service

Financial institutions also behave more cautiously when providing loans to micro and small-scale enterprises and micro and small-scale enterprises are usually charged comparatively high interest, high collateral and loan guarantees (Shah et al., 2013). The various empirical studies also verified the importance of financial resources

Table 7. Percentage of access to infrastructure of respondents.

Access to infrastructure		Frequency	Percent	Valid percent	Cumulative percent
	No	15	50.0	50.0	50.0
Valid	Yes	15	50.0	50.0	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 8. Percentage of access to financial service of respondents.

Access to financial service		Frequency	Percent	Valid percent	Cumulative percent
	No	10	33.3	33.3	33.3
Valid	Yes	20	66.7	66.7	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

Table 9. Percentage of access to managerial skill of respondents.

Access to managerial skill		Frequency	Percent	Valid percent	Cumulative percent
	No	13	43.3	43.3	43.3
Valid	Yes	17	56.7	56.7	100.0
	Total	30	100.0	100.0	-

Source: Own Survey and Ols.

for a successful business of small firms (Dyer et al., 2014).

The percentage of access to financial service to the respondents by analysis is shown in Table 8. This result indicates that 66.7 and 33.3% of the samples had accessed and not accessed financial services, respectively. This indicates that the largest portion of the respondents had accessed financial services.

Existence of skilled manager

According to Aylin et al. (2013), management skills are a crucial factor for the growth of micro and small-scale enterprises and that the lack of management skills is a barrier to growth and is one of the factors that can lead to failure.

The percentage of existence of skilled manager by the analysis is shown in Table 9. This result indicates that 56.7% were managed and 43.3% of the samples were not managed by managerial skills, respectively. This indicates that the largest portions of the respondents were managed by the skilled manager.

CONCLUSION

The purpose of this study is to investigate the factors affecting performance of micro and small-scale enterprises, age, sex, family size, educational level, access to business information, access to infrastructure, access to financial services, and access to managerial skills. The results from data analysis indicate that certain factors which are critical to the success of business performance have a positive relationship with the performance of the business. Some of the enterprises were found to still be at start-up stage mainly due to lack of access to business information, access to financial services, access to infrastructure, and access to managerial skills and the like. In general, based on the data collected and analyzed, the performance of micro and small-scale enterprises in Guraghe zone, the case of Wolkite town is highly affected due to lack of appropriate infrastructure and low level of education.

RECOMMENDATION

The findings show that the performance of micro and small-scale enterprises was affected by age, sex, family size, access to business information, access to infrastructure, access to financial service, and access to managerial skills. Therefore, based on the findings of the study, the researcher recommends the following:

(1) The government, non-government organization and

micro and small-scale enterprise development agencies should motivate, help, and advise the owner or manager and the participants of the enterprises on their overall business activities.
(2) Giving training on business issues, arrange forum and exhibition for experience sharing and solve the credit infrastructure, supply, and market access problem in collaboration.
(3) Micro and small-scale enterprise operators should device effective marketing strategies
(4) Micro and small-scale enterprises operators should improve their access to business information, access to infrastructure, access to financial service and access to managerial skills by working and making links with different enterprises.
(5) Finally, further research should be conducted to examine factors associated with the performance of micro and small-scale enterprises from time to time.

CONFLICT OF INTERESTS

The author has not declared any conflict of interest.

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Determinants of food insecurity and coping strategies of rural households: The case of Shalla District, West Arsi Zone, Oromia Region, Ethiopia

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Food security at the household level in the rural areas of Ethiopia has remained a challenging goal until today. The design and implementation of effective measures to reduce household food insecurity needs an in depth understanding of its covariates. As a result, this study was conducted with the specific objectives of estimating the situation, extent and severity of food insecurity, identifying factors influencing food insecurity and the traditional coping mechanisms used by farm households in fighting food shortage in Shalla district of West Arsi zone, Oromia region. In order to achieve these objectives, data were collected from 150 randomly selected households in three randomly selected kebeles of the district. Data was analyzed using both descriptive statistics and econometric method. The results from descriptive statistics showed that of the total surveyed households, 62% were food insecure. In addition, results revealed that there was statistically significant difference between food insecure and food secure households with regard to different demographic, economic and institutional factors. Furthermore, the self-reported months of food shortage of the surveyed households was on average 3.5 months for which they have used different traditional coping strategies. The food insecurity gap and severity of the sampled households computed using Foster, Greer and Thorbecke (FGT) indices were 8.5 and 1.4%, respectively. The results of binary logit model showed that family size in Adult equivalent (AE), age and dependency ratio had significant and positive effect on food insecurity, while gender, cultivated land, livestock ownership in Tropical livestock units (TLU), oxen ownership, fertilizer use and income from safety net had a significant and negative effect on food insecurity.

Key words: Food insecurity, Logit, Foster, Greer and Thorbecke (FGT) indexes, Shalla.

INTRODUCTION

Food security is an income issue, either in the form of one's own food production or from non-agricultural activities such as employment to access food through the market (Dione, 2004). Its absence hinders the affected groups not to participate in other economic activities. In the year 2000, World leaders committed themselves to

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the number one Millennium Development Goal (MDG) of eradicating poverty and hunger, by half the proportion of people who suffer from food insecurity between 1990 and 2015. However, the 2003 World Food Summit review, in Rome predicted that many regions would not reach their MDG targets, particularly Sub-Saharan African (SSA) countries where a third of the population is food insecure and with an actual increase (through population growth) in the number of hungry people (Food and Agricultural Organization (FAO), 2004).

Ethiopias' rural population is highly dependent on both crop and livestock production for their livelihood. However, the contribution of agriculture to food security declined as the growth in the food production could not keep pace with the population growth. The level of food insecurity also increases as to the distinction between transitory and chronic food insecurity has become increasingly blurred (PASDEP, 2005; FAO/WFP, 2012).

Ethiopian government and international donors are implementing different types of responses to food insecurity to attain food self–sufficiency and reduced food aid dependency (WFP, 2006). Regardless of substantial resources invested each year by the Government and its partners to reduce food insecurity, both chronic and transitory food insecurity problems continued at the household level (DPPA, 2010; European Union, 2012).

In fact, the general food security situation has highly deteriorated in different parts of the country particularly in Oromia (Disaster Risk Management and Food Security Sector, 2011). In Oromia region, over 90% of food supply comes from subsistence rain fed agriculture (Adgolign, 2006). But drought expanded even to previously rainfall sufficient areas and leading to fall in productivity and crop yield loss (BoFED, 2008). As a result, Oromia regional food security commission indicated that in the year 2007 alone 29% of the District found in the region are reported food insecure (ORRFSC, 2008). This magnitude increased to cover 46% of the District found in the region in the year 2011. Generally, in all zones, particularly in some part of Borena, Guji, Bale, Arsi and west Arsi and the two Hararghe zones, the general food security situation has been highly deteriorated due to the impact of the extended drought which affects the main livelihood of the society in all zones (DRMFSS, 2011).

The WAZDoPED (2012) classified Shalla District as one of the food insecure District found in the zone. Based on data obtained from WAZFS-DPPO (2011), due to recurrent drought occurring, the number of food aid beneficiaries' in the District increased from 22 thousand in 2008 to more than 40 thousands in 2011/2012. According to the same source, the District is becoming the most food insecure demanding food aid for more than 25% of the population. Furthermore, the cycle of drought, famine and distress is widely increasing in study District. Off/non-farm opportunities to improve the lives of farmers and their families are limited. With ever increasing population and recurrent drought, the household food security situation is worsening in the study area.

The problem of food insecurity takes particular forms in its extent, causes and consequences at different level of analyses. Survival strategies also differ according to the degree of the problem, season and also by region, community, household, gender and age. As a result, preparation and implementation of different policies to improve the livelihoods of rural people in Oromia and food security situation needs area specific information on the problems of food insecurity. Intervention that may be based on past research finding conducted elsewhere may lead to erroneous results. Consequently, this study was undertaken in Shalla district of west Arsi zone of Oromia region with the general objective assessing factors influencing rural households' food insecurity situation. The specific objectives of this study were:

1. To determine rural farm households' food insecurity situation, food insecurity gap and its severity in Shalla district;
2. To identify factors influencing food insecurity of farm households in the study area;
3. To analyze the coping strategies that rural farm households of Shalla district use against food insecurity.

MATERIALS AND METHODS

The study was carried out in Shalla district of West Arsi Zone of Oromia Region. It is 30 km from Shashamene and 279 km from capital Addis Ababa. The district is composed of 38 rural Kebeles[1] and the capital, Aje. The elevation of the district is estimated to be in the range between 1000 and 2300 m above sea level. There are two agro-climatic zones found in the district namely kola[2] (68%) and Woinadega[3] (32%). The mean annual temperature of the district lies between 22 and 25°C. The district gets annual mean rainfall ranging from 1000 to 1200 mm (SWFEDO, 2012) (Figure 1).

Agriculture is the primary economic activity in the district where above 95% of the population engaged. Rain-fed crop production is the dominant production system in the district. Added with recurrent drought, the less fertility of land have diminished the contribution of the sector and pronounced food insecurity in the district. The major cereal crops produced in the district are maize, wheat and teff. There are also other cereal crops produced in the district like horse bean, barley and chick peas (SWFEDO, 2012).

Three stages stratified random sampling technique with probability proportional to size was used to draw three kebeles and 150 households. In the first stage, following the agro-climates, the kebeles of district were stratified into two strata namely kola (having 26 kebeles) and Woinadega (having 12 kebeles). In the second stage, using probability proportional to size, two kebeles from kola strata namely Algee Rimaa and Leenca Lamaan, and one kebele from Woinadega namely Fandee Ejersaa were randomly selected. Finally, using a simplified formula provided by Yamane (1967), a total of 150 households were randomly selected from respective lists of farmers in the three kebeles using probability proportional to size.

The study primarily relied on primary data which were collected

[1] The smallest political administrative unit
[2] Commonly used Ethiopian term for areas of altitude 1,800 meters and below
[3] commonly used Ethiopian term for areas of altitude between 1800 and 2400 meters

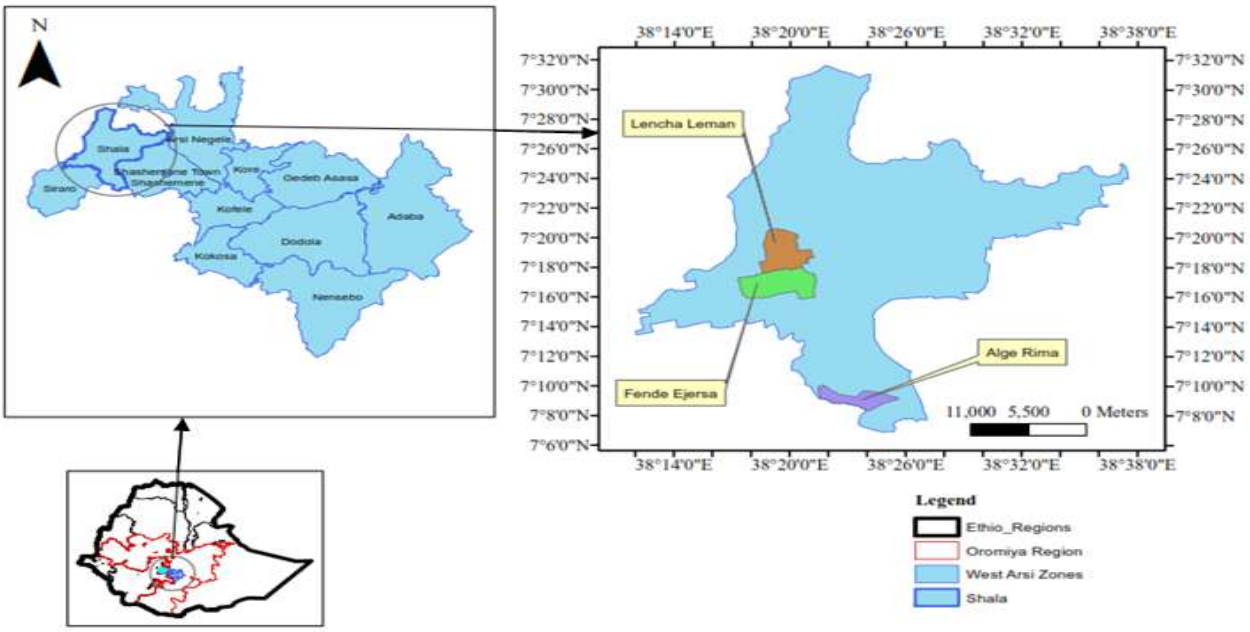

Figure 1. Map of the study area.

by using a semi-structured questionnaire. The primary data collected by the semi-structured questionnaire focus mainly on those factors hypothesized to have an effect on the food insecurity status of households. The important sub-groups included in the questionnaire were: demographic characteristics, household assets, land resources, crop output and coping mechanisms used, use of modern agricultural input, livestock ownership, agricultural extension services, marketing services, credit services, off/non-farm employment and household consumption in last seven days. Relevant secondary data sources were also assessed to supplement the primary data.

The household food insecurity status was measured by direct survey of household consumption. Interview was made in the average period where there was neither surplus (harvesting season) nor shortage. In addition, there was no drought during the survey period. The principal person responsible for preparing meals was asked how much food was prepared for consumption from purchase, stock and/or gift/loan/wage over a period of time. In this study, a seven-day recall method was used since such a measure gives more reliable information than the household expenditure method (Bouis, 1993). According to Gulled (2006), these seven days recall period is selected due to the fact that it is appropriate for exact recall of the food items served for the household within that week. If the time exceeds a week, for instance 14 days, the respondent may not recall properly what he has been served before two weeks.

Therefore, the consumption data collected on the basis of seven days recall method were converted into kilocalorie using the food composition table manual adopted from Ethiopian Health and Nutrition Research Institute (EHNRI, 1997). Then, in order to calculate the households' daily caloric intake, the total households' caloric intake for the last seven days were divided by seven. The household's daily caloric intake per adult equivalent was calculated by dividing the household's daily caloric intake by the family size after adjusting for adult equivalent using the consumption factor for age-sex categories.

The results were compared with the minimum subsistence requirement per adult equivalent (AE) per day of 2,200 Kcal which is set by the Ethiopian Government (MoFED, 2008). Accordingly, this value of minimum subsistence requirement was used as a cut-off point between food secure and insecure households in which case the household is said to be food insecure if it fails to meets this minimum and secure otherwise.

Descriptive statistical tools were employed to explain the food insecurity situation of households with respect to demographic, socio-economic and institutional variables. The specific descriptive statistics used in this study include: tabulation, frequency, percentages, mean, and standard deviation. Statistical tests like T-test and Chi-square test were also used to compare food insecure and food secure households in the study area based on different demographic, socio-economic and institutional factors. To estimate head count ratio, food insecurity gap and to assess the severity of household food insecurity the Foster, Greer and Thorbecke (FGT) index was employed which was widely used for poverty measurement studies Hoddinot (2001). Following Hoddinot (2001), the class of FGT index was specified as follows:

$$P_{\alpha} = 1/n \sum_{i=1}^{q} \left(\frac{z - y_i}{z}\right)^{\alpha} \quad ; \text{If } y_i > z \text{ then } z - y_i = 0 \qquad (1)$$

Where:
n = number of sampled households,
q = number of food insecure households,
Z = cut-off between food security and food insecurity (2200kcal/AE/day)
yi = a measure of per adult equivalent food calorie intake of the ith household
α = the weight attached to the severity of food insecurity (take values 0, 1 and 2)

Due to recurrent drought occurring in the district, food shortage became a common phenomenon. But households used a variety of mechanisms to cope up with the food deficit. Consequently these

coping mechanisms were identified and analyzed by using descriptive statistics (that is percentage).

Econometric model specification

In this study, the dependent variable Y (household food insecurity) is dichotomous variable taking value 1 if the household is food insecure and 0 otherwise. In the case where the dependent variable is dichotomous, probability regression models are the most fitting to study the relationship between dependent and independent variables (Gujarati, 2004). Therefore, in this study logit model is chosen for its simplicity and less complexity of its interpretation.

Then, following Gujarati (2004) logit model is specified as follows:

$$P_i = E(Y = 1/X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i)}} \quad (2)$$

Before the execution of the above specified logit model, the explanatory variables were tested for the existence of multicollinearity where the explanatory variables are highly intercorrelated (Maddala, 1992). In this study, variance inflation factor (VIF) was used to detect the degree of linear relationship among the explanatory variables. The result showed that there was no serious problem of multicollinearity among the explanatory variables.

Definition of variables and hypotheses

In this study, household food insecurity status was taken as the dependent variable which is explained by different demographic, socio-economic and institutional factors. Variables definition and hypothesis are given as follows.

Family size (X_1)

It refers to total family size in the household adjusted to adult equivalent consuming unit to capture the difference in food consumption by age and sex within the household. Zerihun (2009) and Indris (2012) concluded in their study that the higher the family size in adult equivalent, the higher would be the level of consumption which requires large quantity of food entailing positive relationship with food insecurity status. Thus, it is hypothesized in this study that family size in adult equivalent affects food insecurity status positively.

Sex of the household head (X_2)

It is dummy variable taking a value of 1 if the household head is male and 0 otherwise. Sex of the household head is an important determinant of food insecurity. This is because, according to Abebaw (2003) and Abonesh (2006) male headed household are in a better position to pull labor force than female headed ones. In addition, Kassie et al. (2012) concluded in their study that due to differences in access to resources, female headed households are more likely to be more food insecure than male headed households. Therefore, it is hypothesized that male headed households are less likely to be food insecure.

Age of the household head (X_3)

It refers to the period from his/her birth to the time of interview and was measured in years. According to Abebaw (2003), age of household head is negatively related with food insecurity in that households acquire experience and knowledge in farming and accumulate wealth through time which would enable them to be food secure than younger households. But according to Indris (2012), age of the household head is positively related with food insecurity in that food insecurity increases with the increase of age due to the fall in labor force of an individual so as to participate in different income generating activities which in turn helps households to access food. As a result the sign of age is pre-indeterminate.

Land cultivated (X_4)

This refers to cultivated land size measured in hectares. Since it reflects ownership of an important resource, it is expected that, it would decrease the likelihood of household to become food insecure. That is, households with large cultivated land size would be expected to produce more and to be more food secure than those with less cultivated land. Thus, size of cultivated land and food insecurity were expected to be negatively related in accordance with the results of different researchers (Lewin and Fisher, 2010; Arene and Anyaeji, 2010).

Dependency ratio (X_5)

It measures the number of members in non-working age group supported by those in the working age group; therefore it is a measure of the pressure on productive households. It is calculated by dividing household members below age of 15 and above 64 to that number of member in the age range of 15 up to 64. Arene and Anyaeji (2010) and Indris (2012) concluded in their study that dependency ratio positively affects food insecurity status of households. Thus, in this study it is hypothesized that dependency ratio contributes positively to the households food insecurity status.

Livestock owned (X_6)

It refers to the number of livestock owned by the household in terms of tropical livestock unit (TLU). Livestock contribute to household's economy in different ways: as a source of pulling power, source of cash income, source of supplementary food and means of transport. In addition, livestock are considered as a means of security and means of coping strategy during crop failure and other calamities. Thus, households with more number of livestock have a better chance to be food secure and thus, have less risk of food insecurity. Adugna and Wogayehu (2011) in their study in Wolayita, found that households with less number of livestock have more probability to be food insecure than households with more number of livestock.

Education level of the household head (X_7)

This refers to the formal years of schooling attained by the household heads. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs and diversification of household incomes which, in turn, would enhance household's food supply. Thus, negative relationship between education level of the household heads and household's food insecurity is expected in this study in accordance with many other studies result (Frehiwot, 2007; Ayantoye et al., 2011; Lewin and Fisher, 2010; Arene and Anyaeji, 2010).

Oxen owned (X_8)

This refers to the number of oxen owned by the household to undertake its farming activities. Oxen are one of the important farm assets and are the major source of traction power in the study area. Abebaw (2003) noted that there is a symbolic relationship between crop production and oxen ownership in the mixed farming system. In addition, oxen provide manure and draught power to crop cultivation and therefore used to boost crop production. Therefore, ownership of more oxen power would enable households to have better chance to escape serious food shortages. The same result was also obtained by Habtom et al. (2005) in Koredegaga, Oromia region, Ethiopia. As a result, it is expected that number of oxen owned and food insecurity be negatively related.

Contact with development agents (X_9)

It refers to the frequency that a farmer visited development agents for technical guidance. The higher the contact between the farmer and the development agent, the more information and technology flows from the latter to the former which in turn widens the household's knowledge with regard to the use of improved variety and agricultural technologies. Therefore, those farmers with frequent contact are likely to produce more and become food secure than others and thus, reduce risk of food insecurity. Lewin and Fisher (2010) in their study in Malawi, found that farmers who are less frequently visited by the development agent are more food insecure than those farmers with frequent contact.

Proximity to market center (X_{10})

This refers to the distance between the farmers' home and the nearest market that the household usually made transaction which is measured in kilometers. This is included because proximity to market center creates access to additional income by providing non-farm employment opportunities and easy access to inputs, extension and transportation. It is therefore hypothesized, in this study that the nearer the household to the market center, the less would be the probability of being food insecure. The same result was also obtained by Lewin and Fisher (2010). Therefore, in this study it is hypothesized that proximity to market center is positively related with food insecurity.

Fertilizer use (X_{11})

This refers to the use of chemical fertilizers such as urea and Di Ammonium Phosphate (DAP) to improve farm productivity. Here, it is measured as the total amount applied in the farm land of the household in the survey year in kilograms. Fertilizer use has often been perceived as improving farm productivity per unit area. Thus, households using more kilograms of fertilizer are expected to be more food secure than others. Zerihun (2009) and Adugna and Wogayehu (2011) concluded in their study that households using more quantity of fertilizers were more food secure than others. Hence, fertilizer use is hypothesized contributing negatively to food insecurity.

Improved seed use (X_{12})

This refers to those seeds that come out of research centers. Use of improved seed is expected to give better or more yield than local seed per unit area which in turn reduces the probability that the household become food insecure. As a result, households using improved seeds on their farm land have more potential of producing more crop output which in turn helps them to reduce risk of food insecurity. Adugna and Wogayehu (2011) concluded in their study that households not using improved seeds have more probability of being food insecure than others. As a result, use of improved seed is hypothesized to be negatively related with food insecurity.

Credit use (X_{13})

This refers to the amount of money borrowed from different sources. According to Abebaw (2003), credit for the purpose of consumption or purchase of agricultural inputs like improved seed, chemical fertilizers, etc improves the food security status (reduce risk of food insecurity) of the households. Consequently, households who are getting the amount of credit they required were expected to have more probability of being food secures than others. The result of Ayantoye et al. (2011) in Nigeria also confirms this result. Similarly, in this study it is hypothesized that the amount of credit received is negatively related with food insecurity.

Income from safety net (X_{14})

This refers to income earned from safety net by working on safety net public works or through direct support. The study area is one of the food insecure Districts under productive safety net program (PSNP in west Arsi zone. Households in the study area mostly cover their food shortfall through the income received by working on safety net public works. Therefore, households who have received higher income from safety net are more likely to reduce the risk of food insecurity than others. Zerihun (2009) concluded similar result in his work. As a result, income received from the safety net is expected to affect food insecurity negatively.

Income from off/non-farm activities (X_{15})

This refers to the sum total of earnings generated in the survey year from activities outside farming like retail trading business, casual work on wage basis, etc. When crop production output and income earned from sales of livestock and livestock products are inadequate, households often look for other income sources other than agriculture to push themselves to the threshold of securing access to food (Abebaw, 2003). Consequently, income earned from such activities enables households to reduce the probability of being food insecure. As a result, it is hypothesized that households who managed to earn higher off/non-farm income are less likely to be food insecure.

RESULTS AND DISCUSSION

Descriptive results

Food insecurity status of the sampled households

Results of food insecurity status of the sampled households based on the minimum recommended calorie requirement of 2200 kcal/day/AE shows that out of the total surveyed households, 62% were food insecure while only 38% were food secure (Table 1). The mean per capita calorie intake of the sampled household was 2147.22 kcal, which was lower than the minimum calorie requirement of 2200 kcal. Food insecure and food secure

Table 1. Kilo calories per day per adult equivalent of the sampled households.

Kilocalories per day per adult equivalent	Food insecure (62%)	Food secure (38%)	Total households (100%)	t-value
Minimum	1475.12	2205.46	1475.118	
Maximum	2190.90	3359.07	3359.065	
Mean	1898.83	2552.48	2147.22	18.01***
Standard deviation	137.23	302.08	383.74	

Note: ***Significant at 1% probability level; Source: Field survey, 2013

Table 2. Sex and food insecurity status.

Categorical variables	Food insecure		Food secure		Total		χ^2 -value
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Sex							
Male	68	73.12	52	91.23	120	80	7.24***
Female	25	26.88	5	8.77	30	20	

Note: ***Significant at one percent probability level; Source: Field survey, 2013

Table 3. Food insecurity status and demographic characteristics of the households.

Food insecurity status	Statistic	Age	Family size	Dependency ratio	Education
Food insecure	N	93	93	93	93
	Mean	44.08	4.72	1.82	1.73
	SD	7.33	1.26	0.84	2.4
Food secure	N	57	57	57	57
	Mean	39.19	4.04	1.36	2.64
	SD	5.47	0.89	0.4	2.89
Total households	N	150	150	150	150
	Mean	42.22	4.47	1.64	2.08
	SD	7.07	1.18	0.74	2.65
	t-value	-4.34***	-3.62***	-3.88***	2.08**

Note: *** and **Significant at 1 and 5% probability level, respectively; Source: Field survey, 2013

households were getting the mean calorie of 1898.83 and 2552.48 kcal/AE/day, respectively. There was statistically significant mean difference in per capita calorie intake between food secure and food insecure households at one percent probability level.

Demographic characteristics of households

According to the survey results presented on Table 2, from the total sampled households, male headed households accounted for 80% while female headed households accounted for 20%. With this participation, female headed households were more food insecure which accounted for about a quarter of the total food insecure households or 83.33% of the total female headed households. In addition, male headed households accounted for about 91.23% of the total food secure households or 43.33% of the total male headed households. There was statistically significant proportion difference between food secure and food insecure households in terms of gender at one percent probability level. Thus, the result shows that there was great disparity of food insecurity status due to gender difference among the household heads.

The results of the survey (Table 3) show that the average age of food insecure household heads (44.08 years) was greater than the average age of food secure households heads (39.19 years). In addition, in the study area food insecure households were characterized by large family size in adult equivalent and high dependency ratio. The result then shows that food secure households

Table 4. Food insecurity status of the households and the economic factors.

Food insecurity status	Statistic	Cultivated land	Livestock owned	Oxen owned	Off/non-farm income
Food insecure	N	93	93	93	93
	Mean	1.37	2.69	0.71	188.57
	SD	0.63	2.23	0.75	100.29
Food secure	N	57	57	57	57
	Mean	1.95	5.79	1.75	399.68
	SD	0.65	4.65	1.37	151.73
Total households	N	150	150	150	150
	Mean	1.59	3.87	1.11	288.15
	SD	0.69	3.67	1.14	164.82
	t-value	5.36***	5.48***	6.06***	6.04***

Note: ***Significant at 5% probability level; Source: Field survey, 2013

Table 5. Food insecurity status and institutional factors.

Food insecurity status	Statistic	Fertilizer	Improved seed	credit	Contact with DA	Income from safety net	Proximity to market center
Food insecure	N	93	93	93	93	93	93
	Mean	74.35	48.35	186.39	2.95	771.86	14.71
	SD	38.88	28.97	108.9	1.84	271.34	3.45
Food secure	N	57	57	57	57	57	57
	Mean	132.84	73.86	288.70	4.21	960.48	14.14
	SD	69.72	45.66	361.00	2.52	332.06	2.66
Total households	N	150	150	150	150	150	150
	Mean	95.21	59.76	234.41	3.43	828	14.49
	SD	58.92	39.32	261.86	2.2	301.59	3.18
	t-value	6.45***	3.77***	1.38	3.52***	2.72***	-1.07

Note: *** and **Significant at 1 and 5% probability level; Source: Field survey, 2013

numbers of dependents living in the food secure households were also few relative to food insecure households. Furthermore, food secure households had also achieved more grade level than food insecure households which may help them to reduce the risks of food insecurity.

Economic factors

Average cultivated land of the sampled households was 1.59 ha with a standard deviation of 0.69 (Table 4). This average was greater than the national average of 1.18 ha and the zonal average of 1.42 ha (CSA, 2011). The average cultivated land was 1.37ha (SD=0.63) and 1.95ha (SD=0.65) for food insecure and food secure households, respectively. In addition, food secure household were also in a better economic condition having large livestock in Tropical livestock unit (TLU) and large number of oxen which are very crucial to determine the food security status of households in rural areas. Income earned from off/non-farm activities which are expected to supplement crop and livestock production was also relatively higher for food secure household in the study area. Therefore, the socio-economic analysis of the study area shows that food secure households possessed more resources which have boosted their production level and helped them to reduce the risks of food insecurity.

Institutional factors

The institutional factors analysis of the study area (Table 5) also shows the food secure households were relatively in a better condition. Food secure households have used more amount of fertilizer (132.84 kg) and improved seed (73.86 kg) on their cultivated land which are very important input to increase production and productivity levels of farmers in the study area. Thus, use of more

Table 6. Distribution of household heads by the number of months of food shortage.

Number of months of food shortage	Food insecure		Food secure		Total households	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	0	0	3	33.33	3	3.03
2	16	17.78	5	55.56	21	21.21
3	32	35.56	1	11.11	33	33.33
4	16	17.78	0	0	16	16.16
5	17	18.89	0	0	17	17.17
6	9	10.00	0	0	9	9.09
Total	90	100	9	100	99	100
Mean (SD)	3.68 (1.25)		1.78 (0.67)		3.5 (1.33)	
t-value	-		-		-4.47***	

Note: ***Significant at 1% probability level; Source: Field survey, 2013

yield increasing input by food secure households has helped them to reduce the risk of food insecurity relative to food insecure households who have cultivated very small size of land by applying less of these inputs.

The mean amount of credit received by the food insecure households was Birr 186.39 (SD=108.9) while the average amount of credit received by the food secure households was Birr 288.70 (SD=361.00). The result was in agreement with the hypothesis made that the more the number of contact between the farmer and development agent, the less the probability of households to become food insecure. In addition, the mean annual income was Birr 771.86 (SD=271.34) and Birr 960.48 (SD=332.06) for food insecure and food secure households during the survey year, respectively. Results presented in Table 5 also shows that the mean distance of food insecure households to the nearest market was 14.71 Km while it was 14.14 Km for their counterparts.

Household food deficits

In this specific survey (Table 6) out of the sampled households only 34% reported that what they produced in the reference year was enough to feed their family. While the remaining 66% reported food deficit of an average 3.5 months during the survey year with the minimum of one month and a maximum six months. Among households reporting food deficit, 9% of them were from food secure households while the majority (91%) were from food insecure households. The result shows that food insecure households were facing more number of months of food shortage than their counterparts.

Causes of household food deficits

Households who had reported to had food deficit in the survey year were also asked to list the cause of food deficit in order of their importance. Food insecure and food secure households accounted at about 73.12 and 57.89% mentioned the delay and absence of adequate rainfall as the first and the most pressing problem, respectively. The other most common causes of household food deficit in the study area were listed in Table 7.

Households coping mechanisms against food deficits

As indicated, 66% of the surveyed households had reported food deficit of at least one month and above (Table 8). Then the next question raised for these households was to ask them ‘how did you cope with the food deficit’? They were asked how they were managing the problem of food shortage. Among the most common copping strategies practiced by majority of the households in the study were reducing adults’ meal for children to eat, reducing number and size of meals. But with the extension and increase in the severity of the problems households were also forced to practice the other different copping strategy against food deficit.

Extents of households food insecurity

In the study area, the head count index or the incidence of food insecurity was found to be 0.62 implying that 62% of sampled households could not meet the minimum recommended energy requirement. The food insecurity gap index (P_1) came out to be 0.085. This means that the extent of calorie deficiency gap for the sampled household was 187 Kcal/AE/day. That is, an average of 187 Kcal/AE/day of additional energy food was needed to lift households out of food insecurity. Furthermore, the survey result revealed that the severity of food insecurity in the study area was 0.014 which means that the

Table 7. Major causes of households' food deficit.

Cause of food deficits	Food insecure (%)	Food secure (%)	Total (%)
Delay and absence of adequate rainfall	73.12	57.89	67.33
Insect or pest infestation	-	1.36	0.52
Shortage of oxen	26.88	5.26	18.66
Shortage of cultivated land	46.24	20.25	33.33
Shortage of agricultural input	8.25	15.25	10.91
Less fertile land	11.83	37.54	21.6
Lack of credit	10.13	7.69	9.2
Poor health of farmer	6.15	4.51	5.52
Divorce	3.26	-	2.02
Weed infestation	2.25	3.25	2.63
Price rise in agricultural input	26.00	34.04	29.06
Shortage of labor	6.00	2.25	4.58

Source: Field survey (2013).

Table 8. Most commonly used coping mechanisms.

Coping mechanisms	Food insecure (%)	Food secure (%)	Total (%)
Sale of more livestock than usual	21.51	78.95	43.33
Borrowing of food or cash	44.09	26.32	37.31
Renting out of productive assets(example, land)	26.88	36.84	30.67
Child labor supply	49.46	47.37	48.67
Reduced expenditure on health and education	33.33	28.07	31.33
Reducing expenditure on productive inputs (example, fertilizer, seeds, livestock drugs, etc.)	38.71	21.05	32.00
Short term/seasonal migration	4.30	14.40	8.00
Seek alternative or additional jobs	31.18	5.26	21.33
Rely on less preferred and less expensive food	29.03	28.07	28.67
Reduced meal size	75.27	52.63	66.67
Reduced adults meals for children to eat	92.47	92.98	92.67
Reduced number of meals eaten in a day	86.02	70.18	80.00
Gifts from neighbors and relatives	7.53	10.53	8.67
Receiving relief food	55.91	35.09	48.00
Participating in cash basis safety net public works	10.72	3.51	8.00

Source: Field survey, 2013

severity of food insecurity among the sampled household was 1.4%.

Econometric model results

Determinants of food insecurity

Binary logit model was used to identify the determinants of food insecurity. The model which was estimated using STATA version 11.1 revealed the following results (Table 9). The estimate value of Chi-square was 108.35 which was significantly higher than the critical Chi-square value of 30.58 with 15 degrees of freedom at one percent significance level. Thus, we can say that at least one of the parameters of the determinants of food insecurity included in the model was significant or the hypothesis that all the coefficients, except the intercept were equal to zero was rejected, implying the model was a good fit (Table 9).

The predictive efficiency of the model as a measure of goodness of fit test in the logistic model was also seen by using the overall predictive efficiency (Count R^2). Results in Table 9 showed that out of 150 total surveyed households, 86% (that is 129 households) were correctly predicted by the model. In addition, regarding the

Table 9. The maximum likelihood estmates of logit model.

Variables	Coef.	Std. Err.	P>/Z/	ME
SEXHH	-2.040	0.806	0.011	-0.377
AGEHH	0.164	0.059	0.006	0.03
EDUCLEVEL	-0.222	0.092	0.216	-0.041
FAMSZEAE	0.994	0.377	0.008	0.184
DEPRTIO	1.287	0.505	0.011	0.238
LANDCULT	-1.793	1.037	0.084	-0.331
FETRIUSE	-0.017	0.010	0.085	-0.003
IMPRSEED	-0.016	0.010	0.124	-0.003
TLU	-0.242	0.139	0.081	-0.045
NMBOXEN	-0.884	0.513	0.085	-0.163
CONTDA	-0.040	0.170	0.813	-0.0074
CREDITU	-0.001	0.003	0.641	-0.00025
PROXMRKT	0.053	0.087	0.539	0.0099
NONAOFRM	-0.003	0.002	0.225	-0.00047
SAFET	-0.002	0.001	0.006	-0.00035
Constant	-11.916	3.214	0.245	
Percent correctly predicted (count R^2)[1]				86.00%
Sensitivity[2]				88.17%
Specificity [3]				82.46%
LR chi-square				108.350***
Log likelihood				-45.434
Number of observation				150

[1]Based on 0.5 cut value
[2]Correctly predicted food insecure group based on 0.5 cut value
[3]Correctly predicted food secure group based on 0.5 cut value
Note: ***, **,* are significant at 1%, 5% and 10% probability level, respectively.Source: Model output.

predictive power of the model within the group, 88.17 and 82.4% of food insecure and food secure households were correctly predicted by the model. Therefore, the model is good enough in classifying the surveyed households into food insecure and food secure households and it is appropriate for the data.

The logit model results also revealed that among fifteen explanatory variables considered, nine were statistically significant (Table 9). These include, age of household head, sex of the household head, family size in adult equivalent, dependency ratio, cultivated land size, fertilizer used, livestock holding in Tropical livestock unit (TLU), number of oxen owned and income from safety net. They significantly affected households' probability of being food insecure at different probability levels. The signs of all explanatory variables were as expected. The discussions of significant variables are as follows:

Sex of household heads

It had significant and negative relationship with the household food insecurity status. It was significant at 5% probability level. The negative sign showed that male headed households were more likely to be food secure than female headed households. Other factors remaining constant, food insecurity decreased by 37.7% for male headed households than female headed households. The possible explanation was the differential access to production resources where male had more access to production resources like cultivated land than females. This was similar with the work of different individuals (Firew, 2007; Zerihun, 2009 and Indris, 2012). Thus, it can be inferred from the result that sex difference in headship of the farm households was one cause of households' food insecurity.

Family size

This variable was found statistically significant (at one percent probability level) and had positive relationship with the household food insecurity status. The positive sign showed that the probability that the household was food insecure increased as the family size in adult equivalent increases. Other variables remaining constant, increased in the family size in adult equivalent by a unit, increased the probability that the households was food

insecure by 18.4%. The underlying reason was the fact that as family size increased, with limited resources additional family member increased the vulnerability of households to food insecurity by contributing more to consumption than to production. The result was in conformity with the works of Zerihun (2009) and Indris (2012).

Age of household heads

It had significant (at one percent probability level) and positive relationship with the household food insecurity status. The positive sign showed that the probability that the household was food insecure increased as the age of household head increases. Other variables remaining constant, increased in the age of the household head by one year, increased the probability that the household was food insecure by 3%. The possible explanation was that with the small pieces of land supporting the households, as the age of the household head increased, labour force of an individual would fall so as to participate in other different income generating activities which in turn increased exposure of households to food insecurity. This result was in conformity with the works of Indris (2012).

Dependency ratio

It had positive and significant relationship with the household food insecurity status. It significantly affected the food insecurity status of households at 5% probability level. The positive sign showed that the probability of becoming food insecure was high for households where productive members were less than unproductive members. Other variables remaining constant, the probability that the household was food insecure increased by 23.8% as the dependent age group increased by a unit. The possible reason was that high dependency ratio results in large numbers of dependents in the households with less contribution to production of households which in turn increased risk of food insecurity to the household. This was in conformity with the works of Adugna and Wogayehu (2011) and Indris (2012).

Land cultivated

It had significant (at ten percent probability level) and negative relationship with the household food insecurity status. The negative sign showed that the probability that the household was food insecure decreased as cultivated land increases. Other variables remaining constant, increased in cultivated land by one hectare, decreased the probability that the household was food insecure by 33.1%. The possible explanation was that, when cultivated land increased, households would be able to minimize its production risks or would be able to produce more which in turn helped to reduce food insecurity problem of his family. This result was in conformity with the hypothesis of this study and the works of Zerihun (2009).

Fertilizer use

This variable was found statistically significant (at ten percent probability level) and had negative relationship with the household food insecurity status. The negative sign showed that the probability that the household was food insecure decreased as the amount of fertilizer used increased. Other variables remaining constant, increased in the amount of fertilizers applied by one kilogram, decreased the probability that the household was food insecure by 0.3%. The possible explanation was that, increased in the use of fertilizer increased productivity and production. In addition, in the descriptive results it was shown that, less fertility of cultivated land was among the major cause of household's food deficit in the area which in turn was increasing the problem of food insecurity in the area. As a result, use of increased amount of fertilizer could minimize the problems and furthermore could improve the problem of food insecurity. This result was similar with the results of Adugna and Wogayehu (2011).

Livestock holding

It had negative and significant relationship with the household food insecurity status. It significantly affected the food insecurity status of households at ten percent probability level. Other variables remaining constant, increased in the number of livestock holding in Tropical livestock unit (TLU), decreased the probability that the household was food insecure by 4.5%. The possible explanation was the fact that, households with large number of livestock in tropical livestock unit had better chance of earning more income from livestock production. This in turn helped households to buy foods when they faced shortage and invested for the purchase of farm input which increased production and thus ensuring food security at the household level. Similar result was also obtained by Indris (2012).

Number of oxen owned

This variable was found statistically significant and had negative relationship with the household food insecurity status. It significantly affected the food insecurity status of the households at ten percent probability level. Other variables remaining constant, increased in the number of

oxen owned by one, decreased the probability that the household was food insecure by 16.3%. The possible explanation was that oxen as the most traction power in the area, helped households to produce more by themselves or to earn income by renting their oxen to others which in turn helped households to access food. Similar result was also obtained by Zerihun (2009).

Income from safety net

It had negative and significant relationship with the household food insecurity status. It was significant at one percent probability level. The negative sign showed that, households with large income from safety net had more probability of becoming food secure than others. The possible explanation was that the program provided additional income for the households with which they purchased foods from the market when their stock was very low and thus ensuring food security for their family. Other variables remaining constant, increased in income from safety net by one Birr, decreased the probability that the household was food insecure by 0.035%. The result was in conformity with the result of Zerihun (2009).

CONCLUSION AND RECOMMENDATIONS

The result of this study shows that 62% of the surveyed households were unable to get the minimum daily energy requirement. In addition, the food insecurity gap and severity of food insecurity was also high calling for intervention. Important factors positively related to food insecurity were age, gender, family size and dependency ratio. Therefore, interventions intended to help food insecure households in the area have to give priority to old aged and female headed households. Furthermore, strengthening capacity of females through education should be an integral part of the intervention. Households should also be educated on the need to adopt the family planning techniques so that they may bear the number of children which their resources can accommodate. Since majorities of the households in the study area are Muslims, natural birth control and other alternatives should be carefully assessed by considering the culture and religion aspects of family planning facilities.

Land, livestock and oxen ownership were negatively related with the food insecurity status of households in the study area. However, with an increase in population size of the District, land was becoming in short supply and the farmers were forced to produce crop on small plot of land (WAZDoPED, 2012). It is, therefore, important that the zonal and regional government should integrate development of the rural sector, the spread of small-scale industries throughout the rural areas and the reorientation of economic activity through promoting off-farm and non-farm employment opportunities. This could shift some proportion of households from entire reliance on land. Furthermore, livestock development packages must be introduced and promoted to increase their production and productivity. In addition, farmers' capital problem should be solved through enhancing rural credits to the farmers. But provision of rural credit in the area should address the religious practice of households in the area. In addition, to increase their production and productivity necessary efforts should be made to provide improved water supply, sustainable forage program and veterinary services.

Income generated from safety-net was found to have negative effect on food insecurity status of households. This is because; safety nets in addition to meeting the immediate consumption needs of vulnerable households are intended to enhance productivity by allowing investment in agricultural input and prevent asset depletion of households which in turn complement households effort to manage potential shocks. Therefore, the program should continue its operation through proper targeting and identification of beneficiaries, and its fruit should be monitored and evaluated on continuous basis.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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