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The effect of socioeconomic factors on household agro-enterprise incomes amongst dryland farming communities in Chepareria ward, Kenya

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Dry lands cover over 40% of the Earth's land surface, and 84% of Kenya's land mass consists of arid and semi-arid lands (ASALs). Chepareria Ward in West Pokot County, Kenya, is among the most degraded ASALs. Since 2014, the Dryland Farmers Research Network (DFRN) project, a soil and water conservation (SWC) initiative, has been implemented in Chepareria Ward. All SWC activities are community-driven and anchored on the circular economy principle of agro-ecology. The study aimed to identify socio-economic determinants of household agro-enterprise incomes in Chepareria Ward. It adopted a cross-sectional design that involved a survey of 400 farmers. Among these, 200 respondents were randomly selected from DFRN Project farmer beneficiaries in four locations, and an additional 200 non-DFRN farmers were interviewed from four other locations. Data were analysed using descriptive statistics and logistic regression models. The study found household head age, female-headed households, household size, head of household education, household land size, and household income to be significant determinants of household agro-enterprise incomes. The study concluded with recommendations for development practitioners, policymakers, and future research.

Key words: Circular economy, crop enterprises, household, livestock enterprises, West Pokot County.

INTRODUCTION

Dry lands cover over 40% of the Earth's land surface and are inhabited by more than two billion people (Davies, 2012; IUCN, 2017). In Kenya, drylands make up approximately 84% of the total land surface (Barrow and Mogaka, 2022) and provide economically valuable essential provision services such as livestock and plant production, as well as water supply (Adeel et al., 2005;

IUCN, 2012). Ngugi and Nyariki (2005) argue that by harnessing these services, the well-being of households in dryland areas can be enhanced through non-extractive or extractive livelihoods. West Pokot, one of Kenya's 47 counties, is a dryland region located within Longitudes 34° 47' and 35° 49' East and Latitudes 10° and 20° North. It covers an area of approximately 9,169.4 km² and

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experiences a bimodal type of rainfall (CIDP, 2018). The poverty rate in the region is reported to be 57.4% (KIHBS, 2016), and the livelihood economy is predominantly pastoral, relying on natural resources such as pasture, water, fuelwood, timber, and wild fruits (CIDP, 2018; RoK, 2017b; Wairore et al., 2019). The average per capita landholding stands at 20 acres, with a primarily rural population dependent on pastoralism as the main source of livelihood (CIDP, 2018; RoK, 2017; Wairore et al., 2019).

The agriculture and livestock sector accounts for 84% of the county's economy. Environmental degradation, characterized by gully erosion and low vegetation cover, is a common challenge in the county, attributed to factors such as deforestation, charcoal burning, forest encroachment, unsustainable farming methods, overgrazing, sand mining, and severe soil erosion (CIDP, 2018). Household socio-economic characteristics (SECs) play a crucial role in determining agro-enterprise development. The lack of comprehensive assessments of the socio-economic factors influencing agro-ecological transitions in sub-Saharan Africa is evident. Anderson et al. (2019) identify key elements facilitating or hindering this transition, including access to knowledge, securing land, obtaining seeds, and accessing water, among others. Market access is also a critical aspect, but Sinclair and Coe (2019) note that farmer support and public incentives often favour subsidizing modern agricultural practices, hindering the adoption of agro-ecological approaches.

While agricultural yields have dominated policy discussions in recent years (Seufert and Ramankutty, 2017; FAO, 2016), focusing solely on yields provides limited insights into the economic viability of agricultural practices or businesses (Crowder and Reganold, 2015; Seufert and Ramankutty, 2017). The authors argue that understanding the value or price of agricultural output is essential for assessing the revenues of agricultural businesses. However, realized revenues must be considered in the context of the socio-economic environment in which farmers operate. Thus, SECs are critical factors influencing agro-enterprise development. SECs encompass a multidimensional concept reflecting the status of an individual or household within society (Marmot et al., 2008). Therefore, measuring SECs is crucial for planning and policy-making in the agricultural development sector (Hagdoost, 2012). Factors such as age, family size, gender, experience, education, social status, and land ownership, among others, determine access to labour, credit, agricultural inputs, technology, markets, and more, significantly influencing smallholder farm incomes (Diaz et al., 2022). Empirical research findings (Nouman et al., 2013) underscore the vital role of farmers' socio-economic characteristics in determining farm incomes. Through the Drylands Farmers Research Network (DFRN) project, the University of Eldoret has been assisting communities in Cheparareria Ward, West

Pokot County, in addressing soil and water degradation challenges since 2014. Significant accomplishments of the project include the organization and capacity building of farmers, fostering a positive community attitude toward land conservation, constructing soil and water structures, and promoting the selection and adoption of dryland crop varieties (Drylands FRN, 2019). The sustainability of these achievements is currently a pressing concern for the Drylands FRN team. They emphasize that the economic empowerment of local communities provides better opportunities for sustaining soil and water conservation (SWC) activities beyond the project's lifespan (Drylands FRN, 2021). The objective of this study was to analyse how socioeconomic factors influence agro-enterprise incomes in households in Cheparareria Ward. The study's recommendations aim to inform development practitioners, such as the DFRN project, and policymakers at the county and national government levels involved in addressing land rehabilitation issues in arid and semi-arid areas (ASAL).

MATERIALS AND METHODS

Study area

The study was conducted in Cheparareria Ward, characterized as an agro-pastoral area with an estimated population of 41,563 (KNBS, 2019). Data collection targeted farmers involved in soil and water conservation (SWC) activities, distinguishing between those participating in the DFRN project and those who were not (Non-DFRN farmers), as illustrated in Figure 1. DFRN respondents were selected from four project areas: Chepturunguny, Korellach, Senetwo, and Cheparer locations. Non-DFRN respondents were sampled from Pserum, Sharpogh, Tampalal, and Ywalateke locations, randomly chosen from the 11 non-DFRN locations. The study utilized a cross-sectional survey design to investigate the socio-economic impact on agricultural enterprises within local households. Both primary and secondary data were collected, with primary data acquired through interviews with respondents and focused group discussions (FGDs). Additionally, qualitative data were obtained through semi-structured interviews, such as FGDs and literature reviews. Secondary data were gathered from literature reviews, including project reports, government reports, and empirical research materials.

Sample size and sampling strategy

The number of households supported by DFRN Project from the treatment population was 322 (DFRN, 2020). A simplified formula (Yamane, 1967) for proportion was used to establish sample size for the treatment group. Sample size was determined using the following formula (Equation 1):

$$n = N / [(1 + N(e)^2)] \quad (1)$$

where n = corrected sample size, N = population size, and e = Margin of error (MoE), and $e = 0.05$ based on the research condition. A survey sample size of the treatment (DFRN) group was thus established at $n = 322 / (1 + 322 \times 0.0025) = 178.4$, rounded off at 200 households. An equal sample size (200) was considered for the control group (Non-DFRN) that was randomly sampled from the non-beneficiary regions. The sample size was distributed

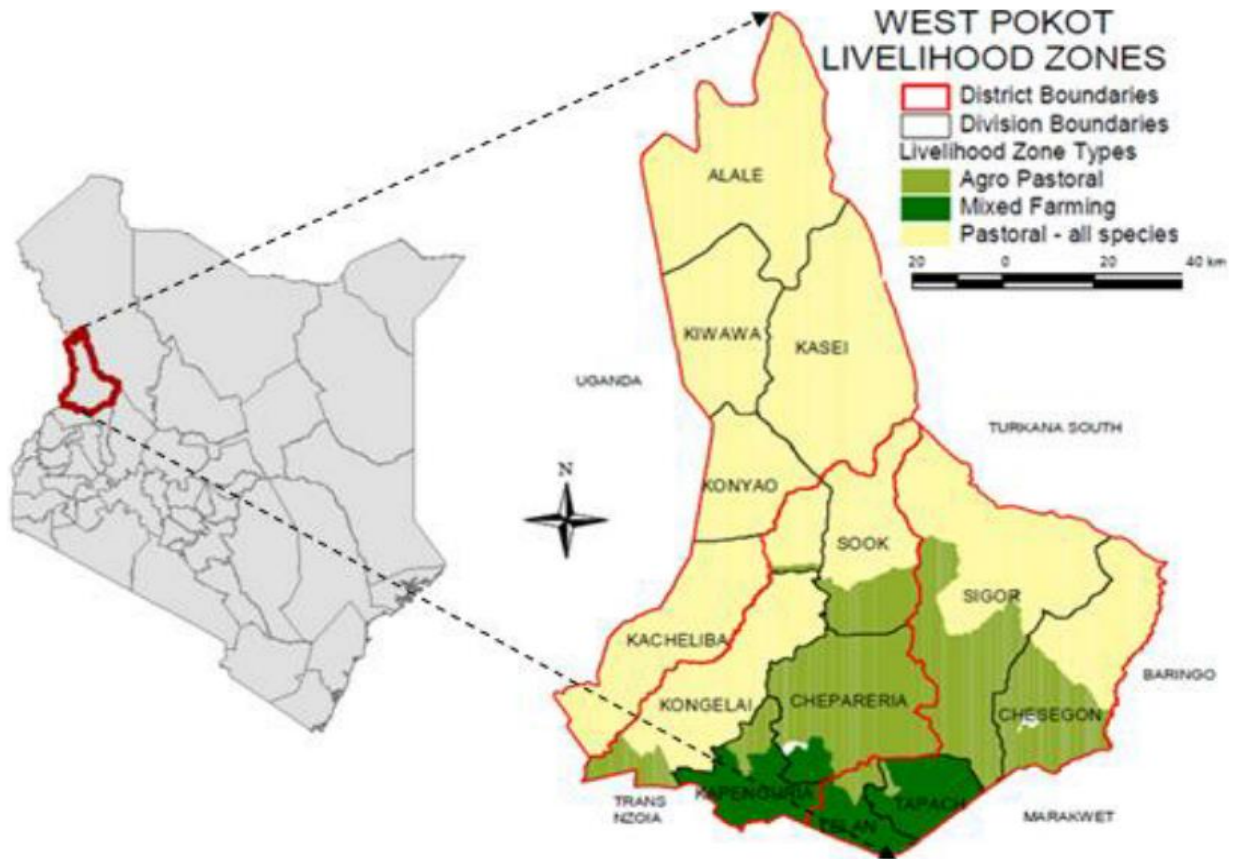


Figure 1. Location of West Pokot County in Kenya and inset Chepareria Ward in West Pokot County.

proportionately across four regions sampled from the 11 regions not served by DFRNP in Chepareria Ward.

Data collection

The study employed Simple Random Sampling to select 400 farmers, with an equal distribution of 200 participants from the DFRN project and 200 non-DFRN beneficiaries, for the household survey. A structured questionnaire was developed, pre-tested, and used to collect primary data from the sampled smallholder farmers in the study area. The primary goal was to identify agro-pastoral enterprises and analyse the socio-economic determinants of their efficiency using digital Open Data Kit (ODK) techniques. Collected data underwent editing, coding, and analysis using SPSS. Descriptive statistics, including frequency, percentages, means, and standard deviation, were employed for the presentation of results. Additionally, economic modelling, involving regression analysis, was performed on the quantitative data. Purposive sampling was utilized to select 30 farmers for participation in three FGDs. In each FGD, ten farmers, including a balanced representation of both genders, were engaged to validate the household survey results.

Estimation of socioeconomic factors on household agro enterprise incomes

Multinomial logistic regression was deemed appropriate for analysis

as it aligns with the study's context of classifying subjects based on the values of a set of predictor variables (Schwab, 2002). Consequently, multinomial logistic regression was employed to predict the probability of category membership on the dependent variable, considering multiple independent variables.

Following Hellerstein and Mendelsohn (1993), the dependent variable (logit(p)), the number of socio-economic factors of farmer x can be expressed as:

$$\text{logit}(p) = \log\left(\frac{p}{1-p}\right) = \lambda_0 + \lambda_1 x_1 + \dots + \lambda_k x_k \dots \quad (2)$$

The basic set-up of logistic regression is as follows. Given our dataset containing *N* points, each point *x* consisted of a set of *k* input variables *x*₁ ... *x*_{*k*} (also called independent or predictor variables), and a binary outcome variable logit(*p*) (also known as a dependent variable).

The goal of logistic regression was to use the dataset to create a predictive model of the outcome variables [logit(*p*)] that are assumed to depend on the explanatory variables *x*₁ ... *x*_{*k*}. Based on the aforementioned model, the following model was used to establish regression coefficients using SPSS as demonstrated:

$$\text{Logit}(p) = \lambda_0 + \lambda_{ha} x_{ha} + \lambda_{fh} x_{fh} + \lambda_{hs} x_{hs} + \lambda_{he} x_{he} + \lambda_{ls} x_{ls} + \lambda_{il} x_{il}$$

where λ_0 = intercept regression coefficient; λ_{ha} = coefficient for household head age factor (*x*_{ha}); λ_{fh} = coefficient for female household head factor (*x*_{fs}); λ_{hs} = coefficient for household size factor (*x*_{hs}); λ_{he} = coefficient for household head education level factor (*x*_{he}); λ_{ls} = coefficient for household land size factor (*x*_{ls}); and λ_{il} = coefficient for household income level factor (*x*_{il}).

Table 1. Socio-economic factors of study respondents.

Variable	Non-DFRN respondents N= 200		DFRN respondents N= 200		Pooled data N= 400	
	Mean or N	St. Dev. or %	Mean or N	St. Dev. or %	Mean or N	St. Dev. or %
Age of household head	39	11.52	40	11.99	39	11.75
Female household head	120	60	114	57	234	58.5
Household size	7	2.11	6	2.23	6	2.20
Household education						
Primary	135	68	121	61	256	64
Secondary	31	15.5	24	12	55	13.9
College	25	12.5	8	4	33	8.3
University	13	6.5	7	3.5	20	4.0
Household land size [acres]						
Land size (<1)	28	14	25	12.5	53	13.3
Land size (1-3)	108	54.5	109	54.5	217	54.3
Land size (4-7)	32	16	44	22	76	19
Household income level per month [kshs]						
Income level (<1000)	29	14.5	84	42%	113	28.5
Income level (5001-15,000)	33	16.5	29	14.5%	62	15.5
Income level (15,001 - 30,000)	24	12	7	3.5%	31	7.8
Income level (>30,001)	19	9.5	5	2.5%	24	6.0
Sample size (N) = 400						

Field Survey Data (2021).

RESULTS AND DISCUSSION

Descriptive statistics

Data from the household survey were analysed to measure socio-economic characteristics (Table 1), revealing factors influencing incomes from household enterprises, including the age and gender of the household head, household size, household head education level, household farm size, and household income level. The household

head plays a crucial role in the economic well-being of the household. The mean ages of respondent farmer households are presented in Table 1, with a pooled data mean age of 39. This was similar for both DFRN farmers and non-beneficiaries, with an average age of 40 for the latter. Table 1 also shows results for household heads' gender, indicating that female-headed households were more common (58.5%) in the study area than male-headed households. Comparatively, female household heads were

more prevalent among non-DFRN respondents (60%) than DFRN respondents (57%). Household size refers to the number of people residing in a given residence unit. In Table 1, pooled data show a family size of 6 members, which was similar to that of DFRN beneficiaries, while the family size of non-DFRN respondents was 7. Education level was a crucial factor in this study due to its impact on income generation from agricultural enterprises.

Pooled data (Table 1) indicate that more than half of the farmer household heads (64%) had

completed primary-level formal education. The proportion of those who completed secondary, college, and university education was 13.9, 8.3, and 4%, respectively. Household farm size influences farmers' ability to engage in different income-generating activities. Table 1 shows that the proportion of households with less than 1, 1-3, and 4-7 acres for pooled data was 13.3, 54.3, and 19%, respectively. Therefore, the majority of respondents owned between 1 and 3 acres of land. For both non-DFRN and DFRN beneficiaries, the majority (54.5%) of respondents, shown in Table 1, owned between 1 and 3 acres of land. Household income is also a major determinant of household participation in agro-enterprise activities. Pooled data results in Table 1 indicate that 28.5% of respondents earn less than KShs 1,000 per month. Additionally, 16.5% of respondents earn between KShs 5,001 and 15,000 per month, while the majority (42%) of DFRN beneficiaries earn less than KShs 1000. Therefore, non-DFRN participants earn more than beneficiaries of DFRN per month.

Analysis of socio-economic determinants of agro-enterprise incomes of dryland smallholders

The study investigated household characteristics of sampled smallholder dryland farmers with a specific focus on: (i) age of household head, (ii) gender of household head, (iii) household size, (iv) household head education, (v) household farm size, and (vi) household income level. Regressions results in Table 2 show the relationships of the aforementioned socio-economic factors for both DFRN and non-DFRN respondents in the study that had significant relationship with agro-enterprise incomes at household/farm level.

Age of household head effect on agro-enterprise income

According to pooled data results in Table 2, the estimate of the coefficient of household on agro-enterprise income is significant ($\lambda = .030$, $OR = 1.483$, $p < 0.05$). This implies that older household heads were more likely to earn income from agro-enterprise activities than households with younger heads in ASAL areas. This result is in tandem with Tauer, (1995) finding that as age increases for the farmer, he or she gains more gains experience leading to higher productivity as a result of better managerial competence. However, productivity and farm incomes may plummet later in life. According to some scholars (Li, et. al., 2020; Chen, et. al., 2010) due to the inadequacy of their bodily energy, aging smallholder farmers incline to vacate their land, decrease labour input to agricultural production and lessen land use rate. Consequently, the outcome is deficient agricultural labour and land input that has a harmful influence on agro-

enterprise incomes. As for the DFRN participants, influence of age on agro-enterprise income was also significant ($\lambda = .034$, $OR = 1.034$, $p < 0.01$) and insignificant for non-participants in DFRN project. This implies that DFRN targets of 40 compared to mean age of 39 for non-beneficiaries explains the observed impact of age on incomes for DFRN beneficiaries. Therefore, DFRN should target 40 and above farmers for income generation activities support.

Female Household Head Gender Influence on Agro-Enterprise Income

Results in Table 2 indicate significance ($\lambda = -.708$, $OR = .493$, $p < 0.10$). The negative coefficient signifies that female household heads are less likely to increase income from agro-enterprises compared to their male counterparts. A study by Oyinbo (2013) found that gender was significant at a 1% probability level with a positive impact on maize farmers' income. The author further argues that this was caused by the inequality in production resources and supportive services access by the female and male farmers with the latter having more advantageous access to production capital particularly land and other helpful services than women. Similar results ($\lambda = -1.083$, $OR = .338$, $p < 0.10$) were recorded for non-participants of DFRN, and insignificant influence for DFRN participants. This finding is consistent with studies by previous scholars. For instance, Gebre, et. al., (2021) found that maize productivity in male-headed households was generally higher than that of female-headed households. However, if female-headed households received the same return on their resources as male-headed households, their productivity would augment. With over 50% of DFRN respondent household headed by women, DFRN should address female headed household challenges to facilitate their involvement in agro-enterprise income activities.

Household size and agro-enterprise income

Table 2 shows that household size was only significant ($\lambda = 0.259$, $OR = 1.296$, $p < 0.05$) for DFRN households. A positive coefficient implies that a high household size increases the chance of earning income from agro-enterprises. This finding, however, contradicts Omideyi's (1988) study, which reported that while family size was high in rural Nigeria, agricultural productivity was low, as was income derived. Further, the author averred that almost all the food produced by the household was consumed since productivity was low for large family sizes. Additionally, Meyer and Nishimwe-Niyimbanira (2016), found that as the size of a household increases, the amount of money spent on goods and services increases, but at a decreasing rate. This implies that a

family may spend more on goods and services with the addition of more children, but the percentage of additional costs for each child becomes less. The studies, therefore, suggest that the net effect is a lower level of household income, little savings, and increased poverty. The average family size of DFRN participants of 6 members, which is over the national average of 4 (KNBS, 2019), means that households in the area have more members to feed at the expense of selling agricultural products for income generation. Therefore, DFRN should target increasing productivity on the farms to generate additional products for sale and income.

Agro-enterprise income impact of household head education

Pooled data (Table 2) shows a significant but negative influence of education on agro-enterprise income vis-à-vis primary education ($\lambda = -0.678$, $OR=0.508$, $p<0.01$); secondary ($\lambda = -1.456$, $OR=0.508$, $p<0.01$); college ($\lambda = -2.268$, $OR=0.104$, $p<0.01$); and University ($\lambda = -2.973$, $OR=0.051$, $p<0.01$) for a household head. This suggests that the independence of education from agro-enterprise income increases with the education level of the household head. Results (Table 2) further show that the influence of education was only significant among the non-DFRN participants: primary education ($\lambda = -1.203$, $OR=0.300$, $p<0.05$); secondary ($\lambda = -1.348$, $OR=0.260$, $p<0.10$); college ($\lambda = -2.809$, $OR=0.060$, $p<0.01$); and university ($\lambda = -3.161$, $OR=0.042$, $p<0.01$). This contradicts the findings of Muhammad et al. (2019) in their study on the impact of education on farmers' earnings in Malawi. They reported that the education of farmers had a significant and positive association with the earnings of the farmers. Recently, Guyen et al. (2021) revealed also that education has a positive impact on the income of young households. The authors further reported that the longer the schooling years, the higher income youth can attain. This is in part explained by the fact that a farmer who has higher education is less likely to become a full-time farmer. He or she may be a part-time farmer or quit farming. This will result in less or no earnings from farming. But there may also be chances to have a high potential to earn more from farming. If a farmer has high agricultural education, then he will be most likely to become a full-time farmer with high earnings (Bratberg et al., 2008). A household head earns more if he has more agricultural education because knowledgeable farmers have more ability to share information, better skills, and more capacity to cope with change. This suggests better decision-making at the farm level. In addition, as Åström (2009) reports, an educated farmer has better earnings as a result of a conducive and cultured domestic environment. The insignificant education for the DFRN farmers means that agricultural training is not the best option for supporting farmers to earn incomes from agro-enterprises in the

project area.

Influence of farm size on agro-enterprise income

The size of the land was examined for its effect on household income. Pooled data results (Table 2) show that household land size of up to 3 acres significantly influences dependence on agro-enterprises for income generation. The negative influence was highest ($\lambda = -1.841$, $OR=0.159$, $p<0.01$) for households with less than 1 acre of land than for those with between 1 to 3 acres ($\lambda = -1.078$, $OR=0.34$, $p<0.05$). The results are in line with Das Varun and Ganesh-Kumar's (2017) finding of a U-shaped relationship between farm size and farmers' income, as was similarly determined by Frederik and Ashley (2019), who reported that while output per unit of land does decline with increasing farm size, agricultural incomes increase with farm size. As for non-beneficiaries of DFRN, significance ($\lambda = -1.410$, $OR=0.244$, $p<0.10$) was only observed for the household land size of less than one acre and insignificant for the DFRN participants. This implies that the more land a household has, the more they are inclined to depend on non-farm enterprises for income generation. Although a majority (54.5%) of households in the DFRN farmers have land between 1 and 3 acres, land size was an insignificant influencer of farming income, which therefore should not be considered in promoting income generation from agro-enterprises. The study finds that a U-shaped relationship exists between farm size and farm/farmer's income.

Non-farm household income effect on agro-enterprise income

Household income includes incomes of all people above a particular age occupying the same housing unit regardless of relation. The main sources of income for most respondents were the sale of agricultural products, off-farm wage employment, and wages in kind or food donations. Pooled data results (Table 2) indicate that income levels of the household had a negative association with the generation of income from agro-enterprises by households. Results show that the higher the household income level, the less likely it will depend on agro-enterprises for income generation: household income level of 5,001-15,000 [$\lambda = -1.556$, $OR=0.211$, $p<0.01$]; 15,001-30,000 [$\lambda = -2.03$, $OR=0.131$, $p<0.01$]; and over 30,000 [$\lambda = -2.918$, $OR=0.054$, $p<0.01$]. The negative coefficients (Table 2) indicate that households with higher incomes of over 30,000 are less likely to engage in agro-enterprise for income generation. Comparatively, the highest negative influence ($\lambda = -3.917$, $OR=0.020$, $p<0.01$) was found at the income level of 15,001-30,000 for the DFRN beneficiaries compared to non-DFRN participants ($\lambda = -3.088$, $OR=0.044$, $p<0.01$) for households at the over 30,000 income level. Recent

Table 2. Logistic regression analysis: socio-economic factors effect on agro-enterprise incomes.

Independent variable	Factors/levels (Variable)	Non DFRN beneficiaries		DFRN beneficiaries		Pooled data	
		Coefficient (λ)	Odds ratio (OR)	Coefficient (λ)	Odds ratio (OR)	Coefficient (λ)	Odds ratio
Age of household head		0.026	1.026	0.034*	1.034	0.030**	1.483
Female household head		-1.083***	0.338	-0.282	0.754	-0.708***	0.493
Household size		-0.059	0.943	0.259**	1.296	0.060	1.063
Household head education	Education (1. Primary Education)	-1.203**	0.300	-0.148	0.862	-0.678***	0.508
	Education (2. Secondary Education)	-1.348*	0.260	-1.609	0.200***	-1.456*	0.233
	Education (3. College Education)	-2.809***	0.060	-1.715	0.180**	-2.268***	0.104
	Education (4. University Education)	-3.161***	0.042	-2.996	0.050**	-2.973***	0.051
Household farm size	Land size (Less than an acre)	-1.410*	0.244	-0.693	0.500	-1.841***	0.159
	Land size (Between 1-3 acres)	-0.405	0.667	-0.248	0.780	-1.078**	0.34
Household resource level	Income level (Between Kshs. 5001-15,000)	-1.482***	0.227	-1.633***	0.195	-1.556***	0.211
	Income level (Between Kshs. 15001 - 30,000)	-1.622***	0.198	-3.917***	0.020	-2.03***	0.131
	Income level (Over Kshs. 30,001)	-3.088***	0.044	-2.531**	0.080	-2.918***	0.054
	N		200		200		400
	-2 Log L		136.554		131.611		286.283
	McFadden's R ²		0.443		0.320		0.333
	Percent correctly predicted		84.5%		85%		82%

*Show significant variables affecting HH Enterprise Incomes at either 0.01 (***), 0.05 (**) and/ or 0.10 (*) levels of significance. Field Survey Data (2021).

studies by Salamun et al. (2020) indicate that non-farm household income has a significant positive effect on agricultural productivity. However, a study by Rakotoarisoa (2019) initially indicated household's participation in regular off-farm activities had no significant effect on household agricultural income per capita. Nonetheless, by differentiating farm income into crop and livestock incomes, it was established that involvement in off-farm activities did not affect crop income per capita but increased livestock income per capita. The study indicates that the higher the household

income, the less likely they will engage in agro-enterprise activities to generate income. With most (42%) of DFRN participants earning less than 1,000 per month, the DFRN project should target these poorer farmers for generating income from agro-enterprises in the project area.

Conclusion

In this research, determinants of household agro-enterprise incomes in drylands areas were

investigated in Chepareria Ward, West Pokot County of Kenya. The primary findings show that household socioeconomic factors influence farm incomes of ASALs households in Kenya. In terms of age, the study concludes it is an influencer of agro-enterprise income generation, as was the gender of the household head.

The study also determined that farm household size affects income generated from the farm, just like the education level of the household head. The size of the farm was also established to have a significant impact on farm income, as was the

case for the household income level's inverse relationship with agro-enterprise income. Socio-economic factors are, therefore, imperative for the development of agro-enterprise policies for sustainable poverty alleviation and land rehabilitation interventions in drylands.

Recommendations

Recommendations for consideration by ASAL development practitioners like the DFRN project and policymakers in the West Pokot County government and the Government of Kenya:

- (1) Target the middle aged (40 and above) household heads as a strategy to increase farm incomes through activities that enhance crop productivity and livestock production at the household level;
- (2) Support female headed household heads to increase incomes from farming through marketing facilities that will help them to get an appropriate price for their produce;
- (3) With more mouths to feed, farmer households should be supported to increase investment in farm productivity so as to generate additional products for sale to generate income;
- (4) Promote the adoption of new technologies at the expense of farmer agricultural training so as to boost production to increase incomes from agro-enterprises;
- (5) Support farmers earn more income from agro enterprises through crop intensification and improved price realisation in the Chapareria ward and other ASAL areas; and
- (6) Poorer Chapareria Ward and other ASAL farmers should be targeted so as to enhance income generation from agro-enterprises through improved efficiency in input use by increasing output and reducing costs.

In terms of further research, the study recommends a study on the role of household agro-enterprise incomes in the sustainability of land rehabilitation interventions in dry land areas.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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