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Original Article

Enhancing Household Livelihood Outcomes through Resilient Agri-Food Systems among Small-scale farmers in Kitui County, Kenya

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ABSTRACT

The practice of resilient agri-food systems, especially in arid and semi-arid areas, is considered key to attaining sustainable livelihoods. Changes in climatic conditions have forced small-scale farmers to develop adaptive capacities related to food security. This study was done in Nguni ward Kitui County involving 246 small-scale farmers, two focus groups discussion, and four key informants. The sampled participants had practiced resilient agri-food systems for the last five years from the time of data collection. A gender dynamic was established after 71.5% of the respondents were found to be female and 28.5% male. More females practiced resilient agri-food systems but did not own productive assets like land. A statistically significant relationship between resilient agri-food systems and household livelihood outcomes was determined where the probability value was less at a 95% confidence level ($0.01<0.05$). Further analysis showed a positive association between household income and sex $\chi 2=9.551$ where p (0.008) was less than 0.05. In conclusion, resilient agri-food systems practices such as conservation agriculture positively influence the household livelihood outcomes like diversification of livelihoods, reduced prevalence of human, crop, and livestock diseases, and improved ability to cope with shocks and trends. The study recommends the provision of incentives, insurance, and social safety nets to encourage small-scale farmers to practice resilient agri-food systems.

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INTRODUCTION

Globally, the primary source of livelihood for nearly four billion people is food systems (United Nations, 2020). Food is vital to human beings, and this has been emphasized in the Sustainable Development Goal two on zero hunger, achieving food security, and promoting sustainable agriculture. The demand for safe and adequate food is on the rise since it is estimated that the global population will grow from 7.8 billion in 2020 to around 9.9 billion people by 2050 (Population Reference Bureau, 2021). The transformation of agri-food systems is discussed almost in all the development forums by scholars and policymakers as a subject of interest (Béné et al., 2019). The major concern is the sustainability of modern food systems, including how and where they are produced, packaged, processed, distributed, consumed, and disposed.

Oxford Dictionary of Human Geography defines the agri-food system as "the totality of actors involved in the production, distribution, and consumption of food, the relations between them, and the regulatory apparatus governing these arrangements" (Castree et al., 2013 pg. 2). Through food systems, livelihoods are created. However, to realize this sustainably, there is a need for a global food revolution failure to which a twin burden will be created. The burden will entail feeding humanity and struggling to live within the polluted environment (Steffen et al., 2015). Food systems are affected by environmental, technological, economic, political, and socio-cultural factors. These drivers are vital to ensuring the sustainability of food systems. Drivers like economic and political factors have allowed the domination of food systems by capitalists worldwide. Large agribusinesses focus on maximizing profits by buying food at low prices from the producers. To meet the demand of these large corporations, the producers, in return, use extractive farming practices without considering human and planet health (Béné et al., 2019). A shift to resilient food systems indicates a sustainable change and introduction of practices geared towards positive outcomes such as reducing food wastage, food loss, equity in food access, creation of value chains, and biodiversity protection (Chaboud & Daviron, 2017).

Research, development, governance, and regulations are among the key activities embraced in agri-food systems. For instance, Hudson et al. (2020) found that resilience to extreme weather in Europe was attributed to recovery, resistance, and adaptive capacity. In general, Lipper et al. (2021) posit that adaptation and adoption of innovative methodologies in agriculture call for transformation in food systems. In Uttarakhand hills-India, Bisht (2021) opines that there are small-scale farmers embracing resilience to climate change through various ecological farming methods such as organic

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farming and polycultures. According to Lu et al. (2022), China has been trying to achieve food security not only within its borders but also across the globe. The country has food security measures through transformative food systems. Some of the functional areas of China's resilient agri-foods systems include land consolidation, creation of food reserves, value addition, and diverse nutrition foods innovations.

In the African context, Sitko and Jayne (2018) argue that challenges such as declining productivity, soil degradation, and weak African food systems, irresponsiveness to climate change need new dimensions in sustainable and innovative food systems methods. Makate et al. (2019) posit that in South Africa, multiple factors affect the level of resilience in agricultural production, including credit access, education, training, and market deficits.

There are still many gaps in the practice of resilient agri-food systems (Gillespie et al., 2019). For instance, the way food is produced, packaged, processed, distributed, consumed, and disposed of is ecologically and socially unsustainable. Food's ecological and social meaning is slowly being lost, leading to changes that endanger human and planetary health (Aude, 2020). This has posed complex challenges such as chronic diseases, environmental degradation, inequality, and malnutrition (Duncan et al., 2021). In addition, the practice of extractive farming by small-scale farmers has contributed to climate change, affecting agri-food systems' sustainability. Amicable solutions to these challenges are inadequate. Therefore, there is a need to change the patterns in the agri-food systems for resilient food pathways to be realized. The effects of these on household livelihood outcomes also need to be investigated. Kitui County is among the arid and semi-arid areas in Kenya, and over the years, disarray concerning food systems has been witnessed. However, small-scale farmers in this region survive through resilient practices. Together with the paucity of empirical data on resilient agri-food systems and their influence on household livelihood outcomes, these fundamental reasons necessitated carrying out this study.

METHODOLOGY

The study was done in Nguni ward, Kitui County, in Kenya. The area receives minimal rainfall and is characterized by rocks and underground salty water. Nguni ward was purposively sampled because despite the ecological challenges, some farmers use resilient practices to produce food. The study employed quantitative and qualitative approaches during data collection between September to December 2021. A list of 915 small-scale farmers was generated purposively by identifying those who practiced resilient agri-food systems consistently for the last five years from the data collection period. Simple random sampling was used through a random number generator to sample 278 small-scale farmers, but 246 formed the response rate as 32 respondents were not available in their households. A household questionnaire was designed to capture respondents' demographics, resilient agri-food systems, and household outcomes. The household survey was supplemented with two qualitative methods: focus group discussion and interview. A total of two Focus Group Discussions were conducted, each with ten participants. Key informant interviews were conducted with the following participants: Nguni ward county administrator, community research leader, agricultural extension officer, and a project coordinator from Caritas-Kitui region-an NGO focusing on resilience livelihoods in dry lands. Quantitative data was analysed using SPSS and hypothesis tested through Chi-square and Analysis of Variance (ANOVA). Qualitative data were transcribed and used to support the quantitative data during the interpretation of the findings.

RESULTS AND DISCUSSIONS

Demographic Characteristics of the Respondents

Age, sex, and income variables had a significant impact on the study. *Table 1* presents data on these demographics.

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Table 1: Household Demographics

Demographics	Category	Frequencies	Percentage (%)
Sex	Female	176	71.5
	Male	70	28.5
Age	18-27	10	4.1
	28-37	23	9.3
	38-47	120	48.8
	48-57	80	32.5
	Above 58	13	5.3
Monthly Income	0-5000	113	45.9
	5001-10000	82	33.3
	Above 10001	51	20.7

Source: Survey data

As shown in *Table 1*, 71.5% of the respondents who practiced resilient agri-food systems were female, while 28.5% were male. The variance in gender distribution is based on the fact that women, especially in Africa, are major suppliers of labour on the farm. Danso- Wiredu (2018) in her study on gendered dynamics and reciprocity in fishing communities in Ghana, confirms that work is highly divided on a gender basis. As in the study area, Kitui, such divisions have become entangled in peoples' everyday lives. This also corresponds with findings from Zimbabwe, which underscores greatly that after the dilapidation of the Zimbabwe British relations, women have played an important role in the revival of the country's agricultural sector. In particular, many women could own land, which allowed them to be involved in food production and tobacco export (Bungu, 2019).

Age is also considered an important demographic variable when analysing agri-food systems. It sheds light on the productive categories that should be given more attention when improving food systems. The majority of the respondents (48.8%) were between 38-47 years. The study findings also revealed that most of the respondents (45.9%) earned a monthly income in Kes 0-5000, while a small percentage (20.7%) earned above Kes 10,001. These earnings were largely from the practice of resilient agri-food systems considering that the study area is dry and receives minimal rainfall.

Resilient Agri-Food Practices, Opportunities, and Interventions

The study also analysed the practices, opportunities, and interventions for the small-scale farmers practicing resilient agri-food systems. The findings on this are presented in *Table 2*.

Table 2: Resilient Agri-Food Practices, Opportunities, and Interventions

Variable		f	%
Main RAS Practices learnt and being implemented	Apiculture (Bee keeping)	42	17.1
	Aquaculture	6	2.4
	Agro-forestry	15	6.1
	Conservation agriculture	69	38
	Livestock integration	7	2.8
	Poultry farming	78	31.7
	Kitchen garden	29	11.8
Information provider	Government extension officer	18	7.3
	Non-Profit organizations (NPOs)	142	57.7
	Peer famer	71	28.9
	Social media	15	6.1
	Incubation process for eggs hatching	23	9.3

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Variable		f	%
Other areas for further training	Record keeping of farm produce	22	8.9
	Vaccination of chicken	17	6.9
	Handling of chicks	20	8.1
	Marketing and selling strategies without brokerage	71	28.9
	Technologies to produce organic fertilizers	43	17.5
	Rain harvesting technologies	50	20.3
Recommendations for improvement	Certification for packaging (KEBS)	24	9.8
	Provision of aggregation centres	46	18.7
	Linkages and networks (marketing, trainings, inputs)	45	18.3
	Provision of infrastructure (roads, mobile network)	47	19.1
	Provision of non-saline water for irrigation	84	34.1

Source: Survey data

Table 2 shows that most of the respondents (57.7%) were trained by non-profit organizations (NPOs) on resilient agri-food practices. Only a small percentage of the respondents (6.1%) used social media to learn the same practices. This could be attributed to a lack of network in the study area and respondents' ignorance of social media usage. About 28.9% of the respondents were trained by their peer farmers, while government extension officers taught 7.3%.

Following the training, 38% of the respondents started practicing conservation agriculture as their main source of livelihood. Some of these conservation agriculture practices include; the use of organic fertilizers, minimum tillage of the land, and cover crops and sunken beds. Poultry farming was also practiced by 31.7% of the respondents, followed by apiculture (beekeeping) at 17.1%, kitchen garden at 11.8%, agroforestry at 6.1%, and livestock integration at 2.8%. Few respondents (2.4%) practiced aquaculture, which could be attributed to the lack of water in the area.

The respondents also needed extra training to improve their livelihood outcomes at the household level. The majority of the respondents (28.9%) wanted to be taught how to market and sell their produce without intermediaries. Availability of water being a big challenge in the study area, 20.3% of the respondents requested to be trained on rain harvesting techniques to enable them to do farming. Considering that most of the respondents practiced conservation agriculture, 17.5% requested training on how to produce organic fertilizers in large quantities. Other areas that needed further training include the incubation process (9.3%), record keeping (8.9%), handling of chicks (8.1%), and vaccination of chickens (6.9%). One of the members of the Focus Group Discussion added that extra training was needed because they faced a lot of challenges on their farms:

> *"…. practicing resilient agri-food systems is not easy, we need more training on it. We lack consistent agricultural extension services and this affect the way we produce food. Market prices within our locality are also discouraging and our wish has always been to sell our produce in big towns or even export to outside countries. Some of our crops wither because the water available is salty. How we wish government could do something and provide reliable water…"* (Participant 005 in FGD 1).

The respondents also made general recommendations to support their food systems. For example, 34.1% of the respondents requested non-saline water for irrigation, while 19.1% called for development agencies to intervene and provide good infrastructures such as roads and mobile networks. Provision of aggregation centres was also considered very urgent by 18.7% of the respondents, as 18.3% needed linkages to markets, training, and farm inputs. A small percentage of the respondents (9.8%) wanted to be guided on how to get certification for the packaging of their produce. This also came out strongly from an apiculture farmer in the Focus Group Discussion and Nguni ward county administrator:

> *"…. we have been producing honey for many years now. Unfortunately, we can only sell it locally because we lack Kenya Bureau of*

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Standards (KEBs) authorization. Some of us also have kitchen gardens and we have always thought of how we can sundry the greens and package them to sell in supermarket and preserve some for-household use. However, this has not been achieved but it's still our dream…" (Participant 004 in FGD 2).

"…. I have advised the department of agriculture in Kitui County to construct aggregation centres for our farmers in Nguni ward to replicate what is in Ngomeni market. In addition, agricultural extension officers are training the farmers on agro-ecology practices for resilience…. (KII 01).

The study findings depict the existing literature that describes resilience to maintain structures around a lifestyle. The same description is shown in the works of Ahmed et al. (2022) who conducted a study in the Rift Valley region of Ethiopia. The researchers point out the drought periods that have left the community without food, weakening their livelihoods. In efforts to estimate the level of vulnerability among the communities, the study used spatial and metrological data to determine the level of exposure, adaptive capacities of the communities, and sensitivity. The study findings showed that adaptive capacity significantly varied from one region to another, where the regions with higher vulnerability in livelihoods were aggravated by drought. The study recommended climate-smart farming as an intervention measure. However, the study only showed the levels of vulnerability rather than creating an intervention like the one in the current study on the use of Resilient Agri-Food Systems (RAFS).

The findings reflect the posting of Ortiz and Peris (2022) who argued that family farmers have been innovating ideas that would create sustainability in food systems. Using an association of farmers to practice resilient methods in farming in Guatemala, the study was guided by transformative capacity building among the farmers in rural settings. The study used Focus Group Discussions and interviews to collect data from farming stakeholders. The findings indicated that farmers' organizations and associations were key in cultivating innovations in the agriculture sector. Under the umbrella of farmers' organization, the farmers attracted technical transformation in innovative agriculture, creating sustainability. The study also supported that, partnerships with institutions and other relevant networking were key interventions in resilient agri-methods in Guatemala. The study also identified gaps ascribed around generational dimensions.

Household Livelihood Outcomes

Data on household livelihood outcomes resulting from practicing resilient agri-food systems were analysed descriptively using frequencies and percentages. The questionnaire was designed with statements measuring the extent the respondents had experiences with each item. These were measured on a Likert scale of 1-5 where 1 = none at all, 2=little extent, 3=moderate extent, 4=large extent, 5=very large extent. The results are presented in *Table 3.*

Table 3: Household Livelihood Outcomes

To what extent have you experienced the following in the last one year?	Percentage (%)				
	1	**2**	**3**	**4**	**5**
Increase in stock of assets (productive)	9.3	24.0	48.0	13.8	4.9
Acquiring more household income from practice of RAS	2.0	15.0	35.4	43.1	4.5
Improved food security (availability, access, utilization, and stability)	0.4	52.5	45.5	1.6	-
Higher farmer participation in leadership of farmer groups	0.4	9.8	28.0	50.8	11.0
Improved access to market and good pricing of farm inputs	28.0	56.9	14.7	0.4	-
Reduced dependency on others for livelihoods	0.4	4.5	18.7	61.8	14.6
Reduced consumption of savings and assets	7.3	-	22.8	42.7	27.2
Improved practice of waste management through the 4Rs (e.g., Re-use, Repair, Reduction and Repair-biogas, biomass, solar)	5.7	26.8	39.9	27.2	0.4

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To what extent have you experienced the following in the last one year?	Percentage (%)				
	1	2	3	4	5
Improved coping with various shocks and trends (drought, floods, disease, death, job loss)	-	0.4	6.5	48.4	44.7
Increase investments in social capital networks e.g., farmers cooperatives, members associations	0.4	0.4	17.9	44.3	37.0
Diversification and/or intensification of resilient agri-food systems	-	-	7.8	33.7	58.5
Improved knowledge and practice of e-commerce	23.6	50.8	23.2	-	2.4
Improved access to better social amenities (Schools, hospitals)	-	2.8	27.2	58.2	11.8
Reduced prevalence of human, crop, and livestock diseases	-	0.4	6.5	37.4	55.7
Improved knowledge and practice of value addition from production to waste management	-	5.3	29.2	47.6	17.9

Source: Survey data

Table 3 shows that the increase of assets was moderate among the households at 48%. In comparison, 43.1% of the respondents acquired more income to a larger extent after engaging in resilient agri-food systems. The findings also shows that about 52.5% had improved their food security to a little extent, and 50.8% were, to a larger extent, able to participate in farmers' groups, unlike before. Despite the consistent problem of markets for their produce, 56.9% of the respondents felt that there was little improvement in access to the market and pricing of farm inputs. Shuaibu and Nchake (2021) studied the use of innovative marketing of agricultural products in Sub-Saharan Africa. Using two-stage least square instrumental methods, the study considered the concept of reverse causation for products. The study found that creating a market credit pool would enhance the agricultural products market as direct intervention. This shows that there are still innovative ideas for enhancing the market for agricultural products.

In another dimension of marketing, Taufiq et al. (2022) studied the association between prices of agricultural products at the farm versus consumer retailing in Indonesia. Using rice as the study product, the regression analysis indicated an association between prices at the two levels of the product processing. The study revealed that while there was horizontal integration of the prices at each level in the long run, the process in the short run had a vertical integration. There were differentiated market prices at the farm, and the consumer sales points attributed to distribution costs. The study recommended government intervention in enabling cheaper transport of the rice to retail markets. *Table 3* also shows that a larger extent (61.8%) of the respondents pointed out that their level of dependency on other people had reduced, and they were self-reliant. The majority of the respondents (42.7%) had reduced their consumption of savings and assets to a larger extent. A moderate impact on improved waste management through the 4Rs was felt by 39.9% of the respondents, 48.4% of the respondents had improved their coping strategies with various shocks and trends, and on the same scale, 44.3% had increased their social capital networks. To a very large extent, 58.8% of the respondents had diversified and intensified their livelihoods. The majority of the respondents' knowledge and practice of e-commerce had improved (50.8%) to a little extent. About 58.2% of the respondents had to a large extent, improved access to better social amenities such as hospitals and schools. The impact of reduced incidences and prevalence of human, crop and livestock diseases were evidenced by 55.7% of the respondents to a very large extent. Lastly, to a large extent, 47.6% of the respondents had improved knowledge and practice of value addition from production to waste management.

From the rating of 1-5, a very large extent had the greatest impact and depicted the most improved household livelihood outcomes. Within this scale, it is evident that diversification and intensification of resilient agri-food systems had the greatest impact (58.5%), followed by the reduced prevalence of human, crop, and livestock diseases (55.7%). Improved coping with various shocks and trends (drought, floods, disease, death, job loss) came third at 44.7%. In contrast, increased investments in

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social capital networks, e.g., farmers' cooperatives and members' associations, came fourth at 37%. The study findings reflect the existing literature, which points out the outcomes of food systems. According to Delgado and Tschunkert (2022), systems, in this case, food systems, aim to create outcomes that they are designed to produce. This, therefore, means that we should analyse and alter food systems if the outcomes are negative.

Bivariate Analysis

Data analysis using inferential statistics was done to test the association between variables. Chi-square and ANOVA tests examined whether the relationship between variables was statistically significant.

Increase in Household Income and Sex

Table 4: Chi-square for household income by sex

Rates of household income	Sex		
	Female	**Male**	**Total**
Little extent	35 (83.3%)	7 (16.7%)	42 (100%)
Moderate extent	68 (78.2%)	19 (21.8%)	87 (100%)
Great extent	73 (62.4%)	44 (37.6%)	117 (100.0%)
Total	**176 (71.5%)**	**70 (28.5%)**	**246 (100%)**
(p-value=0.008; χ^2=9.551 where p<0.05; df=2, N=246)			

Table 4 shows the calculated Chi-square statistic was 9.551, the degree of freedom 2 and the reported significance level 0.008, which is less than the set alpha of 0.05. This means a positive statistical association between the increases in household income by sex. The findings reflect the existing literature from the United States, where women were keen on resisting gender orientation to farming to attain food justice and sustainability. Using a feminist and queer approach, Leslie et al. (2019) indicate that relational agriculture was a tool for stabilizing food supplies through re-orienting gender roles in the United State farms. In a related study in Tanzania, Masamha et al. (2018) found a weak link between sexes in cassava farming. The study stated that women were the majority in the processes of harvesting and sales. On the other hand, more men were in control of finances and resource planning around cassava farming. Women were lowly involved in ownership, cross-border marketing, and control of high-value nodes.

Adam et al. (2021) recognizes the importance of women's empowerment and gender equality in the agri-sector. Using fish agri-food systems, the researchers opined that gender equality would be a factor in food security and livelihoods across the globe. Guided by the UN Sustainable Development Goal of zero poverty, the study proposed a systemic gendered tool for reducing inequities and barriers in resilient agri-food systems.

The Relationship between Resilient Agri-food Systems and Household Livelihood Outcomes

The regression analysis between resilient agri-food systems and household livelihood outcomes was computed, and the results are shown in Table 5. The hypothesis was also tested using ANOVA and coefficient. The study's null hypothesis was that "there is no statistically significant relationship between resilient agri-food systems and household livelihood outcomes".

Table 5: Analysis of Variance for Resilient Agri-food systems and HLO

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	127.472	1	127.472	6.775	.010[b]
Residual	4591.102	244	18.816		
Total	4718.573	245			

a. Dependent Variable: Household Livelihoods Outcomes
b. Predictors: (Constant), Resilient Agri-food Systems

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The ANOVA statistics presented in Table 5 show the regression model significance with an F-statistic of 6.775 at a .010 significance level. The significance value of p=0.010 is less than 0.05. This implies that the observed aggregate variability in the resilient agri-food systems had a statistical influence on a household livelihood outcome while the random factors did not. The findings can be compared with the results from South Africa, where multiple factors were found to affect the level of resilience in agricultural production (Makate et al., 2019). Smart innovations adoption, access to credit, land, education, and information were factors that affected the level of agricultural productivity. There was also a differentiated impact based on geographical locations and gender. The study recommended the institutionalization of gender-sensitive policy to address gender disparities in the practice of resilient agriculture.

The regression analysis process yielded coefficients presented in *Table 6.*

Table 6: Regression Analysis Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	48.838	1.296		37.674	.000
	Resilient Agri-Food	.219	.084	.164	2.603	.010

a. Dependent Variable: Household Livelihood Outcomes

Table 6 shows that the standardized coefficient was positive (.164). This coefficient was statistically significant at a 5% significance level because the p-value (0.01) is less than 0.05. This shows that the independent variable had a positive and significant relationship with the dependent variable. Therefore, the null hypothesis "there is no statistically significant relationship between resilient agri-food systems and household livelihood outcomes" was rejected. The findings imply that agri-food systems significantly influence household livelihood outcomes among farmers in Kitui County. In a modelled context, the following would be the results;

$Y = 48.88 + 0.164X +/- 0.084$

Where: Y is the Household Livelihood Outcomes; X is the level of Resilient Agri-food Systems

The statistics imply that with zero level of resilient agri-food systems (X=0 units), there would still be household livelihood outcomes equivalent to 48.88 +/- .084 units. However, introducing one unit of resilient agri-food systems would increase household livelihood outcomes by .164. This change would be significant at .01.

The findings concur with Bisht (2021) who opines that there are small-scale farmers in Uttarakhand hills in India who are embracing resilience to climate change through various ecological farming methods. Interventions that have benefitted the farmers include economic incentives, eco-nutrition education, and support. To champion innovative and improved agriculture on the hilly farms, the practices have been enhanced with support for biodynamic farming, improving markets, value chain development, and school meal programs adoption. Still in India, Priyadarshini and Abhilash (2021) evaluated the impact of COVID-19 on agri-food systems. India was reported to have had the second-largest number of COVI-19 infections by the World Health Organization. The researchers found that the country had to incorporate the most innovative ways into the agri-food systems to remain afloat in household food supplies. The country used strategies including 'Planetary Healthy Diets', an adoption to overcome food insecurity that faced the country during the peak of the COVID-19 pandemic. The findings depict the importance of preparedness for pandemics affecting household food supply. The current study in Kitui County- Kenya, did not have an objective on the effect of the pandemic. The COVID-19 pandemic accelerated the practice of agri-food systems in the county, creating a surge in food supplies in the country (CABI, 2020).

In a Chinese study by Lu et al. (2022), it is reported that China has been in efforts to achieve food

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security within its borders and across the globe. China has been practicing food security measures through transformative food systems. Some of the effective areas of China's resilient agri-foods systems include land consolidation, creation of food reserves, value addition, and diverse nutrition foods innovations. However, numerous challenges face the practices. The reduced diversity in foods, reduced agricultural lands and unsustainable environments are some of the pointed-out challenges. Similarly, the Kitui County scenario in resilient agri-food practices is not unique nor void of challenges.

In the African context, Sitko and Jayne (2018) used the challenges facing agricultural production such as declining productivity, soil degradation, weak African food systems, and irresponsiveness to climate change to call out for new dimensions in sustainable and innovative methods. Among the proposed methods include transformative subsidies for agricultural productivity, social safety through direct investment, the creation of alternative food systems, and organic farming. These are the concerns raised in the justification for the current study for the small-scale farmers in the larger Kitui County. The use and adoption of innovative mechanisms for agri-food systems are long overdue.

CONCLUSION

The study concluded that resilient agri-food systems practices influence household livelihood outcomes in Kitui County. Most of the farmers trained were facilitated by non-profit organizations (NPOs) on resilient agri-food practices and practiced conservation agriculture as their primary source of livelihood. Despite the training, the majority felt that they needed extra training to improve their livelihood outcomes. To enhance resilient agri-food systems in Kitui County, the provision of aggregation centres was considered very urgent (18.7% of the respondents). The majority of the study participants (43.1%) indicated having acquired more income to a more significant extent after engaging in resilient agri-food systems. Moreover, most of the respondents (56.9%) felt that there was little improvement in access to the market and pricing of farm inputs. Household livelihoods had improved as a large portion of the participants (61.8%) pointed out that their level of dependency on other people had reduced, and they were self-reliant.

The study also showed that most of the respondents (42.7%) had reduced their consumption of savings and assets to a larger extent. This was supported by statistics where a positive statistical association between increased household income and sex was found ($\chi^2=9.551$). The study found that aggregate variability in the resilient agri-food systems had a statistical influence on a household livelihood outcome while the random factors did not.

RECOMMENDATIONS

The study recommends a clear focus on agri-food systems with diversified pathways. This will enable the adoption of the most feasible methods for supporting individual household livelihoods. The use of training, providing incentives, and introducing insurance and social safety nets like it is in European countries may be a turnaround that will increase the benefits of agri-food systems practices on household livelihood outcomes in Kitui County.

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AUTHORS' CONTRIBUTIONS

The first, second and third authors participated in the research process from research conception to the development of research tools, data collection, analysis and writing of the research report.

REFERENCES

Adam, R., McDougall, C., Beveridge, M., & Marwaha, N. (2021). Advancing gender equality and women's empowerment in fish agri-food systems: Four pathways. WorldFish (WF) Publisher.

Ahmed, J. N., Tilahun, E. A., Italemahu, T. Z., Sintayehu, E. G., & Amphune, B. E. (2022). Modeling the vulnerability of livelihood systems to drought along livelihood zones in the Northwestern Escarpment of the Ethiopian Rift Valley. *Papers in Applied Geography*, (just-

Article DOI: https://doi.org/10.37284/eajass.5.1.705

accepted), 1- 48. https://doi.org/10.1080/23754931.2022.2068352

Aude, C. (2020). Beyond culturally-significant practices: Decolonizing ontologies for regenerative food-systems. In *Routledge Handbook of Sustainable and Regenerative Food Systems*, 50-64. Routledge. https://doi.org/10.4324/9780429466823

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D & Khoury, C. K. (2019). When food systems meet sustainability–Current narratives and implications for actions. *World Development*, *113*, 116-130.Doi: https://doi.org/10.1016/j.worlddev.2018.08.011

Bisht, I. S. (2021). Agri-food system dynamics of small-holder hill farming communities of Uttarakhand in north-western India: socio-economic and policy considerations for sustainable development. *Agroecology and Sustainable Food Systems*, *45*(3), 417- 449. https://doi.org/10.1080/21683565.2020.1825585

Bungu, O. (2019). The Role played by the Zimbabwean Women in Reviving the Agricultural Sector after the Dilapidation of the Zimbabwe - British Relations. *Journal of African Foreign Affairs*, *6*(2), 5–30. https://www.jstor.org/stable/26798959

Centre for Agriculture and Bioscience International. (2020). *New research highlights impact of COVID-19 on food security in Kenya and Uganda*. Phys- Org blogpost. https://phys.org/news/2020-09-highlights-impact-covid-food-kenya.html

Castree, N., Kitchin, R., & Rogers, A. (2013). Political Ecology. *A Dictionary of Human Geography*. https://doi.org/10.1093/acref/9780199599868.001.0001

Chaboud, G., & Daviron, B. (2017). Food losses and waste: navigating the inconsistencies. *Global Food Security*, *12*, 1- 7. https://doi.org/10.1016/j.gfs.2016.11.004

Danso-Wiredu, E. Y. (2018). Gendered Dynamics and Reciprocity in Fishing Communities in Ghana: The Case of Penkye, Winneba. *Journal of Black Studies*, *49*(1), 53–70. https://www.jstor.org/stable/26574544

Duncan, J., Carolan, M. S., & Wiskerke, J. S. C. (Eds.). (2021). *Routledge handbook of sustainable and regenerative food systems*. London: Routledge. Doi: https://doi.org/10.4324/9780429466823

Gillespie, S., van den Bold, M., & Hodge, J. (2019). Nutrition and the governance of agri-food systems in South Asia: A systematic review. *Food policy*, *82*, 13-27. https://doi.org/10.1016/j.foodpol.2018.10.013

Hudson, P., De Ruig, L.T., de Ruiter, M.C., Kuik, O.J., Botzen, W.J.W., Le Den, X., Persson, M., Benoist, A. & Nielsen, C.N. (2020). An assessment of best practices of extreme weather insurance and directions for a more resilient society. *Environmental Hazards, 19(3),* 301-321, https://doi.rog/10.1080/17477891.2019.1608148

Leslie, I., Wypler, J. & Bell, M. (2019). Relational Agriculture: Gender, Sexuality, and Sustainability in U.S. Farming. *Society & Natural Resources, 32(8),* 853- 874, https://doi.rog/10.1080/08941920.2019.1610626

Lipper, L., Cavatassi, R., Symons, R., Gordes, A., & Page, O. (2021). Financing adaptation for resilient livelihoods under food system transformation: the role of Multilateral Development Banks. *Food Security*, 1-16. https://doi.org/10.1007/s12571-021-01210-7

Lu, Y., Zhang, Y., Hong, Y., He, L., & Chen, Y. (2022). Experiences and Lessons from Agri-Food System Transformation for Sustainable Food Security: A Review of China's Practices. *Foods*, *11*(2), 137. https://doi.org/10.3390/foods11020137

Makate, C., Makate, M., Mango, N., & Siziba, S. (2019). Increasing resilience of smallholder farmers to climate change through multiple adoption of proven climate-smart agriculture innovations. Lessons from Southern Africa. *Journal of Environmental Management*, *231*, 858- 868. https://doi.org/10.1016/j.jenvman.2018.10.069.

Article DOI: https://doi.org/10.37284/eajass.5.1.705

Masamha, B., Thebe, V., & Uzokwe, V. (2018). Mapping cassava food value chains in Tanzania's smallholder farming sector: The implications of intra-household gender dynamics. *Journal of Rural Studies, 58*, 82-92.

Ortiz, R., & Peris, J. (2022). The Role of Farmers' Umbrella Organizations in Building Transformative Capacity around Grassroots Innovations in Rural Agri-Food Systems in Guatemala. *Sustainability, 14(5)*, 2695. MDPI AG. http://dx.doi.org/10.3390/su14052695

Population Reference Bureau. World Population (2021). R https://www.prb.org/what-we-do/focus-areas/world-us-population-trends/. Accessed on 18/08/2021

Priyadarshini, P., & Abhilash, P. C. (2021). Agri-food systems in India: Concerns and policy recommendations for building resilience in post COVID-19 pandemic times. *Global Food Security*, *29*, 100537. https://doi.org/10.1016/j.gfs.2021.100537

Shuaibu, M. & Nchake, M. (2021). Impact of credit market conditions on agriculture productivity in Sub-Saharan Africa. *Agricultural Finance Review, 81(4),* 520- 534. https://doi.org/10.1108/AFR-05-2020-0063

Sitko, N. J. & Jayne, T. S. (2018*). Integrating Climate- and Market-Smartness into Strategies for Sustainable Productivity Growth of African Agri-food Systems*. Working or Discussion Paper. https://doi.org/10.22004/ag.econ.270643

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M. & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science, 347* (6223), 1259855. https://doi.org/10.1126/science.1259855

Taufiq, M., Bashir, A., Adam, M., & Thamrin, K. M. H. (2017). Market Integration of Agricultural Products. *International Journal of Economics & Business Administration (IJEBA)*, (2), 69-82.

Tschunkert, K., & Delgado, C. (2022). Transforming food systems: Local food systems in focus. In *Food Systems in Conflict and Peacebuilding Settings: Ways Forward* (pp. 14–17). http://www.jstor.org/stable/resrep39755.8

United Nation, (2020). Transforming agri-food systems and fostering inclusive rural development in the context of COVID-19 to end rural poverty. https://www.un.org/development/desa/dspd/2020/11/end-rural-poverty/

