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**COLLECTIVE ACTION, WOMEN EMPOWERMENT AND
HOUSEHOLD FOOD SECURITY AMONG SMALLHOLDER
FARMERS IN MURANG'A COUNTY, KENYA**

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EMBU**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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DEDICATION

I dedicate this thesis to the Almighty God, my supportive family, my parents late Charles Maindi and Florence Moraa, my beloved husband Isaac Maina and our three children Viola Kemunto, Edwin Daiki and Edgar Daichi.

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AUTHORSHIP DECLARATION: CO-AUTHORED PUBLICATIONS

This thesis entails co-authored work, part of it is ready for submission for publication and some of it is under review in peer-reviewed journals. The details of the work are highlighted below.

Chapter two: “Collective action typologies and their implications for policy targeting: The case of smallholder households from the central region of Kenya.” *A publication in the Journal of Agriculture and Food Research.*

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LIST OF ABBREVIATIONS AND ACRONYMS

AME	Average Marginal Effects
ASTGS	Agricultural Sector Transformation and Growth Strategy
ATE	Average Treatment Effects
ATT	Average treatment effects on the treated
CA	Cluster Analysis
CEDAW	Convention on Elimination of all Forms of Discrimination against Women
ESR	Endogenous Switching Regression
ESTER	Exogenous Switching Treatment Effects Regression
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FFI	Feed the Future Initiative
FFS	Farmer Field School
FHH	Female Headed Households
FIML	Full Information Maximum Likelihood
GDP	Gross Domestic Product
GGGI	Global Gender Gap
GHI	Global Hunger Index
GOK	Government of Kenya
HDDS	Household Dietary Diversity Score
HFS	Household Food Security
HLPE	High Level Panel of Experts
ICT	Information, Communication and Technology
IDR	Import Dependency Ratio
IFPRI	International Food Policy Research Institute
IIA	Independence of Irrelevant Alternative Assumption
KARLO	Kenya Agricultural and Livestock Research Organization
KES	Kenyan Shillings
KM	Kilometres
KNBS	Kenya National Bureau of Statistics
LTU	Livestock Tropical Units
MCA	Multiple Correspondence Analysis

METE	Multinomial Endogenous Treatment Effects
MHH	Male Headed Households
NACOSTI	National Commission for Science, Technology and Innovation
NARIGP	National Agriculture and Rural Inclusive Growth Project
NGEC	National Gender Equality Commission
NGO	Non-Governmental Organizations
PMG	Producer and Marketing Groups
PO	Producer Organizations
ROSCA	Rotating Savings and Credit Association
SDG	Sustainable Development Goals
SHG	Self-help Groups
SSA	Sub-Saharan Africa
SSR	Self-Sufficiency Ratio
UN	United Nations
UNICEF	United Nations Children’s Fund
UNSSCN	United Nations System Standing Committee on Nutrition
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WDDS	Women’s Dietary Diversity Score
WEAI	Women Empowerment in Agriculture Index
WFP	World Food Programme

DEFINITION OF OPERATIONAL TERMS

Characterization	Is the empirical synthesis of the complexity of the collective action initiatives and stratifying them into a limited number of distinct groups or subsets based on their organizational characteristics (Bijman, 2016).
Collective action	Refers to the the act of uniting individuals to engage in collective and mutual welfare-enhancing activities at an economic, social and environmental level (Lupi <i>et al.</i> , 2021).
Collective action initiatives	Refer to different forms or variants of collective action that engage in collective and mutual welfare-enhancing activities at an economic, social and environmental level (Lupi <i>et al.</i> , 2021). They include producer and marketing groups, savings and credit associations, self-help groups and community based organizations (Bijman & Hanisch, 2020).
Collective action typologies	Are the empirically stratified and distinct subsets or groups of collective action initiatives that manifest homogenous organizational characteristics (Bijman, 2016).
Food security	Refers to a situation where the smallholder farmers have reliable access to sufficient quantity, affordable and nutritious food. (Food and Agriculture Organisation, 2021).
Women empowerment	Is the ‘process by which women smallholder farmers are granted opportunities to make decisions in agriculture and having access to resources to implement those decisions (Galiè <i>et al.</i> , 2019).

Gender

Gender can be defined as socially determined ideas, relations and roles between men and women that are created by political, cultural and economic institutions within the household, community and wider social environment (Phiri *et al.*, 2022).

Nutritional pathways

Paths through which household food security is achieved such as women empowerment, income and production.

ABSTRACT

Food insecurity and malnutrition is a major developmental challenge in Sub-Saharan Africa. In the region, women empowerment holds a potential to achieving household food security (HFS). Despite this, women face gender-specific constraints in their access to productive resources, inequitable decision making and time constraints which limit their potential in achieving household food security. Collective action has been promoted as a pathway to empowering women for improved HFS. However, the empirical basis exploring the effect of context-specificity collective action on women empowerment and HFS is barely established. Employing data collected from 532 proportionately and randomly sampled households, ten focus group discussions, and two key informant interviews, this study assessed the effect of collective action and women empowerment on HFS among smallholders in Murang'a County, Kenya. Based on a multiple correspondence analysis and cluster analysis, the study characterised the typologies of collective action. Secondly, multivariate probit model (MVP) and exogenous switching treatment effects models were applied to assess the determinants of gendered participation patterns in different typologies of collective action. Thirdly, based on METE and MVP, the study evaluated the effect of collective action on women empowerment. Lastly, a multinomial logit model and endogenous switching regression model were employed to evaluate the effect of women empowerment on HFS through the moderating effects of collective action. The results revealed two typologies of collective action namely, efficiency and livelihood that were highly distinct in their level of formalization, membership composition, nature and scope of coordination, level of social capital, level of social networking and internal governance mechanisms. Findings on participation revealed gender gaps across livelihood and efficiency typologies. The gender gaps can be explained by the differences in organizational characteristics and unobservable and observable characteristics between men and women regarding farm size, livestock, off-farm income, bank account, education and farming experience. The women's empowerment outcomes were differentially influenced by the differences in organizational and household characteristics. The efficiency typology improved women's empowerment in income control, public speaking and membership in groups. Livelihood typology improved women's decision-making and autonomy in production, asset, income and credit control, workload and leisure. However, both typologies failed to influence women's ownership of assets. On the HFS effects, on the efficiency typology, except production, the negative effects were observed on income control, asset ownership, workload and public speaking. The findings further revealed that among the livelihood typology, production and public speaking, income control and workload positively influenced HFS and asset ownership negatively influenced HFS. In accounting for the HFS effects along the production and income pathways, the results revealed HFS effects were higher among livelihood typology than efficiency typology. Contrary to the livelihood typology that revealed a positive effect of income on HFS, the efficiency typology showed a negative effect on HFS through income. The overall HFS across the combined pathways of income and production was lower for the efficiency typology than the livelihood typology. Findings the study contributes to the study of new institution economics and concludes that one size fits all promotional policy approaches are inadequate. The study suggests multiple policy interventions that would confer complementarities, synergies and spill over effects in developing the collective action typologies while addressing the goals of food security, gender equality and women empowerment and poverty reduction concurrently.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Food insecurity and malnutrition is a central and persistent developmental challenge worldwide. Global prevalence rates of food insecurity in the past three years has steadily risen from 7.9% in 2019 to about 9.3% in 2022 (Food and Agriculture Organization [FAO], 2023). Food insecurity in Sub-Saharan Africa (SSA) region disproportionately affect up to 23.4% of the 828 million world's population that are exposed to undernourishment (FAO, 2023). In Kenya particularly, despite considerable economic growth between the year 2016 and 2021 occasioned by an increase in food self-sufficiency ratio (SSR) and reduced food import dependency ratio (IDR), an estimated 24% of the Kenyan population was experiencing hunger (Global Hunger Index [GHI], 2023). In the country, about 33% of the population subsist on less than the required daily capita calorific threshold of 2250 kilocalories (Kenya National Bureau of Statistics [KNBS], 2023). Similar to the rest of SSA economies, in Kenya, vulnerability to food insecurity is disproportionately prevalent among smallholders, whereby 38.9% of the farmers live below the poverty line (Gomez *et al.*, 2020).

Smallholder household producers account for almost 80 per cent of the food consumed in the developing world as food producers, processors and traders (Gomez, 2020). In SSA, women smallholder farmers in particular contribute about 60 to 80% of the food consumed in SSA through engaging in crop and livestock production, post-harvest processing and small trade and marketing (Quisumbing *et al.*, 2021). Women also engage in traditional domestic responsibilities of caregiving, hygiene, food provisioning and food preparation practices (such as fetching water, fuel wood and cooking) and community collective action activities that often form a basis for household food security (HFS) (Galiè *et al.*, 2019; Quisumbing *et al.*, 2021). Despite the women's integral roles in contributing to HFS, they face gender inequalities in regard to access to, decision making over and use of productive resources including livestock, labour, land, technology and credit (Quisumbing *et al.*, 2020; Diiro *et al.*, 2018).

In Kenya, about 6% of women own land and only 0.5% have access to financial services (United States International Development Agency [USAID], 2020). Additionally, gender inequalities in Kenya's agricultural sector include inequitable intra-household decision making in production and incomes generated from agriculture (USAID, 2020). Women are also limited in decision-making in community activities such as collective action (Nakazi *et al.*, 2017). Further, in relation to men, women spend more hours in farm, domestic and reproductive responsibilities which limit their participation in income-generating activities and extension and advisory services (Sraboni & Quisumbing, 2018; Diiro *et al.*, 2018). Reducing these gender inequalities by empowering women has gained recognition worldwide as a pathway to influencing household food security trajectories (FAO, 2021; Quisumbing *et al.*, 2020).

Collective action has been promoted as an important entry point for empowering women alongside promoting development of agriculture and rural economies concurrently (Galiè *et al.*, 2019; Sulemana *et al.*, 2020). Some of the common collective action initiatives (CAIs) in SSA include savings and credit groups, producer and marketing groups, forest and water user groups, community based organizations, unions and cooperatives (Mwambi *et al.*, 2020). The importance of collective action in empowering women underpins its potential to address the social vulnerability of women in decision-making processes (Sulemana *et al.*, 2020). This is through transforming the gender relations within the household, community and wider societal levels for greater, scalable and sustainable empowerment outcomes (Aziz *et al.*, 2022). The economic theory underpinning collective action is its novel approach of deploying grassroots cooperation and innovation in ameliorating the negative externalities in agriculture associated with limited public intervention, state and market failures (Serra & Davidson, 2021). Despite the potential of collective action in empowering women, literature reveals mixed evidence on the effect of collective action on women empowerment.

On one hand, collective action has been shown to improve women's livelihoods and empowerment by improving their access to resources, household decision making and access to improved technologies which would reduce their workloads (Galiè *et al.*, 2019; Quisumbing *et al.*, 2020). On the other hand, the gender-specific constraints imply that women face barriers in participating in collective action or

when they participate, their empowerment outcomes could be limited by inequitable social norms, intra-household dynamics and backlash from their husbands (Alemu *et al.*, 2018). Furthermore, women's participation in formal collective action activities including meetings and trainings, may increase their workload given their production, domestic and reproduction responsibilities (Akter *et al.*, 2017; Alemu *et al.*, 2018; Serra & Davidson, 2021). The inconsistent findings point to the need to further explore the patterns of women empowerment arising as a result of differences in organizational characteristics of collective action typologies.

Characterization of the CAIs would create an in depth and consistent understanding of their differences in structure and functionalities and its implications on participation patterns from an intra-household gender dynamics perspective, women empowerment and subsequent HFS effects. However, literature barely reveals documented heterogeneity nature of the CAIs. The women empowerment benefits can only be accrued through inclusion of women in their participation in collective action (Ampaire *et al.*, 2020; Nakazi *et al.*, 2017). Participation in collective action is closely linked to social, human and physical capital (Serra & Davidson, 2021). For instance, well-endowed farmers in respect to education, land sizes, livestock holdings and access to information are more likely to participate in collective action (Karing'u *et al.*, 2020). Following the economic theory of gendered economy in agriculture that refutes gender neutrality in smallholder agricultural sector, there exists differentials and inequalities among women and men in agricultural roles, decision-making power and resource endowments (Doss & Quisumbing, 2020; Duflo & Udry, 2016). Therefore, the willingness and ability to participate in collective action is not homogeneously distributed among men and women (Dohmwirth & Hanisch, 2018).

Participation in collective action has also been linked to organizational characteristics of the groups, and as such attributes may differ across the different group typologies (Fischer & Qaim, 2014). Therefore, assessing the determinants of participation among male and female farmers in various typologies of collective action would draw insights that would enhance inclusivity. Mwambi *et al.* (2020) asserts that collective members' behaviour correlates with the group's organizational characteristics which in turn correlates with the pathways, nature and extent of women empowerment benefits leveraged. For instance, loyalty and commitment, good group internal governance, optimal group size, cohesion, trust and reciprocity, member

homogeneity and enforcement of group rules and regulations could foster women empowerment outcomes (Mwambi *et al.*, 2020; Oxfam, 2013). However, these organizational characteristics depend on, and vary considerably across CAIs. Therefore, it is expected that differentials in characteristics of CAIs may variably affect the nature and extent of the women empowerment benefits leveraged (Mwambi *et al.*, 2021).

Empowerment of women can affect household food security trajectories (Malapit & Quisumbing, 2015; Ragasa *et al.*, 2019). Evidence shows that women's increased control over resources, time use and household income improved the HFS (Padmaja, *et al.*, 2019; Sinharoy *et al.*, 2018). However, in some cases improved incomes among women did not have any effect on HFS because men took control over the incomes (Fischer & Qaim, 2012; Galiè *et al.*, 2019). This mixed findings aforementioned imply that the HFS benefits accrued would not necessarily be accounted by women empowerment effects but they may be attributed to changes in the nutritional pathways of production and household income arising from collective action participation (Nosratabadi *et al.*, 2020). The standard hypothesis in literature holds that participation in collective action improves HFS through production and income (Nosratabadi *et al.*, 2020; Shumeta & D'Haese, 2018).

The previous studies reveal that collective action may not adequately meet HFS needs of households and/or some households may be excluded from participating therein (Cheevapattananuwong *et al.*, 2020). For instance, collective action may improve HFS through improvement in production resulting from collective input acquisition and adoption of improved farming practices and technologies (Shumeta & D'Haese, 2018). However, marketing CAIs may lead to farmers diverting resources to market-oriented production at the expense of for-home consumption production (Linderhof *et al.*, 2019). Conversely, the incomes generated from collective marketing could improve HFS by increasing budgetary allocation of nutritious food items. However, due to liquidity constraints, the households may divert the incomes to other non-food items such as education, health, home improvement and contributions to the collective savings and credit kits (Wegi *et al.*, 2023). The inconsistent findings on the influence of collective action on HFS through production, income and women empowerment implies that the socioeconomic, cultural and institutional factors influencing the three nutritional pathways vary contextually and therefore, it is

difficult to anticipate the direction of the effect of the three pathways on HFS (Quisumbing *et al.*, 2020). Therefore, it is necessary to disaggregate and delineate the effects of collective action on HFS through production and income vis-à-vis the effect of collective action on HFS through the pathway of women empowerment.

Literature barely reveals studies tracing HFS through the linkages of collective action along the nutritional pathways of production, income and women empowerment. This study departs from other studies in several ways. First, the study characterised the CAIs into clusters or typologies that pose homogenous organizational characteristics. This is because the CAIs adopt divergent transaction-cost reduction mechanisms as reflected in their nature and scope of activities, membership and composition, internal governance systems and level of social capital and social networking (Min-Han Tsai & Yir-Hueih, 2022). Despite the diversity, literature barely reveals well documented heterogeneity nature of the collectives notably employing robust econometric models. The very few available studies employ qualitative methods (Bizikova *et al.*, 2020; Groot Kormelinck *et al.*, 2019; Mwambi *et al.*, 2020) and literature review (Bijman & Hanisch, 2012, 2020). Secondly, the previous studies fail to consider the perspective of gender and typological participation in collective action. This presumption treats men and women as homogeneous entities in their collective action participation behaviour (Agarwal, 2000). The studies that consider gender focus majorly on participation of women in groups and barely pay attention to the influence of intrahousehold gender dynamics on participation patterns among men and women (Agarwal, 2000; Selhausen, 2016; Nakazi *et al.*, 2017; Woldu *et al.*, 2018). This study therefore disaggregated and explored the determinants of participation among men and women in various typologies of collective action.

Thirdly, besides membership, the nature and extent of women empowerment benefits accrued correlates with the organizational attributes of CAIs (Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021). In light of many typologies of collective action, it is important to assess whether and how the structures and functionalities across the collectives can foster (through creating opportunities, benefits and synergies) or impede (by posing challenges, costs, risks and trade-offs) cooperation. These situations may deliver win-win, win-loss, loss or trade-off situations in pathways, nature and extent of women empowerment outcomes leveraged as of their HFS benefits (Mwambi *et al.*, 2021; Oxfam, 2013). Yet, most of the studies done on

the effect of collective action on women empowerment largely do not take into account of these heterogeneities but focus on either specific CAIs as single entities or arbitrary pooling of CAIs (Fischer & Qaim, 2012; Ganle *et al.*, 2015; Hoop, *et al.*, 2019; Pionetti, 2011).

The arbitrary bundling of the CAIs in research dissipates collective action typologies into a ‘one size fits all’ collective action program design and policy interventions. Based on the quantitative and qualitative data collected from the smallholder households in Murang’a County, Kenya, the study characterized the CAIs into typologies. The study also assessed the effect of heterogeneities of collective action typologies alongside the gender differentials and inequalities on collective action participation patterns among men and women. The study incorporated on how intrahousehold gender dynamics influence the participation patterns of women across the collective action typologies and conversely explored how participation in collective action influences the intra-household dynamics of gender to empower women. Women empowerment indicators were measured by employing internationally validated Women Empowerment in Agriculture Index (WEAI) indicators of time, production, income, resources, and leadership. Finally, the study delineated how the nature of women empowerment leveraged as a result of participation in different CAIs influences the nature and extent of HFS accrued alongside their respective nutritional pathways. In general, this study assessed the influence of collective action on HFS through production, income and women empowerment among smallholder households in Murang’a County of Kenya. The insights of the study contribute to formulating context-specific, gender-sensitive and nutritionally-sensitive collective action policies. The policies would confer synergies, spill over effects and complementarities in developing the collective action typologies alongside achieving the multiple objectives of poverty reduction, gender equality and food security concurrently.

1.1.1 Overview of the status of food security in Kenya

A report by FAO (2021) shows that 24.8% of the population malnourished, 25.7% being severely food insecure. In Kenya, malnutrition levels are also high with 24% of the population being hungry, 29.4% being malnourished, and 6.0% being overweight (FAO, 2021). Murang’a County reports food insecurity in form of staples

and rates of stunting and wasting in children under five as 20.1% and 5.0% respectively, below the national averages of 29.9% and 13.0% (KNBS, 2023).

1.1.2 Context of collective action in Kenya

Similar to the rest of SSA, collective action in Kenya emerge endogenously as self-driven initiatives under locals' own terms and/or at the initiation of, or by seeking linkage to external agencies, clustering on the kinship or social grounds (Bijman & Hanisch, 2012). Collective action initiatives are instituted in diverse forms as producer and marketing groups, rotating savings and credit associations (ROSCAs), self-help groups (SHGs) and cooperatives (Bijman, 2016). The diversity of the collectives is exhibited by their structure and functionalities in respect to terms of engagement, formalization, membership, internal governance mechanisms and their nature and scope of activities (Bijman & Hanisch, 2020; Francesconi & Wouterse, 2019). In Kenya, the number of farmer collectives have a sustained increase for the past five years, from 5,454 in the year 2015 to 7,461 in the year 2020 (KNBS, 2021).

1.1.3 The status of women empowerment in Kenya

The Global Gender Gap Index Report (2020), ranks Kenya at position 114 out of 153 with the sub index of 0.598. In Kenya, almost 65% of women engage in agricultural sector compared to men at 40% (USAID, 2020). Women own 1% of registered land titles and only 0.5% of the women have access to financial services (USAID, 2020). Women in Kenya work on average work 15 to 17 hours in a day while men work for 6 to 7 hours (USAID, 2020). Women are also underrepresented in decision making in households and in collective action, constituting of about 30% of the membership in agricultural collectives (Sacco Societies Regulatory Authority [SASRA], 2019).

1.2 Statement of the problem

Food security is a major developmental challenge in SSA that has been attributed to gender disparities and differences in agricultural roles, resource endowments and utilisation and decision-making power. In the region, women contribute to HFS through production, food provisioning and preparation and caregiving (Doss & Quisumbing, 2020). Despite this, women face limited access to resources, inequitable decision making and time constraints which limit their potential in safeguarding food security of their households (Njuki *et al.*, 2021). Collective action holds the potential to empower women (Mwambi *et al.*, 2021). However, the mixed findings of women

empowerment on HFS necessitates an empirical exploration of how the context-specificity of collective action influences women empowerment and HFS. However, literature reveals a gap on the influence of collective action on HFS and women empowerment. The little evidence available reveals inconsistencies on the effect of collective action on women empowerment (Ravichandran & Farnworth, 2021). The inconsistencies may be attributed to changes in production and income as well as heterogeneities across CAIs. This points out to the need of disaggregating HFS that potentially arise as a result of improved production and incomes from HFS effects accrued from women empowerment pathway. However, literature barely reveals any study exploring HFS through the linkages of collective action along the pathways of women empowerment, production and income.

This is so especially in paying less attention to the heterogeneous and contextual nature of the cultural, socioeconomic factors influencing women empowerment, production and income. Yet, the empowerment benefits and changes in production and incomes do not deliver HFS outcomes homogeneously across households (Quisumbing *et al.*, 2020). Therefore, this study assessed the mechanisms through which collective action can deliver HFS through income, production and women empowerment. This is through: empirically documenting the organizational characteristics of CAIs. The study extends to delineating how differentials in organizational characteristics influence participation patterns among men and women due to their differentials and inequalities in resource endowments, decision-making power and roles in agriculture. The study further investigated the implications of participation patterns on women empowerment and their subsequent HFS along the pathways of income, women empowerment and production.

1.3 Objectives

1.3.1 General objective

The general objective of the study was to evaluate the effect of collective action on women empowerment and household food security among smallholder farmers in Murang'a County, Kenya.

1.3.2 Specific objectives

The study sought to address the following specific objectives:

- i). To characterise the typologies of collective action and their roles among smallholder households in Murang'a County, Kenya.
- ii). To assess the determinants of participation in different typologies of collective action among men and women smallholder households in Murang'a County, Kenya.
- iii). To evaluate the effect of collective action on women empowerment among smallholder households in Murang'a County, Kenya.
- iv). To evaluate the effect of women empowerment on household food security among smallholder households in Murang'a County, Kenya.

1.4 Research questions

These are the research questions the study sought to answer:

- i. What are the characteristics of the typologies of collective action and their roles among the smallholder households in Murang'a County, Kenya?
- ii. What are the determinants of participation in different typologies of collective action among men and women smallholder farmers in Murang'a County, Kenya?
- iii. How does collective action affect women empowerment among smallholder households in Murang'a County, Kenya?
- iv. How does women empowerment affect household food security among smallholder households in Murang'a County, Kenya?

1.5 Justification of the study

Collective action is important in ameliorating market failures, public intervention gaps and policy inadequacies in promoting women empowerment and HFS. Despite this, empirical literature exploring the effect of the heterogeneities of CAIs on HFS through the triple nutritional pathways of women empowerment, production and income is barely explored. This study contributes to the body of knowledge in new institutional economics academic research for development by documenting the effects of socio-economic context-specificity of CAIs and the households on HFS through the triple pathways of women empowerment, income and production. The insights of the study provide tailored gender-sensitive and nutrition-sensitive policies and collective action program design. Findings of this study would contribute to rural

development through socially and economically empowering the smallholder farmers in Murang’a County. The policies would confer complementarities, synergies and spill over effects in simultaneously contributing to the first Sustainable Development Goal (SDG) of alleviating poverty, second SDG of achieving food security and the fifth SDG of achieving gender equality (United Nations [UN], 2016).

1.6 Conceptual framework

Figure 1.1 presents a schematic conceptual framework linking dependant and independent variables of the study. The explanatory variables include farm and farming factors, demographics, income and assets and infrastructural and institutional factors.

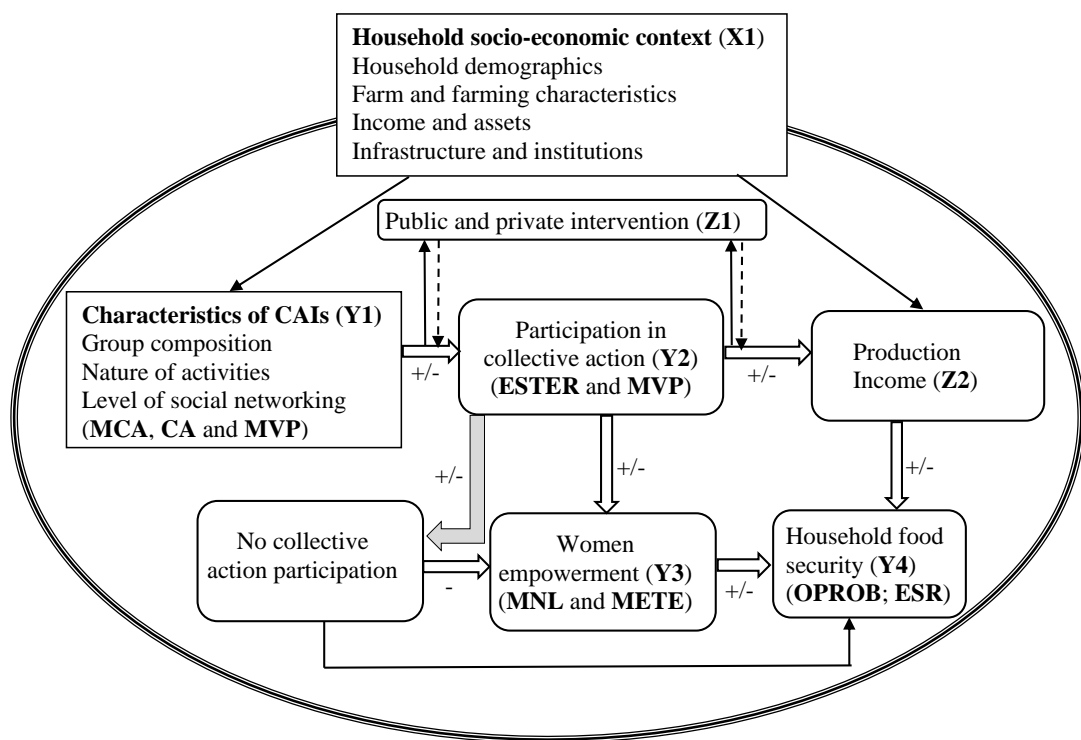


Figure 1.1: Conceptual framework

Source: Author’s conceptualization

Note: X1-Independent variables; Y1 to Y4 and Z2-dependant variables; Z1 and Z2 - intervening variables; MCA-multiple correspondence analysis; CA-cluster analysis; MVP - multivariate probit analysis; MNL - multinomial logit analysis; OPROB - ordered probit model; ESTER-endogenous switching treatment effects regression; ESR - endogenous switching regression; METE - multinomial endogenous treatment

effects model. The arrows indicate the cause-effect relationships among the variables.

The dependent variables include participation in collective action, women empowerment and HFS. In the study, it is presumed that a household will only participate in collective action if the perceived economic and non-economic costs outweigh the expected benefits. It is hypothesised that CAIs adopt divergent transaction-costs mechanisms and therefore, the incidence and perception of the cost and benefits are heterogeneously manifested across CAIs with respect to their structure (membership composition, group size), functionality (nature and scope of activities) and conduct (the level of social capital, level of social networking and internal governance mechanisms (Min-Han Tsai & Yir-Hueih, 2022)). Accordingly, it is expected that different collective action typologies generate varietal costs and benefits among men and women. This is because men and women adopt differential transaction cost-reducing mechanisms in mobilising across the CAIs due to their differentials in resource endowments and utilization, preferences and priorities, empowerment gaps and infrastructural and institutional developments (Doss & Quisumbing, 2020). Therefore, it is expected that the abilities and willingness of men and women to participate in specific CAIs may differ. The differential participation patterns among men and women across different CAIs are expected to pose either win-win, win-loss or loss scenarios on the nature, extent and the pathways of women empowerment benefits leveraged. In turn, the heterogenous women empowerment benefits interplaying with household socio-economic context are expected to variably influence the HFS benefits with respect to the nature, extent and the associated nutritional pathways.

1.7 Scope of the research

The study was limited to the smallholder CAIs in Murang'a County, Kenya and utilized cross-sectional data drawn from household survey, key informant interviews and focus group discussions to explore on the effect of collective action on women empowerment and HFS.

1.8 Outline of the thesis

The outline of the thesis is shown in Figure 1.2. Chapter two and three covers objective one, Chapter two focusses on the characterization of collective action

typologies while chapter three focusses on the roles of CAIs in safeguarding HFS. Chapter four covers objective two that explores the participation patterns among men and women s participation across the different collective action typologies. Chapter five focusses on objective three in evaluating the effects of collective action on women empowerment. Chapter six focusses on objective four that evaluates the effect of women empowerment on HFS. Chapter seven discusses and synthesises the results of chapter two, three, four, five and six, and also highlights the main conclusions and policy implications.

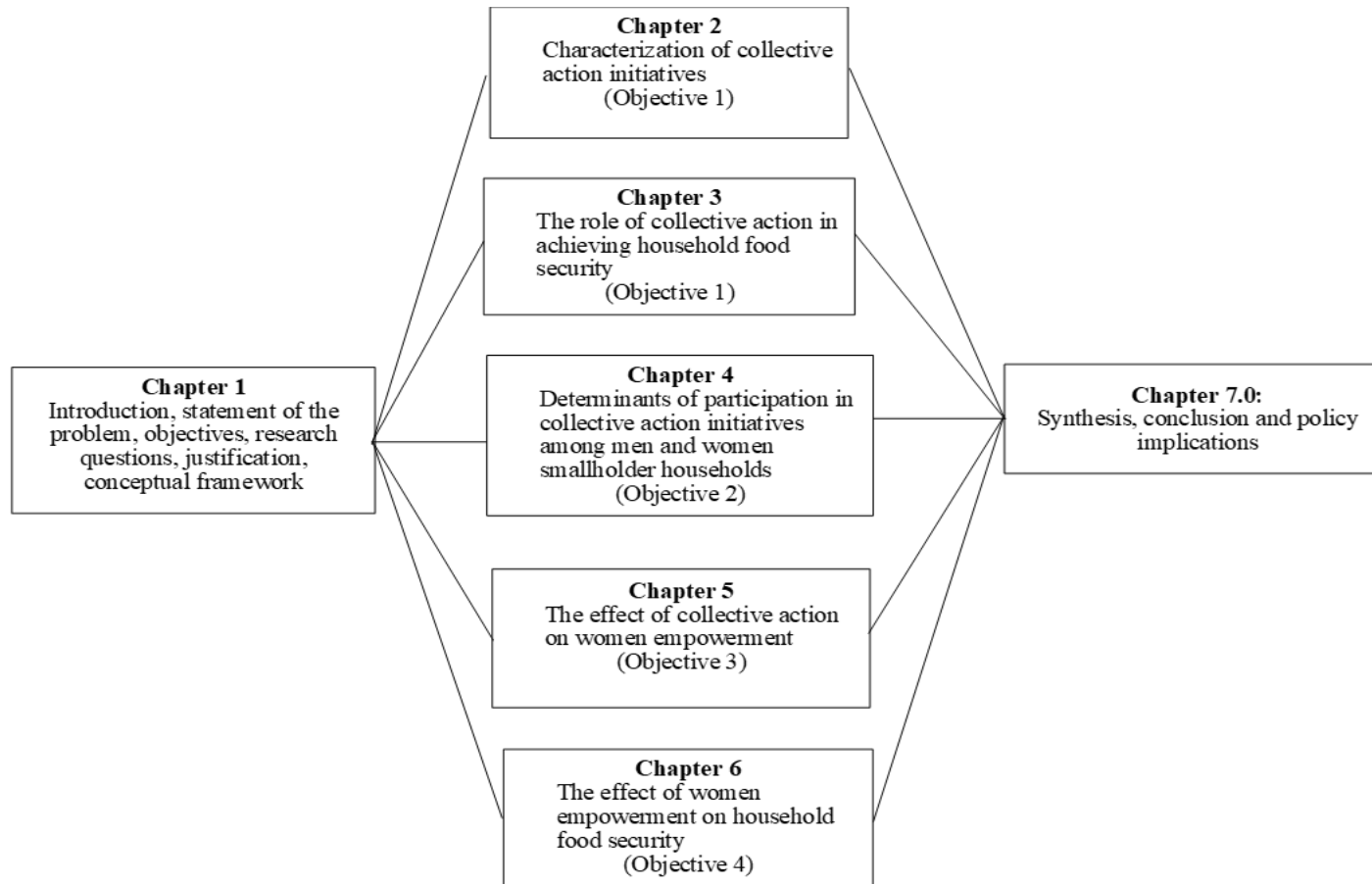


Figure 1.2: Outline of the thesis

Source: Author's drawing

CHAPTER TWO

Collective Action Typologies and their Implications for Policy Targeting: The Case of Smallholder Households from the Central Region of Kenya

Abstract

Collective action initiatives (CAIs) are important in ameliorating negative externalities in agriculture to promote socio-economic development in Sub-Saharan Africa (SSA). However, the empirical basis exploring the context-specificity underpinning the CAIs is barely established. This study characterized the organizational attributes of CAIs and their implications on policy targeting. The study used mixed qualitative and quantitative techniques based on survey data drawn from 532 multistage randomly and proportionately sampled smallholder households, ten focus group discussions and two key informant interviews from the central region of Kenya. Multiple correspondence analysis and cluster analysis were used in exploring the organizational attributes of CAIs. A multivariate probit model was employed to explore how organizational and household socio-economic characteristics influence participation patterns across the collective action typologies. The results revealed two typologies of collective action namely, efficiency and livelihood that were highly distinct in their level of formalization, membership composition, nature and scope of coordination, level of social capital, level of social networking and internal governance mechanisms. The households' participation patterns across the efficiency and livelihood typologies were differentially influenced by institutional and infrastructural factors, farm and farming factors, household demographics and assets. The findings suggest that the 'one-size-fits-all' collective action policy is inadequate and suggests a portfolio of context-specific collective action promotional policies. The policies would confer potential complementarities, synergistic and spillover effects in developing CAIs to address multiple developmental objectives simultaneously.

Keywords: Collective action initiatives, typology, multiple correspondence analysis, cluster analysis, Kenya

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2.1 Introduction

Collective action initiatives (CAIs) help local smallholder communities to increasingly play an active role in ameliorating the negative externalities in agriculture including public intervention gaps, policy inadequacies and market failures to improve the socio-economic welfare of households (Kwizerimana *et al.*, 2023; Zou & Wang, 2022). This study defines CAIs as mutual and collaborative actions and decisions led by smallholder households to improve their social and

economic wellbeing (Lupi *et al.*, 2021). In SSA, the most common CAIs that have emerged in recent decades include community-based organizations, farmer field schools, rotating savings and credit associations, producer and marketing groups and water and forest user associations (Bijman & Hanisch, 2020; Mwambi *et al.*, 2020; Beber *et al.*, 2021). The CAIs can help smallholders mitigate the effects of high transaction costs and asymmetric information in input and output market participation (Ma *et al.*, 2023). In addition, CAIs have helped smallholders to meet modern market challenges such as standards, procurement procedures and certification (Serra & Davidson, 2021). They also strengthen smallholders' institutional agency in markets, social context and policy discourse (Habiyaemye *et al.*, 2023).

The CAIs also help in securing and enhancing households' livelihoods and resilience stock through the pooling of savings, sourcing of credit, accumulation of assets and provision of informal insurance (Mutonyi, 2019). Evidence from developing countries shows that CAIs have increased access and participation in markets (Fernando *et al.*, 2021), enhanced market performance (Habiyaemye *et al.*, 2023; Kwizerimana *et al.*, 2023), household income and assets (Mutonyi, 2019), food security (Lufuke *et al.*, 2023) and empowering women in communities in which they are embedded (Serra & Davidson, 2021). Nevertheless, to be successful in achieving the social and economic objectives, different CAIs can adopt different enabling organizational characteristics to achieve market competitiveness and organizational performance. The CAIs should be able to conduct their activities in a manner that can enable them take advantage of the potential prevailing opportunities including adoption of technological innovations, access to markets and value chain integration (Ampaire *et al.*, 2020). In addition, CAIs should be able to adopt appropriate adaptive and coping strategies in the face of agricultural risks and shocks including crop failure, volatile markets and stresses such as climate variability (Rocha *et al.*, 2021). The CAIs share some common characteristics including their novel approach of deploying local involvement and grassroots innovation in promoting smallholders' economic and social development (Bizikova *et al.*, 2020). They are also characterised by voluntary membership that coheres and operates at the grassroots micro-level bound by neighbourhood and kinship ties.

The CAIs adopt membership entry criteria which can either be open or closed depending on their organizational performance. In most cases, CAIs that seek

efficiency-enhancing activities and successful and best-performing CAIs practice closed membership entry criteria (Ingutia & Sumelius, 2022). Some of the CAIs operate informally while others are registered under the Cooperatives Act, adopting blended institutional arrangements crafted from the cooperatives act and traditional communities in which they are embedded (Mwambi *et al.*, 2020). The CAIs are autonomous self-help entities that are owned, democratically controlled, and benefit their members (Republic of Kenya, Ministry of Industry, 2019). The members of CAIs contribute equitably to as well as democratically control their financial contributions with a common objective of working for the socio-economic sustainable development of their communities through the laws, regulations and policies approved by their members (Ampaire *et al.*, 2020). The CAIs operate as multipurpose entities in pursuing common objectives including but not limited to collective sourcing of farm inputs and credit, collective marketing of farm products, pooling of savings, sourcing of credit, conservation of natural resources, acquisition of assets and provision of informal insurance (Cramer *et al.*, 2016).

The micro-level organizational structures of CAIs prevail as a result of dynamic, complex and continual interactions with the local economic and social context of the smallholder actors in terms of their divergence in resource endowments and utilization, socio-cultural norms, farming systems, institutional and infrastructural developments, policy, legal and regulatory frameworks (Mutonyi, 2019; Serra & Davidson, 2021; Kwizerimana *et al.*, 2023). Subsequently, CAIs manifest diversity in their membership composition, functions, nature and level of coordination, level of social capital, internal governance mechanisms and level of formalization depending on the local socio-economic context within which they are embedded (Ampaire *et al.*, 2020). The heterogeneities differentially influence their opportunities, challenges, synergies and trade-offs in their service delivery. In this context, any effort meant to understand, upscale or develop smallholder CAIs needs to begin with acknowledging such heterogeneity by characterising them into useful and informative frameworks. A scientific way of dealing with the heterogeneity of the CAIs is to artificially stratify them into distinct groups or subsets that are homogeneous according to their organizational characteristics such as functions, level of social networking, formalization, membership composition, nature of activities and level of social capital (Bizikova *et al.*, 2020).

Collective action typologies perform such stratification, wherein the term typology designates both the empirical approach and the type of characterization and the collective action types arising from this procedure (Bizikova *et al.*, 2020). Typologies are important in unravelling the structural relationships between the organizational characteristics to reveal the structural and systemic opportunities and challenges underlying the CAIs (Groot Kormelinck *et al.*, 2019). This would be useful in evaluating the effectiveness of the collective action policies vis-à-vis what kind of policies the CAIs would need to enhance their effectiveness. A few studies have typified CAIs based on different theoretical and empirical approaches in different parts of the world, employing a variety of criteria that intersect across the regions (Bijman & Wijers, 2019; Groot Kormelinck *et al.*, 2019). The first strand of literature typifies market-oriented or efficiency CAIs that perform economic functions. Groot Kormelinck *et al.* (2019) characterized the conventional and organic chain producer (POs) organizations in vegetable value chains in Uruguay. The study found that the conventional chains were established to pursue public incentives, focussing on social and economic activities. Contrariwise, the organic POs purposely engage in seeking market incentives, had a product focus, needed member investment and are highly formalized. Owing to the concerns of increasing organizational and market competitiveness, the characteristics of the POs depict transaction cost-reducing mechanisms along the value chain in internal coordination, enforcing compliance, transparency and accountability. In reducing the transaction costs and risks, while the formal arrangements such as contractual agreements with the collaborating partners are important, the informal conduct such as trust, reciprocity and reputation also mutually bind actors in the exchange processes (Fernando *et al.*, 2021).

Additionally, business-oriented or efficiency CAIs impose exclusive membership in locking out smallholder households that are unable to contribute capital or comply with the product quality requirements (Ampaire *et al.*, 2020). Due to the capital outlay required for economic activities, the efficiency CAIs favour the participation of households that are endowed with land, livestock, information and education (Mwambi *et al.*, 2020). Since younger, females and resource-constrained farmers may lack capital, usually farm at a very small scale and are highly vulnerable to marketing risks, they are more likely to be excluded from the efficiency collective action typology and this may pose a trade-off between inclusivity and efficiency gains

(Mwambi *et al.*, 2021). In Kenya, Mwambi *et al.* (2020) characterized the processing POs and bargaining POs. The study revealed that processing POs processed milk and the bargaining POs coordinated the sale of milk. Contrary to the processing POs, the bargaining POs have an open membership policy, smaller group sizes, few resources, low member investment levels and traded low volumes of milk. The low cost of membership and low investment levels in bargaining POs favour resource-constrained farmers and women, thus promoting inclusivity (Ampaire *et al.*, 2020). However, these traditional features are likely to pose challenges inherent with SSA CAIs including weak management capacity, low entrepreneurial capacities, limited access to inputs and modern technologies (Bijman, 2016). These challenges can impair upgrading of the POs to viable business entities. The second strand of literature typifies CAIs based on their institutionalisation and social embeddedness that seek to benefit the whole community (Cramer *et al.*, 2016; Arasio *et al.*, 2018). These CAIs can be referred to as livelihood CAIs or community-oriented CAIs (Francesconi & Heerink, 2011). Livelihood typologies seek to improve the livelihood and welfare of their members through table banking and credit sourcing, exchanging of information and knowledge, conservation of natural resources, reciprocal labour, risk sharing and provision of informal insurance (Cramer *et al.*, 2016; Bizikova *et al.*, 2020; Dhal *et al.*, 2020).

The community-oriented typologies have narrow social networks and are less formalized and less exclusive. These organizational attributes minimise the transaction costs and risks notably in curbing opportunistic tendencies and defaulting in remitting finances to collective savings kit and credit repayments. The livelihood typology is attractive to females, less endowed farmers with smaller land sizes and incomes because they pose less costs and risks of membership (Selhausen, 2016). The third strand of literature focused on the entrepreneurial role of the CAIs as multipurpose entities that seek to enhance the welfare of both their members and the community (Bijman & Wijers, 2019). This typology provides economic services and social services where markets fail, public goods to ameliorate the voids of the states and a voice in political matters (Bijman & Hanisch, 2020). While multipurpose objectives complement each other in co-benefiting the households, the multifunctionalities can pose heterogeneity in member objectives which may have implications on willingness to invest and participation in decision-making processes

(Dary & Grashuis, 2020). Despite the rich insights, the reviewed collective action typology reveals several eminent gaps that this study sought to address. First, most of the studies focus on the CAIs in fragments including business-oriented CAIs such as POs (Ampaire *et al.*, 2020), farmer companies (Fernando *et al.*, 2021) and cooperatives (Bijman & Hanisch, 2012). Other studies pay attention to the livelihood CAIs including community-based organizations (Dhal *et al.*, 2020) and natural resource management groups (Dhal *et al.*, 2020; Lupi *et al.*, 2021).

Despite the studies representing the most common CAIs in developing economies, the focus on the CAIs in fragments reflects a partial conceptualization of collective action. Therefore, this study focused on a wide range of CAIs that potentially reflect a holistic conceptualization of collective action. The CAIs include community-based organizations, farmer field schools, rotating savings and credit associations, producer and marketing groups and water and forest management groups. Secondly, the studies concur that the social elements complement economic elements in enhancing the effectiveness of the CAIs (Groot Kormelinck *et al.*, 2019). Nevertheless, the studies are skewed towards economic attributes such as nature of transactions, formalization, member investments, position and role in the value chain and business approaches while overlooking the social attributes such as membership composition, internal governance mechanisms, trust and reciprocity. This study focused on both the economic aspects including the nature and scope of coordination, and formalization, and the social elements such as the level of social networking, level of social capital and membership composition.

Thirdly, the extant studies employ qualitative approaches (Cramer *et al.*, 2016; Groot Kormelinck *et al.*, 2019; Mwambi *et al.*, 2020; Fernando *et al.*, 2021) and literature review methods (Bijman & Hanisch, 2020; Bizikova *et al.*, 2020) in exploring the organizational characteristics of CAIs. Upon perusal, literature barely revealed a study employing the quantitative approach in exploring the heterogeneities underlying the CAIs. This study therefore employed mixed qualitative and quantitative approaches in characterising the CAIs. This study employs multiple correspondence analysis (MCA) to unpack and typify the CAIs and their contexts. The study also applied cluster analysis in stratifying the CAIs into a smaller number of distinct groups to designate the boundaries based on their homogeneous organizational characteristics. Additionally, the complementary qualitative approach

provides a profound exploration of the systemic and structural relationships underpinning the organizational characteristics of the typologies.

Fourthly, despite acknowledging the presence of heterogeneities and how they match with the socio-economic context of the participating households. The studies arbitrarily pool the CAIs in the analyses (Gyau *et al.*, 2016) without accounting for the heterogeneities. The context-specificity of the CAIs influences the choice of theoretical and analytical frameworks, data interpretation and generalizations. Therefore, failure to account for these differentials and how they influence the inclusivity, effectiveness and efficiency of the CAIs too often dissipates the collective action policy discourses and program design into a one-size-fits-all approach. While the universal approaches may apply in some CAIs, they may not apply to others at the detriment of the development of CAIs.

This study employs both multiple correspondence analysis (MCA) and cluster analysis to disentangle the nature, similarities and differences of the organizational characteristics underlying CAIs. The study further delineated how the differential characteristics of CAIs pose either opportunities and synergies or challenges and trade-offs to the households in enhancing their effectiveness, efficiency and inclusivity in delivering collective services. On exploring the inclusivity of CAIs, the study holds that heterogeneities across CAIs differentially condition the participation patterns across the typologies owing to the divergent needs, abilities and priorities of the households (Min-Han Tsai & Yir-Hueih, 2022) The heterogeneities imply that the choice of a CAI depends on the other existing forms of CAIs due to their interdependence as either substitutes or complements in collective service delivery. This study therefore employed a multivariate probit model in exploring the participation patterns across the collective action typologies while accounting for their heterogeneities and their interdependence as either complementaries or as substitutes (see methodology section). Additionally, despite the studies increasingly acknowledging to the policy significance of the heterogeneities underpinning CAIs while emphasizing ‘targeted’ policy interventions, the literature barely reveals a study demonstrating how collective action typologies can be used in that manner. This study demonstrates how typologies can be useful in policy targeting to allow for tailored policies that match collective action typology needs.

Based on the quantitative and qualitative data from Murang'a county in Central Kenya, the study characterised, described and compared the organizational characteristics of CAIs and delineates their implications on policy targeting. The thesis contribute to the extant literature on collective action by addressing the three main research questions: 1) What are the organizational characteristics embedded in CAIs in central Kenya? 2) What are the differences and similarities and of the organizational attributes of CAIs in central Kenya? 3) How do organizational characteristics differentially influence households' participation decisions across the collective action typologies? 4) What are the policy implications of the collective action typology? The organizational attributes include formalization, nature and scope of coordination, membership composition, level of social networking, level of social capital and membership entry criteria. This study will be useful in designing distinguished collective action policy approaches for developing CAIs to address the multiple challenges of rural households. The insights are relevant, particularly in the current decades where agricultural research and policy discourse partake advanced and integrated broad-ranging approaches that can concurrently address multiple sustainable development goals including but not restricted to poverty reduction, food security and women empowerment (Valujeva *et al.*, 2023).

2.1.1 Context: Collective action initiatives in Kenya

In Kenya, the government recognizes that collective action holds the potential to deliver Kenyan Vision 2030 and sustainable development goals as articulated in the Agricultural Sector Transformation and Growth Strategy (ASTGS) 2022-2029 (MoALF, 2019). According to the Ministry of Industry, Trade and Co-operatives, smallholder CAIs represent the largest proportion of about 75% of the total collectives in the country, having a sustained increase for the past years from 11,675 in the year 2016 to 19,629 in the year 2021 (Kenya National Bureau of Statistics, 2023a). The CAIs have been in existence since the precolonial times and the Kenyan government has historically promoted a diversity of CAIs in the smallholder sector intending to develop agriculture (Mwambi *et al.*, 2020, 2021). The common recently emerging CAIs include the savings and credit groups, producer and marketing groups, natural resource conservation groups, and farmer field schools among others have contributed to promoting the socio-economic development of the smallholder communities (Mutonyi, 2019; Kwizerimana *et al.*, 2023). A larger part of the Kenyan

population's income depends on rainfed agriculture with an average farm size of one acre (Gomez *et al.*, 2020). Currently, with the current collective action dual-membership by-laws in the country, the farmers participate in multiple CAIs to optimise the available marketing and value-addition opportunities and address the interlinked challenges they face including but not limited to access to input and output markets, informal insurance, finance and credit and extension services (Kenya National Bureau of Statistics KNBS, 2022).

The CAIs emerge either through the initiation of local households or in association with external private-public linkages (Kenya National Bureau of Statistics, 2023a). The CAIs' membership entry is open and the membership exit is flexible. To join CAIs, households need to pay membership registration fees and annual subscriptions to renew membership under the Ministry of Industry, Trade and Co-operatives. However, some CAIs opt to operate informally to avoid paying membership fees and annual membership renewal subscriptions (Ingutia & Sumelius, 2022). The small informal CAIs cohere by kinship or neighbourhood ties and are small consisting of about 15 to 30 members (Kenya National Bureau of Statistics, 2023a). The CAIs operate under laws and regulations that are either self-crafted or embedded in the constitution or both depending on their formalization status. Members contribute a given amount of money to the group at given stipulated times (either weekly, fortnightly or monthly) to the group kits in funding various collective activities including savings, informal insurance, credit sourcing and asset acquisition. The CAIs that engage in collective market are constituents of the cooperatives or unions. The members need a huge capital outlay and monthly subscriptions for marketing activities and share subscriptions.

In recent times, the government, private sectors and NGOs premise agricultural development policies and community-driven development programs on a collective action approach to reach households at the grassroots level. Private-public partnership players provide credit, technical training on product standards and post-harvest management practices, and improved inputs and linkages to financial service providers and output markets (Ingutia & Sumelius, 2022). Registration is a pre-condition for receiving incentives from public-private partnerships. Economically, CAIs help farmers access inputs, gain skills, form enterprises, and process and market their products more effectively and efficiently to generate better incomes (Mwambi

et al., 2020, 2021). The CAIs can bypass intermediaries alongside enhancing their bargaining power and scale economies for improved incomes and reduced poverty and food insecurity (Mutonyi, 2019). Development practitioners and the government also premise the objectives of gender equality and women empowerment on CAIs through providing financial support and micro-credit schemes.

The CAIs have had mixed success, and are prone to fail, collapse or survive albeit with dismal performance in delivering the desired welfare outcomes. This is due to ageing membership, inadequate entrepreneurial vision and innovation, financial and managerial constraints and gender inequities (Ingutia & Sumelius, 2022; Republic of Kenya, Ministry of Industry, 2017). Therefore, the Kenyan government developed a policy framework outlined in the Cooperative Societies Act of 2017 to transform the CAI into vibrant business entities by enhancing their formation and development by addressing the challenges they face (Republic of Kenya, Ministry of Industry, 2019).

2.1.2 Conceptual framework

Figure 2.1 presents the conceptual framework underpinning the study. The arrows show the cause-and-effect relationships among the variables. The independent variables include household socio-economic variables and the dependant variables are the collective action participation patterns. This study employs the theory of collective action (Olson, 1965) and the household utility maximization theory (Singh *et al.*, 2006). Collective action theory is widely used to describe the microeconomic behaviour of an individual in the provision of collective goods within the context of market failures and public intervention gaps (Sullivan & York, 2021). Collective action is one of the institutional arrangements that can help address failures in agricultural markets (Ma *et al.*, 2023). The theory of collective action posits that a group is a collection of rational and self-seeking individuals attempting to maximize the benefits of the collective good subject to the costs that each individual faces in collective action participation (Struben *et al.*, 2020). The costs and incentives in turn depend on the structural variables regarding different characteristics of collective action (Czech, 2016). In this study, collective action theory will be useful in characterizing CAIs with respect to their functionalities and the context with which they interact around their service provision.

The motivation for participating in one typology of CAIs over another CAIs among the existing alternatives underpins the household utility maximization theory. The theory posits that a household is assumed to make production and consumption decisions to maximise utility based on a set of limitations. Underpinning household utility maximization theory, it is presumed that a household will participate in collective action only if the expected utility of participating offsets the expected utility of not joining as shown below:

$$(U_{ij}^P) = E_i [U_i C_i^{Pi} \phi X_{Mi}] \geq E_i [U_j C_j^{Pj} \phi X_{Mj}] \quad 1.1$$

The ϕ denotes the perceived uncertainties and risks associated with the costs and benefits of collective action participation. X_M represent a vector of variables influencing the incidence and perception of the costs and benefits of participation. The consideration of participation choices made on collective action typologies hinges on the concept of ordering the available typological options based on their respective maximization of expected utility (payoff) associated with costs and benefits (McFadden, 1982). A household would choose to participate in a collective typology when the expected utility is higher than other alternatives. A household chooses to participate in a collective action typology i that optimizes its perceived utility (U_{ij}^{Pij}) only if the expected utility of participating in typology i (C_i^{Pi}) exceeds the perceived utility of participating typology j (C_j^{Pj}) as expressed in Equation 1.2:

$$(C_{ij}^P) = E_i [C_i^{Pi} \phi X_{Mi}] \geq E_i [U_j C_j^{Pj} \phi X_{Mj}] \quad 1.2$$

where utility (U_{ij}^P) depends on expected economic and non-economic benefits and costs of participating in typology i (C_i^{Pi}) and typology j (C_j^{Pj}) respectively.

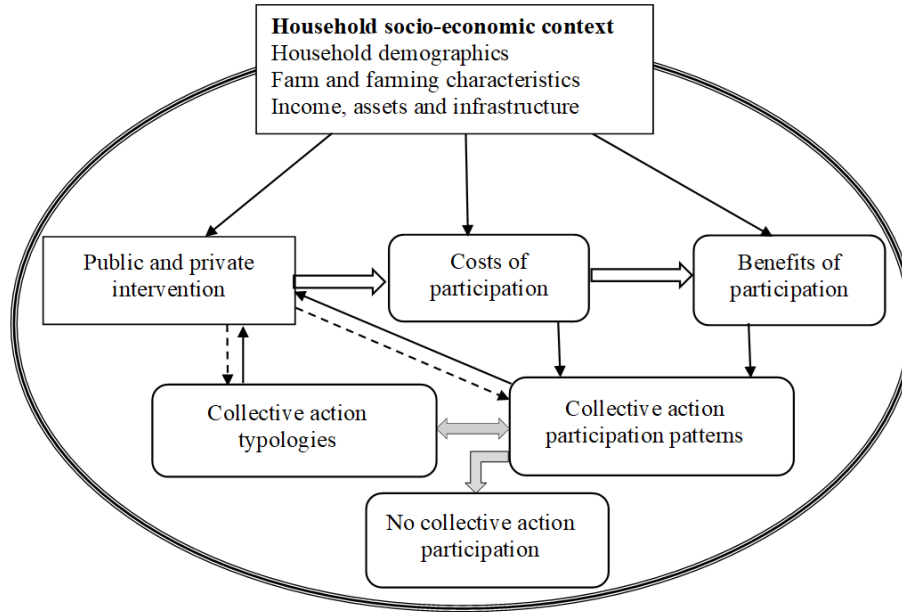


Figure 2.1: Conceptual framework for collective action typologies

Source: Authors' conceptualisation

X_{Mi} and X_{Mj} represent a vector of explanatory variables affecting collective action participation typology i and j respectively ϕ denote the perceived risks associated with the costs and benefits of typology i and typology j respectively. The costs of collective action participation include membership subscriptions and fees; financial capital; opportunity costs of time in participating in collective activities such as meetings, advisory and technical vocational trainings and market days; transaction costs associated with the potential risks such as the vulnerability of individuals to opportunistic behaviors and free riding; defaulting of contractual agreements by the trading partners, defaulting of credit repayments and the internal costs of group mismanagement that spill over to all participants (Min-Han Tsai & Yir-Hueih, 2022).

The benefits of collective action include access to output and input markets; fetching better prices for the farm produce; access to financial services through group credit and savings; building of household resilience stock through risk sharing, provision of informal insurance and acquisition of assets. The incidence and perception of the costs and benefits are expected to be heterogeneously distributed across the households due to differentials in socio-economic contexts among the households concerning demographic characteristics, incomes and assets, institutional and infrastructural factors and farm characteristics. The costs and benefits are also contingent upon the organizational attributes of CAIs (Fu *et al.*, 2022). This is

because the organizational characteristics have the potential to deliver either costs (by posing challenges or risks) or benefits (by posing opportunities) to households (Lupi *et al.*, 2021). Therefore, it is necessary to pay attention to the characteristics of CAIs, the nature of individual actors and their contexts to understand their implications on participation patterns and policy targeting.

2.2 Materials and methods

2.2.1 The study area

The study was done in Murang'a County in Central Kenya, as shown in Figure 2.2. The dots do not have any implication on the sample size but they demonstrate the areas of distribution of the sampled households.

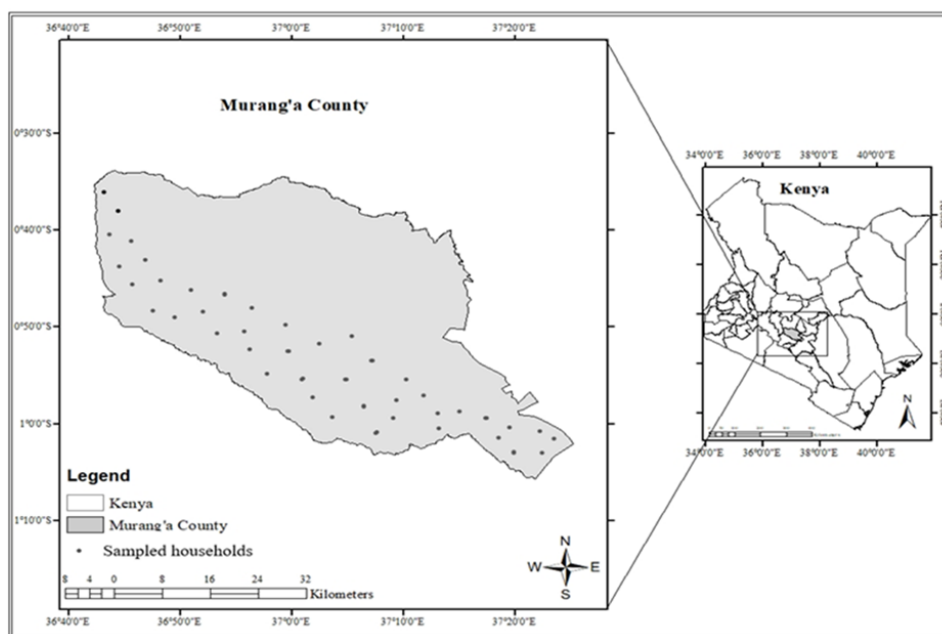


Figure 2.2: Study area and distribution of sample households

Source: Authors' drawing

The county covers a total area of 236km², of which about 193km² is utilised for agricultural production wherein households own about 0.8 acres of farm size. Agriculture providing livelihoods for almost 70 per cent of the rural households in the county (Murang'a County, 2019). Murang'a County presents a suitable national representative case study because of its prominence in CAIs among smallholder households, representing about 65 per cent of the total membership of CAIs in Kenya (Kenya National Bureau of Statistics, 2022). About 67 per cent of the households in the county belong at least to one CAI. The county has collaborated with organizations

such as Kenya Livestock Research Organization (KARLO), Techno Serve and National Agriculture and Rural Inclusive Growth Project (NARIGP) to support the growth and development of CAIs.

2.2.2 Data and variables

The sample size was calculated based on Cohen's (1988) normal approximation of binominal distribution (Equation 2.2).

$$n = \frac{U_{1-\alpha/2}^2 \times (1-P)^2 P^2}{\delta^2} \quad 2.2$$

where n denotes the number of surveyed households, $U_{1-\alpha/2}^2$ denotes 1.96 which is the quantile of the standard normal distribution for the 95% confidence interval (at the value of 0.05); P is the proportion of the smallholder households belonging to at least one CAI, which is 0.67; δ is the margin of error expected for any parameter to be calculated following the survey data. For this study, the margin of error expected was approximated at 0.029, a value that is almost zero that allows for accurate estimates of the parameters under study (Loko *et al.*, 2022). The value of P was computed by considering that one individual was interviewed per household and given that the total agricultural households in the targeted areas is 338695 and the number of households having membership in CAIs was 225,797 (KNBS, 2022). Based on the formula in Equation (2), the total sample size for the study was 532 households.

A multistage stratified and proportionate random sampling method were used to draw the respondents of the study. The first stage involved the selection of two sub counties namely Gatanga and Kandara based on the dominance of CAIs. In the second stage, proportionate and random sampling was used in selecting five wards from Kandara Sub-County and two wards from Gatanga Sub-County. Employing the lists of the registered CAIs from the Ministry of Agriculture, Livestock, Fisheries and Cooperatives of Murang'a County, the common CAIs among the households from the seven wards were proportionately and randomly sampled to ensure representativeness of CAIs across the two sub-counties following the proportionate sampling formula below:

$$n_h = \left(N_h / N \right) * n \quad 2.3$$

where n is the number of the different CAIs to be sampled, N_h denotes the aggregate number of CAIs in a given sub-county (Kandara and Gatanga), n represents the aggregate number of CAIs in the two sub-county. Based on the proportionate formula in Equation (2.3), alongside the lists and guidance of the ward-level agricultural extension officers, the following CAIs were sampled: 31 rotating savings and credit associations; 49 producer and marketing groups, 10 water and forest user groups, 10 farmer field schools, 5 self-help groups belonging to cooperatives and 2 self-help groups that are part of 2 unions. From these CAIS, a total of 353 members were drawn proportionately to their group sizes in addition to 179 non-members from the proximity of the respective sampled group members.

A well-structured and pre-tested questionnaire was used to draw data from the sampled households using trained enumerators in the year 2022 from the month of August to October. In addition, five focus group discussions were conducted from every sub-county and one key informant interview from every sub-county. Before the interviews, a research permit was obtained from the research body of the National Commission for Science, Technology and Innovation. The unit of analysis was the household. The data collected included organizational collective action characteristics that were selected from the reviewed collective action typology research. The variables represent the organizational structure, functionality and conduct. The structure entailed the gender composition that included either females only, males only or mixed gender. The functionalities determine the effectiveness of CAIs (Mwambi *et al.*, 2020). The variables associated with functionality were described by the nature and scope of coordination wherein vertical coordination activities included whether or not CAIs participated in collective farm input sourcing, collective output marketing and sourcing of extension and advisory services. It also included the horizontal coordination activities which included whether or not CAIs participated in table banking and savings, credit sourcing and provision of informal insurance. It is hypothesized that households engaging in horizontal coordination activities would not organize the same way as the farmers engaging in vertical coordination activities.

Social networking can help CAIs connect with the other existing and new CAIs and public-private sector players to facilitate the dissemination of information and efficiency performance (Fernando *et al.*, 2021). The social networking variables

include whether or not CAIs interacted with other existing CAIs of similar interests and objectives within their neighborhood. It also included a variable on whether or not CAIs have formed amalgamations with other CAIs of similar interests either within or outside the village. The variables describing the level of social capital included bonding social capital and bridging social capital. The bonding social capital and bridging social capital variables captured the extent to which the households felt that they would trust their fellow CAI members and the trust they bestowed to other CAIs respectively. The level of trust was measured using a Likert scale where the respondents 'disagree strongly' took the lowest value of 1 and the response of 'agree strongly' took the value of 4.

Finally, the internal governance variable included whether CAIs imposed fines on non-compliant behaviour among the members such as absence or late attendance to group meetings and late remission of the group contributions. The formalization status was indicated by whether or not the CAIs are registered with the relevant authorities and base their activities within the constitution. The group composition captured the gender composition of the CAIs on whether CAIs constitutes women only, men only or mixed gender. The collected data also included the variables household demographics (age and gender), institutional and infrastructural factors (distance to the tarmac, access to information, market and bank account), farm and farming factors (farming experience) and household income and assets.

2.3 Empirical estimation strategy

2.3.1 Identification of the organizational characteristics of the CAIs

Figure 2.3 shows the workflow of the study. Multiple correspondence analysis (MCA) approach was employed to explore the organizational characteristics as well as provide input for cluster analysis. Afterwards, the study analyzed the determinants of households' participation choices across the clusters (herein collective action typologies). MCA and cluster analysis included data for only collective action participants while the multivariate probit model entailed data for both collective action members and non-members. Principal Component Analysis (PCA) is an alternative quantitative dimension reduction model that minimizes the continuous or interval-scale variables into a limited set of non-correlated components while preserving the variability of the dataset (Nyambo *et al.*, 2019). In this case, the MCA

approach is appropriate given the categorical nature of the variables (Rangel *et al.*, 2020; LaFevor, 2022) . The MCA approach provides an in-depth analysis of categorical data including binary, ordinal or nominal without any underlying assumptions. MCA was performed in R software using Factominer and ggplot packages. MCA also provides a two-dimensional correspondence biplot by utilizing the chi-square distances between the data points as a measure of correlation, where closer proximities indicate closer associations (Rangel *et al.*, 2020). Quantitative values of inertia termed as eigenvalues are produced. The eigenvalues depict how much each dimension accounts for the categorical information, the higher the eigenvalue the larger the total inertia among the variables on a particular dimension and vice versa (Florensa *et al.*, 2021).

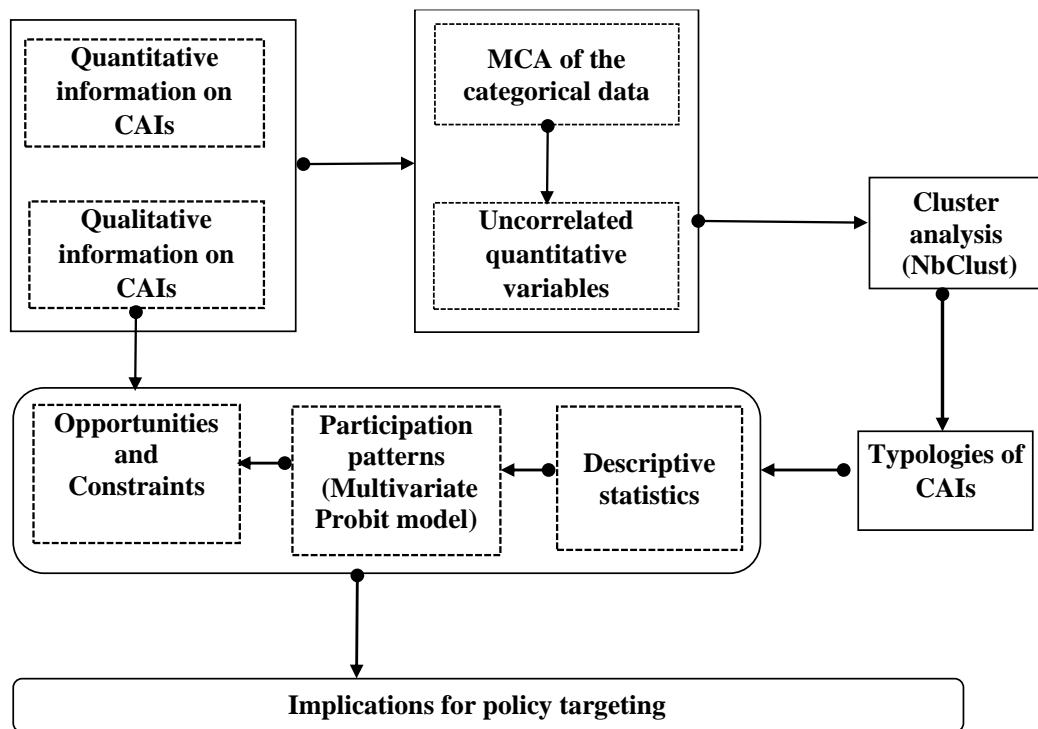


Figure 2.3: The workflow of the study

Source: Authors' drawing

Inertia values represent the mean of the squared correlation ratios of each of the dimension produced in the dataset. In addition, the proportionate contributions of each of the variables to inertia are calculated, which are indicators of relative importance (LaFevor, 2022). Cronbach's alpha is estimated to measure the internal consistency and reliability of the dimensions produced and the categorical variables. The Cronbach's alpha of ≥ 0.60 indicates a higher level of internal consistency and reliability (Rangel *et al.*, 2020). The MCA output allows for uncovering the

dimensions that best describe the collective action organizational characteristics. These dimensions were then employed in the subsequent cluster analysis.

2.3.2 Delineating the differences and similarities of organizational characteristics of CAIs

Cluster analysis typifies CAIs based on dis(similarity) of their attributes denoted by a defined set of variables. The most common methods employed in cluster analysis are hierarchical and k-means. However, these two methods pose limitations including the assumption of normality of distribution, applicability of continuous variables only and an arbitrary choice of the number of clusters (Benassi *et al.*, 2020). In this study, CAIs were typified by employing cluster analysis using the NbClust package in R software (Charrad *et al.*, 2014). NbClust package was appropriate compared to other clustering methods such as hierarchical and k-means given the categorical nature of the independent variables of the study. In addition, the novelty of the technique is that it utilizes a function of k-means and hierarchical clustering with combinations of about 30 different validation indices, aggregation methods and distance measures in a single function call (Charrad *et al.*, 2014). The clustering indices use a combination of information on inter-cluster isolation, intra-cluster compactness and other factors including statistical properties in the data, number of data objects and similarity or dissimilarity measurements. In estimating the optimal number of clusters, the validity indices were applied to outputs of k-means and hierarchical agglomerative clusters by varying the distance measures, number of clusters and clustering methods. The selection of the appropriate number of clusters was based on the majority rule as selected by the 26 validation indices, the best partition and the critical values. The validity of the clusters was then tested using the equality of means test for the clusters assuming homogeneity. In addition, the chi-square test was employed to test for the independence of the variables within the clusters. Afterwards, the organizational characteristics and patterns across the clusters were described using the qualitative data and the existing collective action typology literature. The outputs of cluster analysis alongside the MCA and qualitative data were used to identify the opportunities and challenges of each cluster and demonstrate how the typologies can be used for policy targeting.

2.3.3 Participation patterns across collective action typologies

Household socio-economic determinants influencing participation patterns across the collective action typologies were estimated using a multivariate probit model (MVP). The study distinguishes the choices a household can make in collective action participation namely, efficiency and livelihood. Similar to the multinomial logit regression (MNL), the MVP model allows for joint estimation of more than one collective action typology decision. However, the MNL participation decisions across the existing typologies to be selected from are mutually exclusive (Mwambi *et al.*, 2020). The MVP is appropriate because it allows for joint estimation of more than one collective action typology participation decision while allowing for the error terms to be correlated freely across the typologies to be selected from (Greene, 2016). This follows that the selection of one typology of collective action depends on the choice of other available typologies due to their interdependence which is reflected in the error terms either as complements which are denoted by positive correlation, or as substitutes that are depicted by negative correlation. A household i will choose to participate in the j^{th} collective action typology, which in this case is either efficiency or livelihood (Y_{ipj}^*), if the utility associated with the typology is higher than non-participation. The net utility from the participation of j^{th} collective action typology is a latent variable determined by observed household vectors of socio-economic factors (X'_{ip}), its coefficients (β_j) and the normally distributed disturbance terms (ε_{ip}).

$$Y_{ipj}^* = X'_{ip}\beta_j + \varepsilon_{ip}, \begin{cases} 1 & \text{if } Y_{ipj}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad 2.4$$

where Y_{ij} represents a dichotomous observable variable indicating the participation decision of the i^{th} household as regards to the j^{th} collective action typology.

2.4 Results

2.4.1 Descriptive socio-economic attributes of households

The descriptions of the variables and descriptive statistics for the categorical characteristics of the households are presented in Table 2.1. The household heads who were men constituted of 69.1% while women comprised of 30.9%.

Table 2.1: Descriptions and descriptive statistics of households (categorical variables)

Categorical variable	Definition of the variable	%
Gender	Gender of the household head	
	Female	30.9
	Males	69.1
Age	Age of the household head (years)	
	22 to 35	7.1
	36 to 49	24.4
	50 to 63	36.6
	64 to 77	27.2
	>77	4.8
Education	Education of the household head	
	No formal education	5.1
	Primary	4.0
	Secondary	50.1
	Vocational	37.1
	University	3.7
Farm size	The size of the farm (acres)	
	< 2 acres	93.2
	>2 acres	6.8
Income	Income range per month (Kenyan Shillings)	
	0 to 10,000	79.3
	10,001 to 30,000	13.0
	30,001 to 50,000	5.4
	50,001 to 70,000	1.1
	70,001 to 90,000	0.3
	90,001 to 110,000	0.3
>110,000	0.6	
Bank account	A household has a bank account (1=yes)	50.4

Source: Author's field data

About 36.6% of the households were aged between 50 to 63 years while those aged between 64 to 77 and 36 to 49 constituted of 27.2% and 24.4% respectively.

Table 2.2: Descriptions and descriptive households (continous variables)

Continuous variable	Definition of the variable	Mean	SD
Farming experience	Farming experience (years)	23.79	14.8
Labour	Farm labour (number)	0.98	0.7
Information	Information sources (number)	2.51	1.3
Market	Self-reported walking distance to market (km)	3.2	2.2
Tarmac	Self-reported walking distance to the tarmac road (km)	1.95	1.5
Lnassets	Log of assets	10.05	1.6

Source: Author's field data

The household heads belonging to the age groups of 22 to 35 and above 77 years accounted for 7.1% and 4.8% respectively. Table 2.2 presents the descriptions and descriptive statistics for the continuous variables. An estimated 93.2% own a farm size of less than 2 acres. As shown in Table 2.1, on education, an estimated 50.1% of the households had achieved the levels of secondary education while 37.1% had vocational education. The remaining households accounted for 5.1%, 4.0% and 3.7% for no formal education, primary and university levels respectively. Regarding household income, about 79.3% earn between 0 to 10,000 Kenyan Shillings per month while those earning a range of 10,001 to 30,000 and 30,001 to 50,000 accounted for 13% and 5.4% respectively. An estimated 1.1% of the households were earning between 50,001 to 70,000 whereas the income earners ranging from 70,001 to 90,000 and 110,000 were 0.3%. The households that were earning off-farm income accounted for 49.9%. About 50.4% had a bank account, which is an indicator of access to finance from the banks. The farmers had a mean of 15 years of practising farming, relying on at least one individual responsible for providing farm labour. Regarding information, the households depend on about 3 sources to get information related to agriculture. Additionally, the self-reported walking distance to the nearby agricultural market and tarmac road was 3.2 and 1.95 kilometres respectively.

2.4.2 Descriptive statistics of collective action initiatives

The descriptive statistics for socio-economic collective action variables are presented in Table 2.3. These are the descriptive statistics for the aggregate CAI sampled (rotating savings and credit associations, farmer field schools, producer and marketing groups, water and forest user groups, cooperatives and unions) before characterising them into typologies. The majority of CAIs (87.3%) were registered with the Ministry of Industry, Trade and Co-operatives. This observation follows that registration is a pre-condition for CAIs to carry out collective activities and receive support from the government alongside other supporting agencies and NGOs. With respect to membership entry criteria, an estimated 88.10% of CAIs imposed a closed entry policy to any new aspiring entrants through strict vetting of personal reputation, offsetting the capital outlay for the present collective savings at the kit and assets at the time of joining the group. Regarding the gender composition, about 54.39% of the CAIs constituted of women only while 44.19% comprised of mixed gender and a mere 1.42% constituted of men only.

The CAIs cohere through kinship ties and neighbourhood as exhibited by the larger percentage of the CAIs (82.72%) that were operating as the grassroots sole entities without any amalgamations in the form of cooperatives or unions.

Table 2.3: Descriptions and descriptive statistics of collective action characteristics

Categorical variable	Definition of the variable	%
Registration	CAI is registered with the legal authorities	
	Yes	87.30
	No	12.70
Membership entry	Open entry criteria	11.90
	Closed entry criteria	88.10
Social networking	Amalgamation with other CAIs to form cooperatives	
	Yes	17.28
	No	82.72
	Interactions with other CAIs outside the village	
	Yes	24.60
	No	74.30
Membership composition	Women only	54.39
	Men only	1.42
	Mixed women and men	44.19
Vertical integration	Collective input sourcing	
	Yes	12.75
	No	87.25
	Collective farm output marketing	
	Yes	18.41
	No	81.59
Horizontal integration	Sourcing of extension and advisory services	
	Yes	87.54
	No	12.47
	Pooling of savings	
	Yes	65.44
	No	34.56
Social capital	Credit sourcing	
	Yes	39.94
	No	60.06
	Social welfare	
	Yes	51.60
	No	58.40
Internal governance mechanisms	Extent of the feeling of CAI members' trust in each other	
	Disagree strongly	1.13
	Neither agree nor disagree	1.98
	Agree somewhat	19.83
	Agree strongly	77.05
	Extent of feeling of trust in other CAIs	
	Disagree strongly	14.40
	Neither agree nor disagree	16.10
Agree somewhat	31.20	
Agree strongly	40.20	
Fine imposing on non-compliant behaviour	Yes	88.95
	No	11.05

Source: Author's field data

Conversely, the CAIs that interacted with other CAIs of similar interests outside their villages accounted for 24.6%. The CAIs were engaging in vertical coordination activities such as collective sourcing of farm inputs (12.75%), collective farm input marketing (18.41%) and sourcing of extension and advisory services (87.54%).

The CAIs collectively purchased fertilizers, animal feeds and seeds in bulk at a lower cost. On the other hand, marketing CAIs engage in collective bulking and marketing of the farm outputs such as milk, avocado, indigenous vegetables, goats, chicken, macadamia and French beans. Access to marketing outlets would not otherwise be guaranteed individually due to the high volumes required and high costs of transportation, handling and storage. The CAIs also engaged in horizontal integration activities including pooling of savings through table banking (65.44%), internal credit sourcing (39.94%) either internally or externally through linkages with the financial service providers using CAIs as a collateral. Additionally, about 51.6% of CAIs served to enhance the social welfare of the members by providing members with informal insurance to smoothen household incomes during times of crisis such as crop failure and food shortages. Regarding the social capital attributes, the CAIs showed very high levels of bonding social capital where 77.05% of the households strongly agreed that most of their fellow members could be trusted. Contrarywise, the bridging social capital was relatively high with the members who strongly agreed that most of the other groups in similar neighborhoods could be strongly trusted. On internal governance mechanisms, about 88.95% of the CAIs imposed fines on non-compliant behaviour that contravenes the self-created rules and regulations concerning absenteeism or lateness in attending collective activities such as meetings and exposing the operations of the CAIs to outsiders.

2.4.3 Similarities and differences in organizational characteristics of the collective action typologies

The discrimination measures are presented in Table 2.4. The results presented are derived from the characterization of organizational characteristics of CAIs common in Kenya rotating savings and credit associations, farmer field schools, producer and marketing groups and water and forest user groups. The discrimination measures derived from MCA analysis are presented in Table 4. The MCA full results showing the dimensions, their inertia, and the Cronbach test are presented in the appendices

section. The MCA analysis yielded ten dimensions that accounted for 74.75% of the variability in the dataset.

Table 2.4: The MCA dimensions and their discrimination measures

Organizational characteristics	Dimension 1	Dimension 2	Cronbach test
Collective input sourcing	0.54	0.02	0.81
Collective output marketing	0.72	0.00	0.80
Extension and advisory	0.45	0.00	0.82
Amalgamation	0.50	0.07	0.82
Interactions outside village	0.43	0.06	0.83
Gender composition	0.38	0.04	0.82
Social welfare	0.21	0.06	0.83
Savings	0.19	0.18	0.83
Fine imposing	0.12	0.11	0.83
Members' trust	0.08	0.42	0.84
Other groups' trust	0.07	0.44	0.85
Credit sourcing	0.05	0.27	0.85
Membership entry criteria	0.00	0.32	0.86
Registration	0.05	0.08	0.82
% of variance	19.91	10.95	

Source: Author's field data compilation

The MCA analysis yielded ten dimensions because they had eigenvalues above the value of their means (Appendix 3). The ten dimensions represented 74.75% of the inertia with the average Cronbach's alpha value of 0.84 which according to (Rangel *et al.*, 2020) was considered acceptable.

From the results, a two-dimensional solution was considered adequate for interpretation since it accounted for the largest inertia. The first and second dimensions are respectively presented with eigenvalues being 0.27 and 0.15; the inertia of 19.91 and 10.95; and Cronbach's alpha of 0.63 and 0.47. Although the lower limit of Cronbach's alpha of 0.60 is generally accepted, a smaller value is acceptable due to the low interrelatedness between the items arising from highly heterogeneous constructs (Florensa *et al.*, 2021). The values are demarcated and differentiated in their allocations to each of the two dimensions. The discrimination measures associated with dimension one included collective input sourcing, collective output marketing, extension and advisory services, amalgamations and interactions of CAIs outside the village. Other variables that were most correlated with dimension one included gender composition, social welfare and fine imposing, with the factors being sorted from the most common. On the other hand, the most discriminant variables

associated with dimension two were other groups' trust, members' trust, membership entry criteria, credit sourcing, savings and registration.

In this study, we capture a two-dimensional space of the data involving heterogeneous constructs using the MCA procedure while underpinning this limitation. Nevertheless, the Cronbach test for the variables was above the acceptable threshold of 0.60 (Table 2.4), indicating a greater internal consistency (Florensa *et al.*, 2021). The MCA resulted in 14 discriminant variables that are most essential in explaining the variability in the dataset because they contribute the highest inertia to dimensions 1 and 2. The discrimination measures that were associated with dimension one horizontal coordination activities included collective input sourcing, collective output marketing, extension and advisory services. Dimension one was also associated with social networking (amalgamations of CAIs with other similar CAIs and interactions of CAIs outside the village). Other variables that were associated with dimension one included membership composition (gender composition), and internal governance mechanisms (imposing of fines). The most discriminant variables associated with dimension two were social capital (other groups' trust, members' trust) membership entry criteria and formalization (registration). Both dimensions one and two overlapped concerning horizontal coordination activities including the provision of informal insurance, savings pooling and credit sourcing). The cluster analysis full results are included in the Appendix 10. The Dindex plot as presented in Figure 2.4, proposes 6 as the best optimal number of clusters.

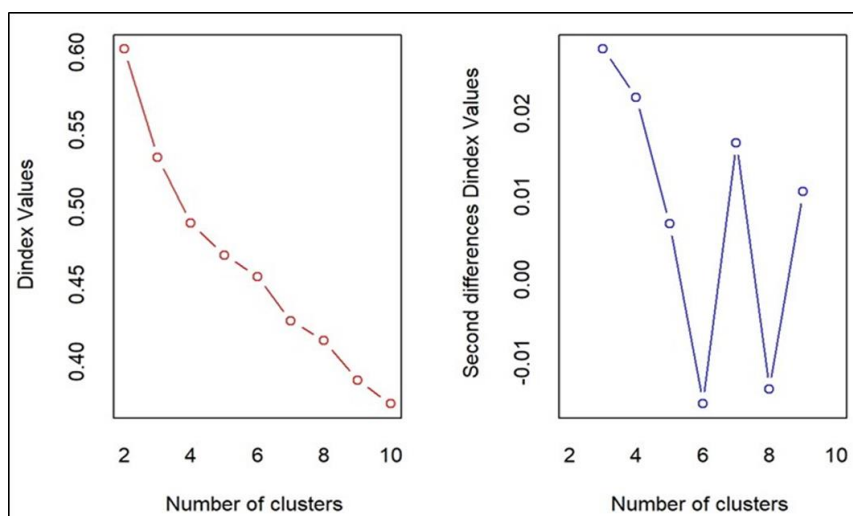


Figure 2. 4: Dindex plot

Source: Authors' field data

Hubert index plot proposes 3 as the ideal number of clusters (Figure 2.5). The two do not seem to unanimously indicate the ideal number of clusters. The cluster analysis yielded 2 as the optimum number of clusters based on the unanimous validation dissimilarity indices including critical values, the best partition and the majority rule.

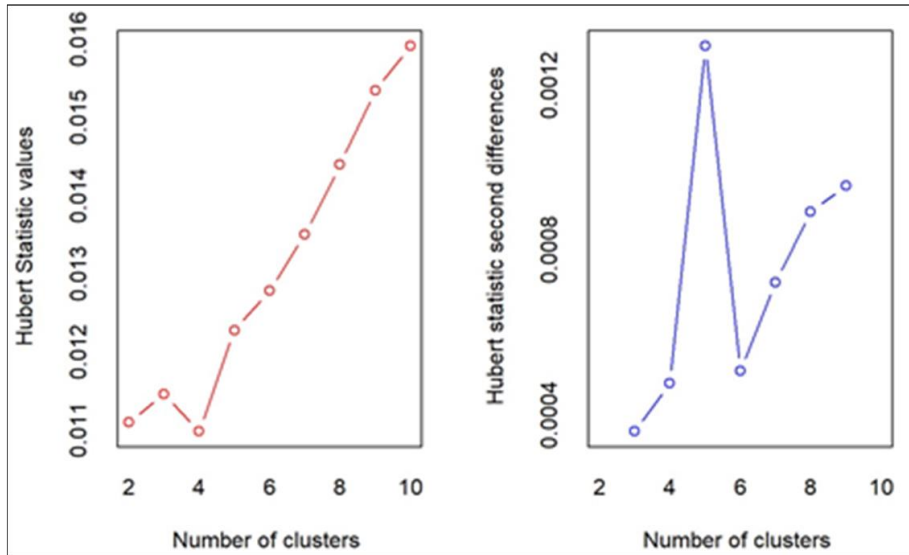


Figure 2. 5: Hubert index plot

Source: Authors' field data

The test of equality of means on the two clusters was significant (hotelling $F(1,352) = 255.78; p > F = 0.000$), hence we reject the null hypothesis of homogeneity of the two clusters. Therefore, the cluster analysis revealed two typologies of collective action. The organizational characteristics across the two typologies are presented in Table 2.5. As shown in the results, the chi-square test of the independence of the cluster variables was significant in almost all variables ($p < 0.05$), indicating the distinctness in organizational characteristics among the two typologies. Following Bijman & Wijers (2019) classification based on functions, typology one is termed as efficiency following their major aim of seeking efficiency in both production and marketing processes through their engagement in collective farm input sourcing, collective output marketing and sourcing of extension and advisory services. The second typology is termed livelihood because of their major focus on enhancing the household livelihood and resilience stock through their engagement in the pooling of savings, sourcing of credit and provision of informal insurance.

Table 2.5: Organizational characteristics of the collective action initiatives

	Cluster one (Efficiency typology)	Cluster two (Livelihood typology)	P-value
Cluster membership	0.18	0.82	
Registration			
Yes	0.52	0.17	0.007
No	0.16	0.15	
Membership entry criteria			
Open entry criteria	0.02	0.10	0.957
Closed entry criteria	0.15	0.73	
Amalgamation			
Yes	0.12	0.05	0.000
No	0.06	0.77	
Interactions outside village			
Yes	0.13	0.12	0.000
No	0.04	0.71	
Gender composition			
Women only	0.00	0.54	0.000
Men only	0.00	0.02	
Mixed women and men	0.17	0.27	
Collective input sourcing			
Yes	0.11	0.02	0.000
No	0.07	0.80	
Collective farm output marketing			
Yes	0.16	0.02	0.000
No	0.02	0.80	
Extension and advisory			
Yes	0.10	0.02	0.000
No	0.08	0.80	
Pooling of savings			
Yes	0.05	0.21	0.000
No	0.13	0.61	
Credit sourcing			
Yes	0.04	0.47	0.000
No	0.13	0.36	
Informal insurance			
Yes	0.01	0.50	0.000
No	0.16	0.33	
Members' trust			
Disagree strongly	0.00	0.01	0.005
Neither agree nor disagree	0	0.02	
Agree somewhat	0.06	0.14	
Agree strongly	0.11	0.66	
Other groups' trust			
Disagree strongly	0.01	0.13	0.009
Neither agree nor disagree	0.01	0.15	
Agree somewhat	0.07	0.21	
Agree strongly	0.08	0.34	
Fine imposing			
Yes	0.12	0.77	0.000
No	0.05	0.06	

Source: Authors' data

The demarcations of the organizational characteristics of the two typologies concerning the two dimensions are presented on a correspondence plot in Figure 2.6.

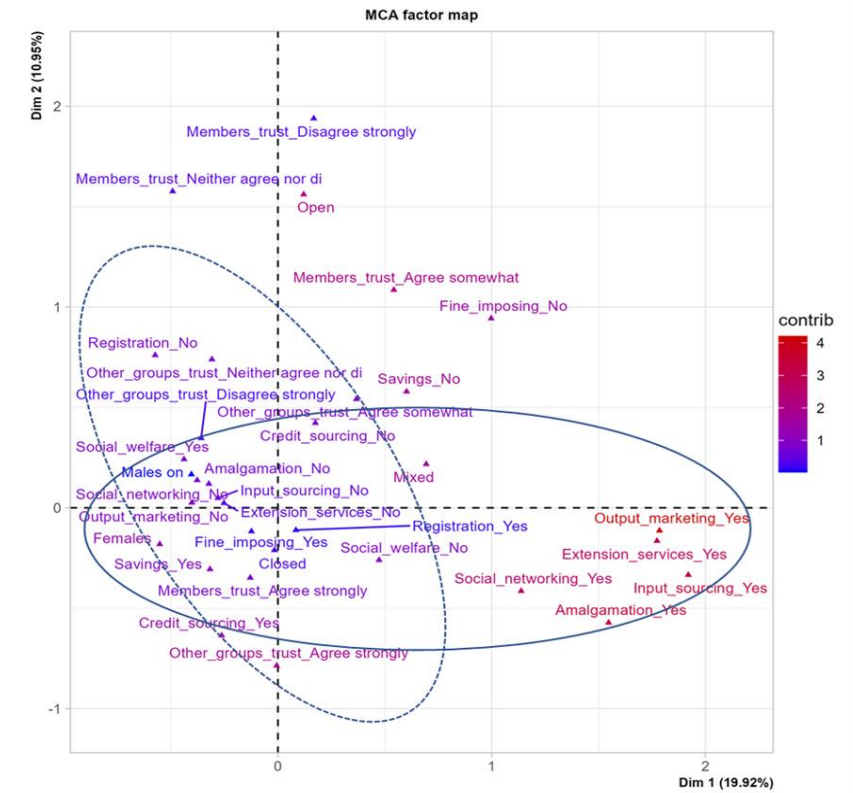


Figure 2.6: A correspondence biplot of variable categorical points

Source: Authors' field data

As shown in Figure 2.6, the oval-shaped circumscribed area shows the cluster points of the categorical variable points as demarcated on the quadrants aligning with the four centroid axes of dimension one ($1 < 0$, $1 > 0$) and dimension two ($2 < 0$ and $2 > 0$). Aligning with the cluster analysis results, the characteristics of the livelihood typology on the axis plane of the $1 < 0$ and $2 > 0$ quadrant highly contrast the efficiency typology on the centroid axis plane of the $1 > 0$ and $2 < 0$ quadrant (Figure 2.6). The descriptions of the organizational characteristics of CAIs across the four quadrants are shown in Figure 2.7. The efficiency typology constituted about 18% of the households while typology two constituted about 82% of the households. The disparities in membership would be an indicator of the differentials in motivation for the households' participation across the two typologies due to differentials in resource endowment and utilization, farm and farming factors, institutional and infrastructural access factors and income (Bijman & Wijers, 2019).

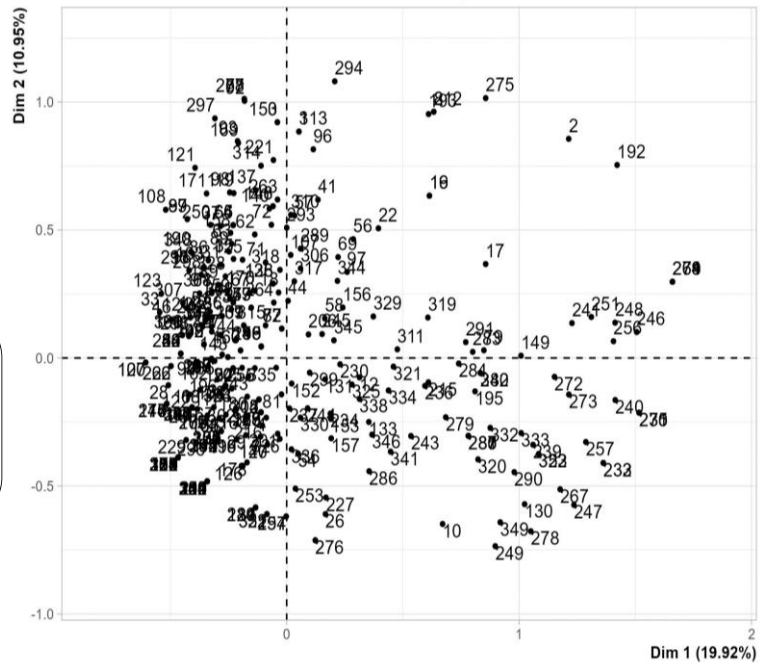
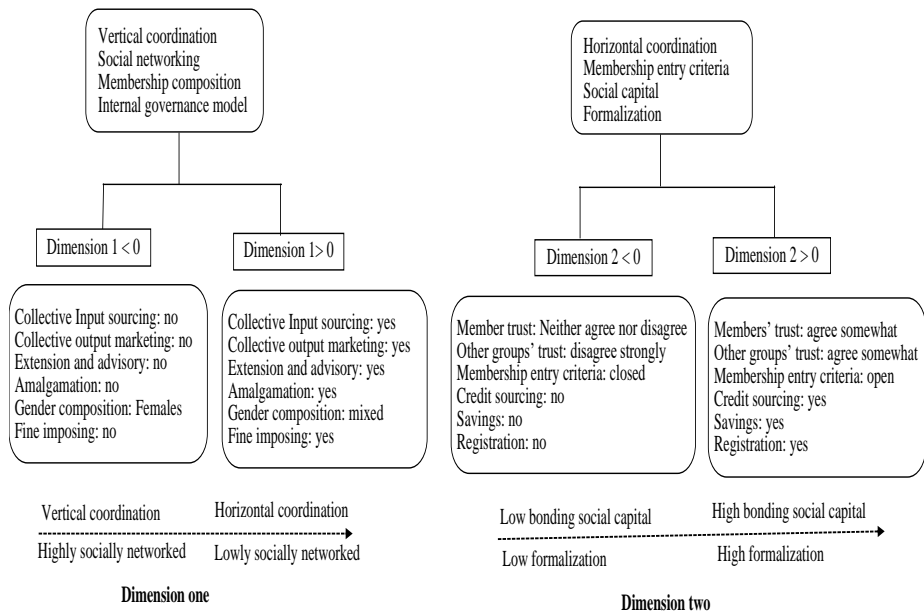


Figure 2.7: Negative and positive centroid coordinates for dimensions one and two

Source: Authors' field data

Figure 2.8: MCA factor map for the individuals

Source: Authors' field data

The results further revealed that typology one barely constituted of men only but mixed membership of both men and women (17%). The field interviews revealed that men only barely formed CAIs in agriculture due to high opportunity costs of time arising from their off-farm engagements and thus leaving the agricultural roles to women, who according to (Kenya National Bureau of Statistics, 2023a) constituted about 60 per cent of the smallholder farmers in Kenya. This finding aligns with Ingutia & Sumelius (2022) that gender composition is an essential factor in determining effectiveness and inclusivity of collective action typologies.

The efficiency typology shows a high level of formalization through their registration (52%), as outlined in the Kenyan constitution. Registration provides legality to CAIs by embedding their collective activities in the constitution. It also legally safeguards CAIs against opportunistic behaviour that may arise from either the group members themselves, group leaders or any associated public and private players such as contracting business partners. The CAIs in this typology interact with other groups engaging in marketing activities outside the village (13%). The CAIs in this typology have merged with other efficiency-seeking CAIs to be part of the cooperatives or unions wherein they collectively source farm inputs and extension services as well as market their output at lower transaction costs per unit.

The results reveal that the typology one members engage in both vertical and horizontal activities. However, the typology revealed a high level of engagement in vertical coordination activities including collective sourcing of farm inputs (11%) such as fertilizers and improved seeds/seedlings/livestock; collective farm output marketing (16%) such as milk, horticultural products, coffee, tea and macadamia; and seeking extension and advisory services (10%) in production, bulking and marketing processes. Conversely, the typology reveals low levels of participation in horizontal integration activities including the provision of informal insurance (1%), pooling of savings (5%) and credit sourcing (4%). The efficiency typology exhibited relatively lower bonding social capital as indicated in their trust in their fellow collective action members (11%). Analogously, the cluster revealed a low level of bridging social capital as shown in the trust of other CAIs with similar objectives (8%). The CAIs of this cluster barely imposed fines on the members' behaviour that contradicted the group rules such as lateness in remitting the financial contributions for the group operations.

Livelihood typology constituted mostly of women (54%) with some CAIs in this typology showing mixed gender (27%). The CAIs in this cluster show low formalization (17%), operating within the village grassroots levels as sole entities without any amalgamations to other CAIs with similar objectives. The typology showed a high level of participation in horizontal integration activities including provision of informal insurance (50%), pooling of savings (21%) and credit sourcing (47%). Conversely, the typology showed low levels of engagement in vertical integration activities such as collective input sourcing (2%), collective output marketing (2%) and seeking extension and advisory services (2%) (Table 2.5). The typology showed high levels of bonding social capital in their trust to other fellow members (66%), and a relatively high level of bridging social capital in their trust to other groups of similar goals (34%). Lastly, the cluster revealed a high level of imposing fines (77%) for non-compliant behaviour among members. The imposing of fines are applied to absenteeism from the group meetings, failure to reimburse the financial contributions for group operations on time and late attendance at group meetings.

2.4.4 Participation patterns across efficiency and livelihood typology

The MVP results for the determinants of participation in efficiency and livelihood collective action typologies are presented in Table 2.6. The test of correlation of error terms between the efficiency and livelihood typology was significant ($r = -0.399$; $p = 0.000$), revealing a moderate interdependence between the two typologies, hence justifying the use of the MVP model. Age and farming experience are indicators of human capital that would influence the participation choices across the collective action typologies. The results show a significant and positive association of farming experience with participation in efficiency whereas it had a negative association with participation in livelihood typology. The farming experience is an indicator of the households' head conversance with the past, present and future production and marketing trends that would incentivize participation in one typology and not another. The findings reveal that the farming experience negatively correlated with participation in the efficiency typology but it revealed a positive association with the livelihood typology. Access to tarmac road is an important factor because it is a measure of transaction costs incurred in accessing output and input markets. There was a negative correlation between the presence of a tarmac road and participation in

livelihood typology but there was no association between tarmac and participation in efficiency typology. Availability of farm labour determines the opportunity costs of the household in participating in collective activities and hence participation choices. Farm labour was positively associated with participation in efficiency typology but it showed no correlation with participation in livelihood typology.

Table 2.6: Determinants of participation in efficiency and livelihood typologies

	Efficiency			Livelihood		
	Coef.	SE	P-value	Coef.	SE	P-value
Age	0.043***	0.008	0.000	-0.013*	0.006	0.042
Gender	-0.288	0.172	0.093	-0.011	0.127	0.929
Education	0.130	0.092	0.157	0.156	0.078	0.046
Farming experience	-0.016*	0.008	0.035	0.005*	0.006	0.429
Farm labour	0.305***	0.101	0.002	-0.095	0.080	0.233
Bank account	-1.087***	0.228	0.000	0.443***	0.129	0.001
Market	0.049	0.041	0.236	0.055	0.034	0.107
Tarmac	-0.034	0.056	0.536	-0.109*	0.046	0.018
Information	0.234***	0.058	0.000	-0.053	0.046	0.250
Lnassets	-0.012	0.049	0.799	0.058	0.041	0.153
Income	0.003	0.010	0.783	-0.005	0.009	0.599
Constant	-3.153***	0.726	-4.340	-0.578	0.600	0.335
Log pseudolikelihood	-411.23					
Wald ² (22)	135.01					
Prob (chi ²)	0.000					

Likelihood ratio test of rho₂₁ = 0; chi² = 77.80; p > chi² = 0.000

Significance levels at *** p < 0.01, ** p < 0.05, * p < 0.1

Source: Author's field data compilation

While information had a positive correlation with participation in efficiency typology, it did show an association with the livelihood typology. Lastly, having a bank account, which is an indicator of financial access, showed a negative association with participation in the efficiency typology but a positive correlation with the livelihood typology.

2.5 Discussion

2.5.1 Organizational characteristics of the efficiency and livelihood typologies

The MCA and cluster analysis provided a distinct separation between efficiency and livelihood collective action typologies. This classification revealed distinctions that

are broadly similar with characterizations from the extant studies (Groot Kormelinck *et al.*, 2019; Bijman & Hanisch, 2020). These findings also align with many studies in the developing world which highlight the role of the efficiency typology in improving efficiency by reducing the risks and transaction costs in accessing markets (Kwizerimana *et al.*, 2023; Min-Han Tsai & Yir-Hueih, 2022). This is through bypassing the intermediaries, guaranteeing price assurance to enhance their market competitiveness and realising economies of scale to improve household incomes and reduce poverty (Kwizerimana *et al.*, 2023). In Kenya particularly where the markets are characterised by imperfections such as high transaction costs, paucity of information and weakly defined property rights, participation in efficiency typology requires substantive capital outlay for investing in efficiency activities (Min-Han Tsai & Yir-Hueih, 2022). Therefore, the efficiency typology is not so dominant among households compared to the livelihood typology. Minority in membership could be explained by their low endowments of productive resources such as labour, land and capital outlay (Njuki *et al.*, 2021; Quisumbing *et al.*, 2021). In addition, the minority in membership in efficiency typology could be explained by the closed membership policy imposed in locking out any potential new entrants by imposing strict pre-conditions to enhance market competitiveness and organizational performance (Groot Kormelinck *et al.*, 2019).

The preconditions include investing double the required amount of capital outlay as collateral for commitment, strict scrutiny of an individual's reputation of any potential new entrant and a mandatory probation period before being confirmed as a full-fledged member. The key informant interviews revealed that restrictive membership entry conditions prevent the new entrants from reneging cooperation through making heterogeneous contributions in the form of capital outlay or volumes and standards required by markets. This finding is consistent with (Mwambi *et al.*, 2020). The efficient marketing-oriented groups do not prefer an open membership policy because it could lead to heterogeneity in volumes and standards of the farm produce resulting in increased governance costs that can have negative effects on efficiency gains. The efficiency typology showed mixed membership of both men and women. Conversely, livelihood typology was dominated by women only. This finding is in line with (Bijman & Wijers, 2019), who found that the less resource-endowed households prefer livelihood typology because it requires less operational

capital for funding the informal insurance, savings and credit kits. The amount of capital was set by the members themselves depending on their financial abilities. The domination of women-only membership in livelihood typology could be explained by women's limited access and control of resources such as livestock, land and finance for investing in efficiency activities (Ampaire *et al.*, 2020). Additionally, given the women's integral responsibilities in safeguarding household food security (Njuki *et al.*, 2021), they tend to skew their preferences to livelihood-enhancing and risk-reduction activities in buffering the households from production and marketing shocks and risks to smooth household income and consumption (Bizikova *et al.*, 2020).

The efficiency typology shows a high level of formalization through their registration status as legal collective business entities compared to the livelihood typology. Consistent with (Bizikova *et al.*, 2020), registration is a pre-condition for engaging in economic activities and receiving any incentives or technical support from multi-agencies. The livelihood typology members prefer informal status due to the inability to pay membership fees and the unfamiliarity of the registration procedures. The efficiency typology operates on a wider geographical scale beyond the grassroots level, forming amalgamations with other collective action entities of similar interests to form cooperatives and unions (constituting thousands of members). This helps to increase the asset portfolio, social networks and market linkages in achieving economies of scale. Conversely, the MCA findings reveal that the livelihood typology is not well socially networked because they operate as sole entities without any mergers with CAIs of similar goals. It constitutes the households, the majority of whom are women who are familiar with each other due to their cohering tendencies based on neighbourhood proximity and/or kinship ties. This explains the closed membership entry criteria in locking out any unfamiliar household outside the neighbourhood of an unknown reputation. These findings support (Ampaire *et al.*, 2020) that women prefer groups that constitute households that they are familiar with, contrary to the efficiency typology which operates beyond the village scales. Women also may face high opportunity costs of time in attending distant venues to participate in efficient collective activities such as technical trainings, meetings and collective marketing days.

Despite the efficiency typology engaging in vertical coordination efficiency activities, the participation levels in these activities were relatively low including collective sourcing of farm inputs, sourcing of extension and advisory services, and collective output marketing. The interviews revealed that most of the households self-excluded from these collective activities due to not only lack of capital but also due to its potential risks that could render the cost-benefit ratio of participating negative. The risks and costs included lack of transport and handling facilities, potential risks associated with high rejection rates of the farm products due to failure to meet the required standards, coordination problems, defaulting of contractual agreements by the product buyers, late disbursement and misappropriation on the payments for collective sales and misuse of collective resources by leaders. The larger group sizes associated with efficiency typology expose members to anonymity tendencies leading to opportunistic behaviours and therefore increasing governance costs in coordination, and reinforcing member commitments (Mwambi *et al.*, 2020). The contractual agreements are useful in minimising governance and transaction costs and risks among the efficiency participants. In this context, formalization is important in legally settling disputes and minimising the opportunistic tendencies herein. Alternatively, some CAIs under this typology impose fines for any inappropriate behaviours contradicting the collective rules and regulations such as absenteeism from, and/or lateness in attending group meetings and side selling of the products to other non-contracted buyers.

Despite the wider geographical scale of operation, the efficiency typology revealed low bonding and social capital reflected in their trust in fellow members and their fellow amalgamated collectives. This would impair the coordination efforts, exchange and sharing of information that could pose detrimental effects on efficiency gains. The risks associated with livelihood typology include reneging on repaying the credit, remitting finances to the savings kit and the informal insurance arrangements. The livelihood typology imposed a closed membership entry criterion to minimise these risks. The livelihood members also upheld informal forms of accountability including trust, reputation and reciprocity. This assertion can be supported by the observed high level of social capital in the livelihood typology, resulting from the familiarity that could enhance trust and reciprocity among the participants with each other. The livelihood typology also exhibited a high level of bridging social capital

in their trust to other groups of similar objectives. In addition, in this typology, the smaller group sizes constituting about 15 to 30 members implied minimising anonymity and opportunistic tendencies as also opined by (Fischer & Qaim, 2014). Furthermore, the CAIs within the livelihood typology impose fines for enhancing commitment and minimising renegeing cooperation and any behaviour that is contrary to the self-crafted group rules.

The MCA and cluster analysis results show that very few CAIs within the livelihood typology engaged in horizontal coordination activities in combination with very minimal vertical coordination activities. Analogously, a minimal number of CAIs within the efficiency typology participated in sourcing credit, table banking and savings and in enhancing the welfare of the households. The multi-purpose orientation of the typologies provides synergies in enhancing the welfare of the households. For instance, the pooling of savings and credit sourcing may complement the efficiency activities by offsetting the required capital outlay and operational expenses (Ampaire *et al.*, 2020). Conversely, while the livelihood typology actively engaged in vertical coordination activities, it showed low levels of engagement in vertical coordination activities such as collective input sourcing, collective output marketing and seeking extension and advisory services. While livelihood-enhancing activities may promote social capital, they would be at the expense of efficiency gains (Groot Kormelinck *et al.*, 2019). Furthermore, the traditional characteristics including poor social networks and low levels of bridging social capital can impair the growth of the livelihood typology to modern business entities. Of notable is that the multi-purpose objectives may expose the participants to portfolio problems and divergent interests that may lead to heterogeneous contributions concerning finances, time and decision-making (Bijman & Wijers, 2019).

2.5.2 Collective action typology participation patterns

The MVP result revealed that age was positively associated with participation in the efficiency typology while age had a negative correlation with participation in the livelihood typology. This finding was supported by Habiyaemye *et al.* (2023) who found a positive correlation between age and participation in farmer cooperatives in Rwanda. Age is a potential indicator of physical, financial and social capital endowments that would motivate economic reciprocity incentives given the huge

initial and operational capital outlay required in engaging marketing activities. A female farmer remarked, *“I cannot afford to be a member of marketing groups because I lack enough land and finances to adapt the new skills for expanding production.”* Another female farmer responded, *“I do not prefer those marketing groups the cost of implementing agricultural practices is so high.”* The findings further revealed a positive association with participation in efficiency typology but showed no correlation with livelihood typology. In the efficiency typology, labour is important for intensive market-oriented and standardised production, participation in technical training and collective marketing days.

Farming experience had a negative correlation with participation in efficiency typology but a positive association with participation in livelihood typology. Farming experience is a form of human capital that increases knowledge and awareness of past production and current production and marketing trends that disincentivise farmers not to choose efficiency typology but to act independently (Gyau *et al.*, 2016). Aligning with Rayamajhee (2019), the knowledge and awareness however motivate participation in livelihood typology in livelihood-enhancing and agricultural risk-reduction such as crop failure, climate shocks, food price hikes and food shortfalls. These groups cushion the households from risks and shocks to smoothen incomes and consumption and they include pooling savings, sourcing of credit, accumulating assets and provision of informal insurance in form of goodwill financial support. On bank account, it was negatively correlated with participation in efficiency typology and positive association with livelihood typology. Bank account is an indicator of access to financial services and the negative correlation in efficiency typology was unexpected because bank account is important for agricultural business transactions.

However, the positive correlation on livelihood typology can be attributed to the requirement of a bank account for livelihood members in contributing to their kits of savings, asset acquisition, informal insurance and credit. Distance to the tarmac road did not influence the decision to participate in the efficiency typology but it showed a negative association with participation in the livelihood typology. This result aligns with Mutonyi (2019) that proximity to the tarmacked roads reduces the transaction costs of accessing financial services and markets and this reduces the likelihood of reciprocity incentives. Access to information showed a positive association with efficiency typology but a negative correlation with livelihood typology. This finding

is in tandem with Habiyaremye *et al.* (2023) that in Rwanda information and participation in milk in milk cooperatives were correlated. The positive association in this study could be attributed to the endowments of the social networks among the efficiency members with other merger CAIs, agribusiness companies, non-governmental organizations and research organizations that facilitate in dissemination of information. Information empowers households to plan and respond to changes in production and marketing processes.

2.5.3 Implications of collective action typologies on policy targeting

The findings reveal that efficiency and livelihood typologies should be assessed according to their context-specificity. In the scaling process, the MCA could not only help in identifying collective action typologies that are closely correlated with the priority criteria but also in providing additional context-specificity of these typologies. On the other hand, the cluster analysis results provide extra substantive information to validate identified typologies based on priority criteria. In addition, MVP results provide insights into specific categories of households to target to align the characteristics of the groups with the socio-economic context of the households. In this context, policy interventions should prioritize efficiency and livelihood typologies for upscaling and development through optimising their specific opportunities while addressing their challenges as shown in the typological framework in Table 2.7. Efficiency typology should be prioritized in stimulating agricultural productivity and marketing due to their close associations with efficiency activities including collective sourcing of farm inputs and extension services and collective farm output marketing. The efficiency typology may confer spillover effects and synergies for improving household incomes, food security, agricultural production, and poverty reduction (Karing'u *et al.*, 2020; Kwizerimana *et al.*, 2023).

Efficiency typology constituted about few households that were older males endowed with farming experience, farm labour and information. Aligning with the objectives of inclusivity, gender equality and empowering of women, there is a need for policies to incentivize and support women and young households to participate in efficiency typology. It is also important for development practitioners to promote and support the formation of women and youth CAIs through gender mainstreaming. The efficiency typology constituted about few households that were older males endowed

with farming experience, farm labour and information. The efficiency typology primarily operates at a large scale with wider social networks and lower levels of social capital in conducting efficiency-enhancing activities. To tap into the opportunities of social networking through amalgamations, there is a need for policies to cultivate an empowering environment for the efficiency typology to collaborate with Business Process Outsourcing (BPO) and Public Private Partnerships (PPP) to facilitate technology and skills transfer and funding of starter capital (Ampaire *et al.*, 2020).

It is also important to put policies in place to forecast and provide real-time data provision on the market dynamics to farmers to encourage timely planning in production and marketing. This would minimize marketing risks associated with price fluctuations that arise due to supply and demand dynamics. Efficiency households are constrained by the stringent standards required by the remunerated markets such as standardised production, strict grading metrics and safety regulations. This inhibits the farmers from participating in collective marketing groups due to high rejection rates of their farm produce, exposing them to side selling at low prices to middlemen. In this regard, there is a need to facilitate training, dissemination of knowledge and information on quality standards to promote participation in market-oriented production. The qualitative results reveal that efficiency gains are compromised by incidences of defaulting on contractual agreements that are attributed to unpredictable and unreliable market dynamics concerning demand, supply and prices.

Therefore, there is a need to educate farmers on contractual agreements and legislate on penalties for defaulting to minimize risks of buyers defaulting or non-consultative altering of the terms of contracts. The efficiency typology reports a low membership profile of the youth and the women. Therefore, following the sustainable development goals of empowerment of women and gender equality, there is a need to incentivize the youth and the women to stimulate their participation. The field observations showed that the County and National Governments are promoting the formation and development of youth groups by facilitating their emergence and transferring business and financial management skills. Additional improvement of policy targeting can be undertaken by further examining the livelihood typology. The typology confers opportunities for improving livelihoods and household incomes as

well as empowering women. The typology is prominent among the smallholder households majorly the younger female-headed households engaging in enhancing the welfare of the households, sourcing of credit and table banking. Empowering women is crucial particularly in SSA because they are integral actors in contributing about 65% of the food consumed in the region as producers, wage workers, food traders, domestic home-keepers and caregivers as well as engaging in food preparation and provisioning (Ayamga *et al.*, 2023; Hillenbrand *et al.*, 2023). In this context, opportunities for the provision of both formal and informal credit and accumulating savings should be encouraged by establishing collective action fund schemes and microcredit schemes with affordable interest rates.

There is a need for policies that stimulate the growth of rotating savings and credit associations and provide information on credit and potential collaterals to minimise the defaulting of credit among households. The high bonding social capital in the livelihood typology should foster financial, agribusiness and development of the groups into business entities. The high bridging social capital calls for policies that create an environment to foster collaborations and facilitate social networking and linkages. Given the differences between efficiency and livelihood, the targeted policies can develop the CAIs by conferring spillover effects or co-benefits of the multiple policies.

Table 2.7: Implications of efficiency and livelihood typologies on policy targeting

Typology	Opportunities and constraints	Implications for policy targeting
Efficiency	<i>Opportunities</i>	
	High level of linking social capital	Collaborations with public and private partnerships to provide new capital and facilitate in skills and technology transfer.
	Market access and value addition	Streamlining market linkages to enhance production and marketing.
	<i>Constraints</i>	
	Outdated business practices	Training and encouraging adoption of modern business practices.
	Contractual agreements defaulting	Creating awareness, sensitization and legislation on potential penalties for defaulting.
	Unpredictable market dynamics	Forecasting and real-time data provision on the market dynamics.
	Stringent market standards	Creating awareness and training on quality standards.
	Low youth and women participation	Incentivize and support the women and youth to participate in CAIs. Promoting and supporting the formation of youth and women CAIs. Gender mainstreaming and creating awareness of gender- responsiveness.
Livelihood	<i>Opportunities</i>	
	Inclusion of women	Supporting the development of women's CAIs to enhance women's empowerment.
	High bonding social capital	Support and facilitate business development through the provision of financial management and business skills.
	Provision of informal insurance	Linking up with insurance providers for training and awareness of agricultural risks and their coping strategies.
	Financial access services	Promote the growth of credit and savings activities by establishing collective action funds schemes.
	<i>Challenges</i>	
	Weak economic capacities	Creation of rotating funds and credit schemes with affordable interest rates.
High rates of defaulting	Ensure credit information sharing and provision of collaterals.	
Low bridging social capital	Fostering collaborations, social networks and financial linkages.	
<i>Challenges</i>		
Efficiency and Livelihood	Poor management and leadership	Regular and proper inventory and communication.
	Low ICT integration	Supporting and developing the capacity of CAIs in embracing ICT.
	Low entrepreneurial skills	Training, inducting and enhancing entrepreneurial skills and capacities.
	Lack of professionalism	Facilitation of proper training on cooperative practices.

Source: Authors' field data

This would lead to the simultaneous achievement of multiple objectives of poverty reduction and improvements in household food security, women empowerment and gender equality.

2.6 Conclusion and policy implications

The study explored the heterogeneity of CAIs and their implications on participation patterns and policy targeting. The results revealed two typologies of collective action namely efficiency and livelihood. While the efficiency typology exhibited the minority in membership, elaborate social networking in mergers and low social capital, the livelihood typology exhibited the majority of the membership, operating at the village grassroots level and manifested a high level of social capital. The efficiency typology adopted transaction cost and risk mitigating strategies of collective input sourcing, collective input marketing and seeking of extension and advisory services. On the contrary, the livelihood typology engaged in livelihood-enhancing activities including providing informal insurance, pooling of savings and credit sourcing. The participation patterns across the two typologies were differentially influenced by age, farm labour, bank account, information and farming experience.

The patterns underpinning the efficiency and livelihood typologies suggest that there is no 'one-size-fits-all' promotional approach in developing the typologies. Their development should be targeted within their contextual specificity by taking into account their specific opportunities and constraints. This allows policymakers to address multiple objectives concurrently by conferring synergistic or spill over effects arising from multiple policy interventions. While the typologies unearthed the underlying organizational characteristics of the groups' heterogeneity, the study did not capture the dynamic and complex diversity of the CAIs in accounting for their transformation trajectories in space and time. Extensive follow-up research is recommended in different socio-economic contexts to extend the empirical findings to broader settings.

CHAPTER THREE

Debunking the One-Size-Fits-All Approach: Synergistic and Trade-Off Effects of Collective Action on Household Food Security among Smallholder Farmers in Central Kenya

Abstract

Collective action is important in ameliorating the negative externalities in agriculture to promote household food security (HFS). This study explored the effects of livelihood and efficiency collective action initiatives (CAIs) on HFS along the pathways of production and income. The efficiency CAIs pursue efficiency-enhancing collective activities including input sourcing and output marketing. The livelihood CAIs engage in household livelihood and resilience-enhancing collective activities such as provision of credit and informal insurance, pooling savings and acquisition of assets. A multinomial endogenous treatment effects (METE) model and an ordered probit model were employed on cross-sectional data collected from 532 households from Murang'a County from central Kenya. The results revealed significant differences in HFS between the efficiency and livelihood CAIs that were attributed to variations in education, age, farm size, labour, household size, access to information, extension services, credit and information communication and technology (ICT). The differences were also accounted for by the variations in the organizational characteristics of the two forms of CAIs that determine their capacity to leverage HFS benefits along the pathways of production and income. Both efficiency and livelihood CAIs showed a positive significant effect on HFS through production. The results further revealed that income positively influenced HFS among the livelihood members contrary to efficiency CAIs that showed negative HFS effects. The HFS across the combined pathways of income and production was lower for the efficiency CAIs than the livelihood CAIs, mainly due to the trade-off income effects exhibited by the former and the synergies accrued from income and production on the latter. The findings suggest that the overall performance of both efficiency and livelihood CAIs in leveraging HFS from joint income and production remains tentative. Therefore, a one-size-fits-all collective action promotional policy and program design approaches are inadequate. The study suggests a portfolio of context-specific collective action policies and interventions that match the differences between the efficiency and livelihood CAIs and their links to HFS. The policies would confer potential synergies, spillover effects and complementarities in strengthening the synergies while mitigating the trade-offs along the income and production pathways between the efficiency and livelihood CAIs. It is essential to enhance access to information, extension and advisory services and ICT among the members of the livelihood CAIs to improve production. It is important to incentivize the non-farm livelihood-enhancing economic activities among the livelihood members to fill the household food gaps arising from low production. It is also important to establish micro-credit schemes and collective action funds to tap opportunities for credit sourcing and pooling savings among the livelihood members while promoting collective input sourcing and output marketing among the efficiency CAIs.

Keywords: Collective action, food security, production, income, multinomial endogenous treatment effect model, Kenya

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3.1 Introduction

The growth in population combined with urbanization, rising incomes, and evolving trends in dietary consumption patterns, is anticipated to increase the demand for food worldwide (Food and Agriculture Organization, FAO, 2023). Already, the number of people experiencing food insecurity and multiple forms of malnutrition has been on an upward trajectory in the past three years from 8 per cent in 2019 to almost 10.5 per cent in 2021 (FAO, 2023). Sub-Saharan Africa (SSA) region in particular represents the highest prevalence rates of up to 23.4% of the 823 million world's undernourished population (FAO, 2023). In Kenya specifically, the number of people facing hunger is also high, representing about 26.9 per cent of its total population (Kenya National Bureau of Statistics, KNBS, 2023). In the country, about 33 per cent of the population subsists on less than the required daily capita calorific threshold of the recommended 2250 kilocalories, a trend that has been on the upturn by about 8.8 per cent between the years 2014 to 2022 (KNBS, 2023). Food insecurity prevalence rates in SSA disproportionately affects rural smallholder households despite contributing to almost 75 per cent of food consumed in the region as food producers, wage workers, processors and traders (KNBS, 2023).

Persistence and vulnerability of food insecurity among smallholder farmers has been ascribed to pervasive market failures including asymmetric information and high transaction costs (Njuguna *et al.*, 2022). The confluence effects of poverty, low public intervention and geographical dispersion exacerbate the effects of transaction costs in accessing resources such as input and output markets, extension and advisory services, finance, credit and agricultural technologies (Njuguna *et al.*, 2022). These constraints limit the capacities of smallholders to improve farm productivity and generate incomes in safeguarding food security for their households (Valujeva *et al.*,

2023). In this context, the national and transnational developmental discourses have been growingly promoting collective action as a survival strategy that can address food security challenges through production, income and gender impact pathways (Nosratabadi *et al.*, 2020). Despite this, the empirical basis exploring the linkages between collective action and household food security (HFS) and its associated agricultural-nutritional pathways has received less attention to date. Like the rest of SSA, examples of collective action initiatives (CAIs) among the smallholder farmers in SSA include producer and marketing groups, savings and credit groups, community-based organizations and water and forest user associations (Cramer *et al.*, 2016).

The novelty of collective action underpins its potential in forming a linkage between the farmers and their socio-economic settings in enhancing efficiency and effectiveness in marketing and production endeavours (Kwizerimana *et al.*, 2023; Zou & Wang, 2022). This is through ameliorating the transaction costs in accessing productive resources, farm inputs, technologies and output markets (Zou & Wang, 2022). Collective action also provides rich income-generating opportunities for non-agricultural diversification activities such as pooling of savings and acquisition of assets that can improve agricultural production by mitigating the farmers' liquidity constraints and smoothing household incomes (Hintz & Pretzsch, 2023). In addition, non-agricultural activities provide informal insurance that cushions the households against the potential idiosyncratic and covariate shocks (Malual & Mazur, 2022). The standard proposition in the literature holds that participation in collective action translates to HFS through the agricultural-nutritional pathways of farm production and household income (Shumeta & D'Haese, 2018; Nosratabadi *et al.*, 2020).

However, the extant studies reveal mixed evidence on the effect of collective action on HFS along the two pathways. For instance, collective action provides rich opportunities to improve HFS through farm productivity and incomes through the synergistic effects of intensive production and ease access to farm inputs and remunerated markets that offer better market prices leading to farm profitability (Linderhof *et al.*, 2019). However, on one hand, the market-oriented or efficiency CAIs require high capital outlay and as such they favour the older, wealthier and large-scale male farmers and thus exclude the resource-constrained farmers from participating therein (Mwambi *et al.*, 2020). Conversely, larger farm sizes may put

more demands on the households' labour which would increase the farmers' opportunity costs of time for participating in group meetings, agricultural training and collective market days (Fischer & Qaim, 2012a; Woldu *et al.*, 2018). In addition, increased focus on market-oriented production could also lead to the trade-offs in utilisation of resources between cash crop production and for-home consumption production (Kirimi *et al.*, 2013; Shumeta & D'Haese, 2018). Since most of the food consumed in smallholder households comes from own production, market-oriented production is likely to increase dependence on food markets which could expose the farmers to price volatility (Kirimi *et al.*, 2013).

Due to poverty, the income derived from collective activities including marketing, savings and credit is likely to be diverted from HFS needs to essential non-food items including education, health, agricultural inputs, home improvement and asset acquisition (Linderhof *et al.*, 2019). Additionally, a study done by Sraboni and Quisumbing (2018) shows that collectively generated incomes may not translate to HFS due to the social norms limiting women's control of household incomes and expenditures. This can pose adverse effects on HFS since women play integral roles in food production, domestic work and caregiving that influence the nutritional outcomes of their households (Njuki *et al.*, 2021; Quisumbing *et al.*, 2021). Resource-constrained smallholder farmers notably women are risk averse and this implies that they are less likely to take risks associated with collective marketing such as defaulting on sale contractual agreements and rejection of the farm produce due to failure to meet the designated standards (Gyau *et al.*, 2016). Therefore, resource-constrained farmers and women prioritise livelihood-enhancing, household-risk reduction and food self-sufficiency options by engaging in CAIs that focus on accumulating household assets, pooling savings, sourcing credit and providing informal insurance (Dhal *et al.*, 2020). However, financial obligations in contributing to savings and informal insurance kit coupled with the inability to repay the credit may leave farmers impoverished and food insecure (Ganle *et al.*, 2015).

The inconsistent findings imply that the influence of collective action on HFS depend on socio-economic attributes of households and the characteristics of CAIs. This is because farmers are heterogeneous entities in their demographic and socio-economic conditions, resource endowment and utilization and social networking patterns (Cramer *et al.*, 2016; Min-Han Tsai & Yir-Hueih, 2022). Therefore, farmers employ

heterogenous transaction-cost-reducing strategies in mobilizing across CAIs depending on their abilities and needs (Min-Han Tsai & Yir-Hueih, 2022). The heterogeneities imply that farmers adopt different collective coping mechanisms for agricultural risks and shocks to improve production and the generation of incomes (Zou & Wang, 2022). This leads to win-win, win-loss or loss situations on the nature and extent of HFS leveraged and their associated nutritional pathways. Despite this, the context-specificity of these concepts has remained obscure in literature yet they pose implications on the choice of the analytical framework, interpretation and generalization of the findings.

The extant research stream typically employs pooled regression analyses with collective action dummy indicating whether a farmer participates or not in regressing the effects of collective action on HFS. This approach makes it difficult to disentangle how different CAIs would respond and benefit from households' investments and promotional policies and subsequent HFS leveraged vis-à-vis the households' investment strategies and the promotional policies these CAIs might need to optimise HFS benefits (Dhal *et al.*, 2020). As a result, this approach dissipates collective action policies and program design into a 'one-size-fits-all' approach that may pose a threat to the development of CAIs in promoting HFS (Republic of Kenya, 2019). This study focusses on the producer and marketing groups, savings and credit groups, community-based organizations and water and forest user associations. These CAIs are classified according to their economic functions into market-oriented or efficiency and community-oriented or livelihood CAIs. The two forms of CAIs are distinct in their gender composition, nature of activities, level of social capital and social networking (see the next sub-section).

The study employed rich household survey data from the smallholder farmers from Murang'a County in the central region of Kenya to explore the effects of participation in efficiency and livelihood CAIs on HFS. Murang'a County presents a suitable representative case study because it accounts for up to 65 per cent of the aggregate membership of the agricultural CAIs in Kenya (KNBS, 2023). In particular, like the rest of the country, the efficiency and livelihood CAIs are prominent in the county. However, upon perusal, no study has explored the effects of the two categories of CAIs on HFS. This study contributes to the discourse of collective action and HFS by exploring: 1) How participation in efficiency CAIs affects HFS along the

nutritional pathways of production and income; 2) How the HFS are differentially influenced by the household and organizational characteristics of the livelihood and efficiency CAIs; 3) How HFS outcomes are differentially influenced by the nutritional pathways of income and production across the efficiency and livelihood CAIs. The study employed a multinomial endogenous treatment effects model (METE) to explore and disaggregate how participation in efficiency and livelihood CAIs influence HFS along the nutritional pathways of production and income. The METE model controls for the endogeneity problem that can be attributed to reverse causality between HFS outcomes and collective action participation which although evident, has not been addressed in most empirical studies. The study also employs an ordered probit model to provide a real explanation of the differential effect of linkages between the household socio-economic attributes and organizational characteristics of the two forms of CAIs and HFS.

Understanding the differences and causes of differences of HFS across the efficiency and livelihood CAIs has implications, especially on interventions meant for improving the HFS status of the smallholder households in particular. From a policy perspective, the insights of the study would inform implementation of more context-specific and nutrition-sensitive collective action program design and promotional policies. The next sub-sections present the descriptions of efficiency and livelihood CAIs, the nexus between collective action and HFS and the conceptual framework. Section two presents materials and methods describing the study area, data and empirical strategies. Section three discusses the results while section four draws the conclusions and the policy implications of the study.

3.1.1 The efficiency and livelihood collective action initiatives

The efficiency CAIs pursue efficiency-enhancing activities in minimising transaction costs in marketing and production processes including collective purchasing of farm inputs, collective bulking and marketing of farm outputs. They are largely dominated by men owning larger farm sizes and they practise market-oriented production. The efficiency CAIs are highly formalized and they operate as primary solo entities or as second-tier amalgamations in the form of cooperatives or unions. They are characterised by high bridging social capital in networking with the government, non-government organizations and agribusiness companies to receive extension and

advisory services as well as technical training. The majority of the smallholder households do not prefer efficiency CAIs because: they require large amounts of capital for investing in membership fees, share contributions and meeting production standards; they are prone to risks such as rejection of farm produce due to failure to meet the stipulated standards; defaulting of the contractual agreements by the potential buyers; and delay in disbursement of the payment from the collective sales.

The livelihood CAIs engage in food self-sufficiency and livelihood-enhancing activities in reciprocal and collective asset acquisition, pooling of savings, provision of informal insurance and sourcing of credit either internally or with bank linkages. The livelihood CAIs constitute the majority of the membership largely dominated by women, owning small land sizes and practicing subsistence farming. The livelihood CAIs operate informally due to the incapability of the farmers to afford the membership fees and annual subscriptions. Contrary to the efficiency CAIs, they are characterised by high bonding social capital level. This is because they operate as single entities, consisting of members with kinship ties or from the neighbourhoods and largely grounded on customary principles and ideas of promoting the members' well-being.

3.1.2 The linkage between collective action and household food security

The (FAO, 2023) states that “food security exists when all people, at all times, have economic, physical and social access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy life”. In this regard, collective action provides multiple and synergistic functions that can promote HFS along the three interlinked pathways of income, production and women empowerment as shown in Figure 3.1. However, this study is limited to the two pathways of income and production. Literature reveals inconsistencies in the effects of collective action on HFS. This is because farmers mobilize depending on their needs, priorities and abilities, and as a consequence, they collectively adopt divergent transaction-cost-reducing mechanisms in promoting agricultural production and generation of incomes (Min-Han Tsai & Yir-Hueih, 2022).

For instance, collective action influences own farm production through the effects of input as a result of a reduction in the transaction costs per unit in accessing farm inputs including seeds, fertilizers and extension and advisory services either through

government schemes, output market providers and certified input providers (Gyau *et al.*, 2016). Agricultural production influences HFS directly when households consume what they produce in form of type, seasonality and quantity of food (Lutomia *et al.*, 2019). Production can also influence HFS indirectly through its multiplier effects on incomes when agricultural produce can be sold to generate incomes which can be allocated to purchasing nutritious foods as well as the availability of variety of foods in the local markets and the food prices (Harris-Fry *et al.*, 2017; Ragasa *et al.*, 2019).

Collective action can also improve production through the acquisition of production and marketing skills, information, knowledge and experiences arising from the synergistic and spill-over effects of peer social learning, grassroots innovation, vocational training and extension and advisory services (Larsen & Lilleør, 2014; Nosratabadi *et al.*, 2020). Additionally, the provision of collective training on post-harvest handling practices can increase the farmers' opportunities to improve HFS through minimising the losses associated with a decrease in food supplies, diminished market value, food safety and nutritional content of food and non-food crops (Mutungi *et al.*, 2023).

This could enhance own-farm diversification in meeting own consumption needs and increasing market surplus (Linderhof *et al.*, 2019). However, diverse farming depends on the availability of the household's non-farm income, larger land sizes and market participation opportunities (Waha *et al.*, 2018). Furthermore, women farmers in particular face high opportunity costs for attending such trainings that are important in improving post-harvest management, production and marketing skills (Nakazi *et al.*, 2017). Collaboration of the farmers can influence production through the supply of reciprocal labour among the members (Andersson & Gabrielsson, 2012). This is particularly important with the increasing rate of rural to urban migration that has created labour shortages in rural farming (Kehinde *et al.*, 2021).

Collective action improves commercialization of agricultural outputs to improve HFS through production arising from synergistic effects of competitiveness and gains in income (Kirimi *et al.*, 2013)..

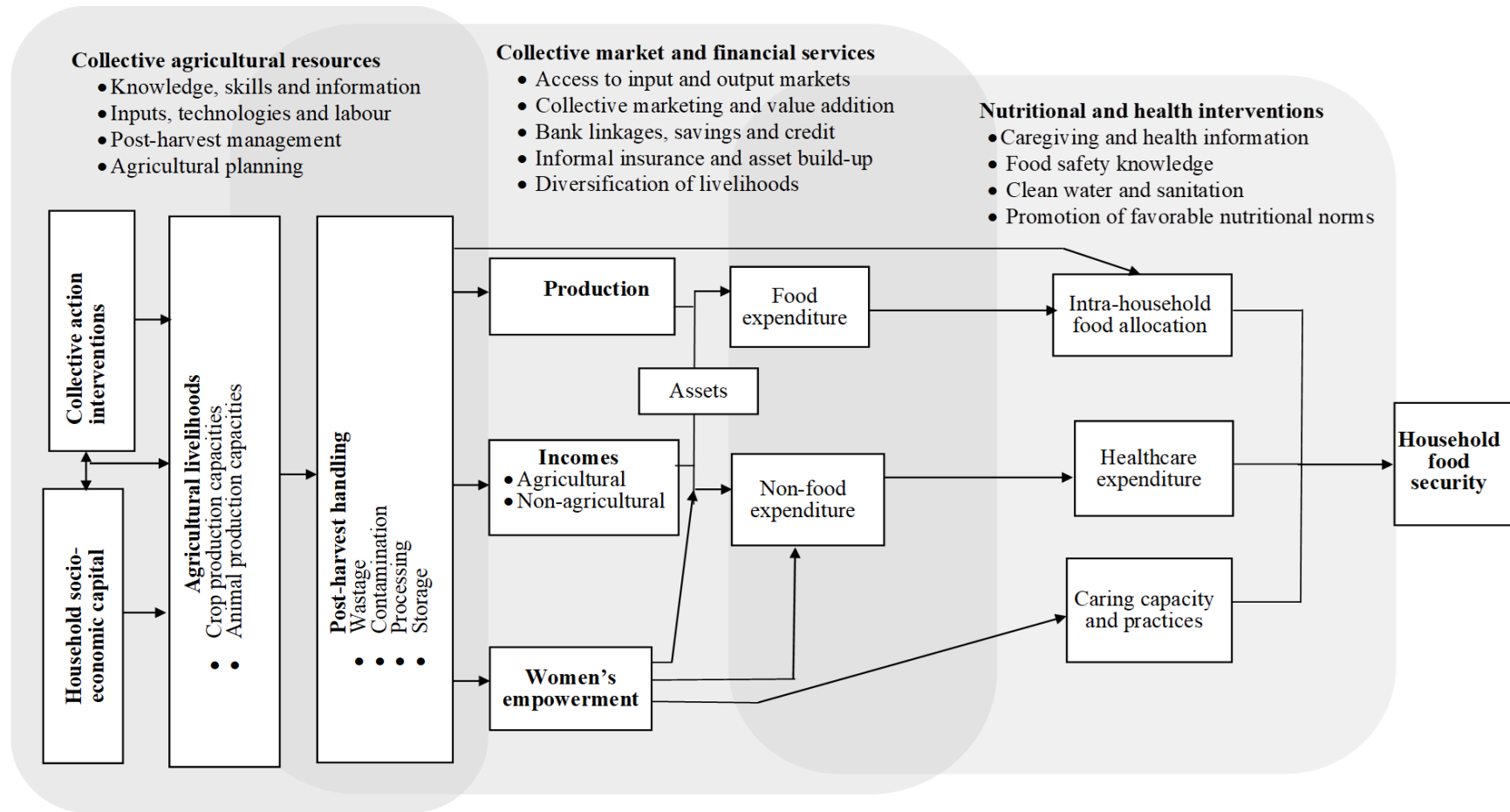


Figure 3.1: Linkages between collective, agriculture and household food security

Source: Author's drawing

However, evidence shows substantial improvements in collective commercialization among the older collective marketing groups that are well endowed with land belonging to groups characterised with inclusivity in decision-making and high levels of bridging and bonding social capital (Fischer and Qaim, 2012a; Niles *et al.*, 2021; Sseguya *et al.*, 2018). Otherwise, newly formed CAIs can be constrained by low mutual trust and uncertainties over reciprocity incentives. On the contrary, other studies found negative associations between bridging social capital and HFS (Koster *et al.*, 2021). Among the households, Kihiu and Amuakwa-Mensah (2021) assert that larger effects of HFS can be realized through commercialization when both men and women in the household are guaranteed equal access to the markets. In addition, substantial effects of HFS are accrued among well-educated male farmers who own larger farm sizes and are knowledgeable on production (Bernard & Taffesse, 2012). An increase in income through product commercialization could increase the purchasing power and smooth consumption of more nutritious and diversified diets by increasing the demand for fruits and animal products to replace the pulses and cereals, which make up the bulk of household diets, particularly in Kenya (Fongar *et al.*, 2019). In addition, income eases the farmers' budgetary constraints by increasing expenditure on non-food items including education, assets, farm inputs and healthcare (Harris-Fry *et al.*, 2017; Ragasa *et al.*, 2019; Kihiu and Amuakwa-Mensah, 2021). Incomes can also enhance HFS through the multiplier effects of increased production, demand for labour and farm inputs and creation of local employment (Wegi *et al.*, 2023).

Conversely, households with low-income resources and budgetary constraints face trade-offs between spending on non-food and food commodities such as education and healthcare (Kaiser *et al.*, 2020). Commercialization of agriculture through collective marketing is perceived as an avenue of generating more household income due to its comparative advantages over subsistence farming, however, it is also seen as a shift from subsistence to cash crop farming (Linderhof *et al.*, 2019). This can lead to a decline in diversification and a loss in food self-sufficiency at the farm level hence increasing dependence on local markets (Kirimi *et al.*, 2013). Areas where markets are not well integrated and characterised by poor infrastructure and linkages can pose risks to household incomes such as price hikes (Poole, 2017). For instance, a study by Shumeta and D'Haese (2018) shows that collective marketing does not

translate to HFS through production because farmers tend to divert their resources from food self-sufficiency production to cash-crop-oriented production. Households with access to collective action credit and savings can easily mitigate such risks, otherwise, subsistence farming serves as a form of insurance against the costs and risks of the markets (Kirimi *et al.*, 2013).

Formalization of CAIs is also an important factor in determining HFS. Evidence reveals that formalized CAIs that are registered as business entities are well-socially networked and therefore stand a high chance of receiving economic and technical support from public and private partnerships Fischer and Qaim (2012a). However, resource-constrained households may opt for informal collective arrangements due to the inability to meet registration fees and annual membership renewal fees. Group composition also plays a critical role wherein mixed-gender CAIs contribute to diverse leadership skills, knowledge and organizational capacities that can enhance the HFS benefits leveraged and overall organizational performance (Dohmworth & Hanisch, 2018). Conversely, the social norms limiting women’s speaking in public imply that the mixed-gender CAIs tend to skew their needs to male farmers while neglecting the interests of female farmers (Nakazi *et al.*, 2017). In this context, women-only CAIs guarantee women’s full participation in speaking out to share farming knowledge, experiences and skills in securing the livelihoods and nutritional options for their families (Dohmworth & Hanisch, 2018).

3.1.3 Conceptual framework

The schematic representation of the conceptual framework of the study is shown in Figure 3.2. The arrows illustrate the cause-and-effect relationship between the dependent and independent variables. The study underpins the household utility maximization theory where a household is incentivised to participate in a form of collective action if it optimises its perceived utility (U_{ij}^{Pij}), only if the expected utility (U_i) of participating in a CAI i (C_i^{Pi}) exceeds the perceived utility (U_j) of participating a CAI j (C_j^{Pj}) as expressed in Equation (3.1).

$$(U_{ij}^P) = E_i [U_i C_i^{Pi} X_{Mi}] \geq E_i [U_j C_j^{Pj} X_{Mj}] \quad 3.1$$

where utility (U_i^{Pi}) depends on the expected costs and benefits of participating in CAI i (C_i^{Pj}) and CAI j (C_j^{Pj}) respectively. The costs of collective action participation

include membership fees and subscriptions, financial capital and opportunity costs of participating in group activities such as training, advisory and extension services and market days. The benefits of collective action include but are not limited to access to markets, and access to financial services through group savings and credit.

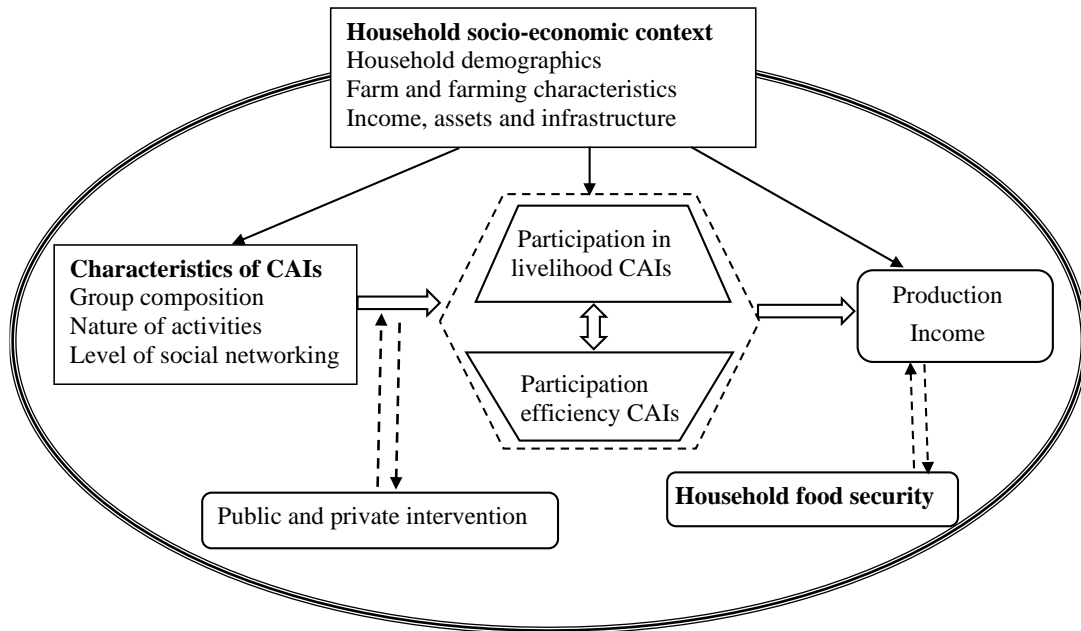


Figure 3.2: The conceptual framework of linking collective action and food security

Source: Author’s conceptualization

The perception and incidence of the costs and benefits are expected to be unevenly distributed across the households due to their divergent socio-economic characteristics including farm and farming factors, income, household demographics, and institutional and infrastructural factors as denoted by X_{Mi} and X_{Mj} respectively.

In turn, it is hypothesised that that varietal households’ socio-economic characteristics are manifested in organizational characteristics of the two CAIs such as membership composition, nature of activities, level of social networking, level of social capital and formalization. The differential transaction-cost-reducing mechanisms are expected to generate differentials in the HFS leveraged across CAIs along the production and income pathways across the livelihood and efficiency CAIs.

3.2 Methodology

3.2.1 Study area and data

The study was done in Murang'a County in central Kenya. The County presents a suitable representative case study based on its prominence in agricultural CAIs that represent about 65 per cent of the aggregate agricultural collectives in the country (KNBS, 2023). Murang'a is also selected because, despite about 80 per cent engaging in agriculture, the county experiences high food insecurity in terms of staples including cereals and pulses (KNBS, 2023). The area also experiences high stunting and wasting of children aged under five, about 20.1% and 5% respectively, which is slightly higher than the national average of 19.4% and 4.2% respectively (KNBS, 2023). The total sample size constituting collective action members and non-members was computed following Cohen, (1988) normal approximation of binominal distribution (Equation 3.2).

$$n = \frac{U_{1-\alpha/2}^2 \times (1-P)^2 P^2}{\delta^2} \quad 3.2$$

Where n denotes the number of surveyed households, $U_{1-\alpha/2}^2$ is 1.96 which is the quantile of a normal standard distribution for the 95% confidence interval (at 0.05); P is the share of the smallholder households with membership in at least one CAI for one year, which is 0.67; δ is the margin of error expected for any of the parameters to be computed following the survey data. In this study, the margin of error expected was fixed at 0.029, a value that is closer to zero to allow for accurate estimates of the parameters (Cohen, 1988). The value of P was calculated by bearing in mind that an individual head per household was interviewed given that the aggregate number of agricultural households in the targeted study area is 338695 and the number of households having membership in CAIs was 225,797. The total sample size obtained from Equation 3.2 is 532 respondents.

A multistage stratified and proportionate random sampling approaches were used to draw the respondents of the study. In the first stage, Kandara and Gatanga were selected because of their high proportion in CAIs. In the second stage, following a random proportionate sampling procedure, from Kandara sub-county, five wards were chosen and two counties were chosen from Gatanga sub-county. In the third stage, we employed collective action lists generated by the Ministry of Agriculture,

Livestock, Fisheries and Cooperatives of Murang'a County. Then several CAIs were randomly and proportionately sampled to ensure the representativeness of the households across CAIs following the proportionate sampling formula as shown:

$$n_h = \left(\frac{N_h}{N} \right) * n. \quad 3.3$$

Where n is the number of different CAIs, N_h is the total number of CAIs in a given Sub-County, N is the total number of CAIs in the county, n is the total number of CAIs in the two Sub-Counties. With the aid of the lists and guidance of the ward-level extension officers, the following CAIs were sampled: 49 producer and marketing groups, 31 savings and credit associations, 5 cooperatives, 2 unions and 10 water and forest user groups. From these CAIs, a total of 353 members were randomly and proportionately sampled according to group sizes in addition to 179 non-members neighboring the respective group members. The study used a well-structured and designed questionnaire to collect cross-sectional data from the selected sample in the year of 2022 from August to October. Before data collection, a research license was issued from the National, Commission for Science, Technology and Innovation (NACOSTI). The type of data collected included frequencies and types of different food groups consumed by the households within the last seven days following the survey, household demographics, institutional and infrastructural factors, farm and farming factors and income.

3.2.2 Measurement of household food security

The study employed the Food Consumption Score (FCS) as a measure for HFS. The FSC is a weighted score based on dietary diversity and food frequency the food groups consumed within the last seven days before the survey (World Food Programme, 2015). Following WFP, the FCS of a household was estimated by multiplying the frequency of foods consumed in the last seven days with the weights of each food group as expressed in equation (3.4).

$$\begin{aligned} \text{FCS} &= \beta_{\text{istaple}} X_{\text{istaple}} + \beta_{\text{ipulse}} X_{\text{ipulse}} + \beta_{\text{iveg}} X_{\text{iveg}} + \beta_{\text{ifruit}} X_{\text{ifruit}} \\ &+ \beta_{\text{imeateggfish}} X_{\text{imeateggfish}} + \beta_{\text{isugar}} X_{\text{isugar}} + \beta_{\text{imilk}} X_{\text{imilk}} \\ &+ \beta_{\text{ioil}} X_{\text{ioil}} \end{aligned} \quad 3.4$$

where; β_i is the frequency of consumption; X_i denote the weight of each food group for vegetables, staples, meat/egg/fish, fruits, pulses, sugar and oil. The sum scores were then used to estimate the FCS, with the maximum score value of 112 which would only be achieved if the household consumed each food group for the seven days preceding the survey. Higher FCS indicates better HFS status because the diet is likely to be more balanced and richer in essential nutrients. Consumption scores of 0 to 21 were regarded as chronic food insecure, 21.5 to 35 were termed as transitory food insecurity and more than 35 were classified as food secure.

3.2.3 Determinants of household food security across collective action initiatives

Regression analysis where a dummy binary collective action participation variable may not be appropriate because it fails to delineate the interactions between the livelihood and efficiency CAIs and the socio-economic characteristics of the household in the model. This is because the pooled regression presumes that the set of variables has the same effect on HFS for both livelihood CAIs and efficiency CAIs. An ordered probit model is suitable because the HFS outcomes are ordinal and it is based on the assumption that there occurs cut-offs between the food security outcomes across the efficiency and livelihood CAIs (Lutomia *et al.*, 2019). Consider three categories of self-reported HFS status with y_i as the underlying latent ordered HFS categorical outcome is expressed as:

$$y_i = X_i^T \beta + \varepsilon_i \quad 3.5$$

where $X_i = (1, x_{i1}, \dots, x_{ij}, \dots, x_{im})^T$ is the vector of covariates for the i th household ($i=1, \dots, n$ and $j=1, \dots, m$); n is the total number of observations; m is the number of socio-economic variables; x_{ij} is the value of variable j th for the i th household; $\beta = (\beta_0, \beta_1, \dots, \beta_j, \dots, \beta_m)^T$ is the vector of coefficients and ε_i is the random error term that follows a normal standard distribution. The value of the HFS status y_i is then determined as:

$$z_i \begin{cases} 1 & \text{if } z_0 < y_i \leq z_i \\ K & \text{if } z_{K-1} < y_i \leq z_K \\ C & \text{if } z_{C-1} < y_i \leq z_C \end{cases} \quad 3.6$$

where $Z (z_0, \dots, z_K, \dots, z_C)$ are the values for all the HFS categories. z_0 , and z_{k-1} and z_{c-1} denote food secure, transitory and chronic food secure respectively. The rest of the values are subject to the constraint $y_i \leq \dots \leq z_i \leq z_K \leq z_{C-1}$. Given the value of X_i , the likelihood that the household i falls to each HFS category is:

$$\begin{aligned}
 p(z_i = 1) &= \Phi(z_i - X_i^T \beta) \\
 p(z_i = K) &= \Phi(z_k - X_i^T \beta) - \Phi(z_{k-1} - X_i^T \beta) \\
 p(z_i = C) &= 1 - \Phi(z_{c-1} - X_i^T \beta)
 \end{aligned} \tag{3.7}$$

where, $\Phi(\dots)$ shows the cumulative probability function of the normal standard distribution.

3.2.4 Effect of collective action on household food security

In estimating the effect of collective action on HFS, the study employed METE (Deb & Trivedi, 2006a). The METE was selected because it employs a joint two-step estimation process in accounting for endogeneity problems emanating from the reverse causality between the HFS status and collective action participation and the unobserved factors influencing HFS. The first step entails a selection equation based on a multinomial logit model that examines the household's collective action participation decisions. The second step is a METE outcome equation that examines the effect of collective action participation on HFS, using FCS among the livelihood and efficiency CAIs wherein non-members are the reference group. In accessing the effect of HFS we include the indicators of HFS along the pathways of agricultural, income and the overall HFS through the combination of income and production pathways. On the agricultural pathways, the study considers the indicators of quantity of maize and beans output (the two most essential staple crops in the study area) to reflect the effect of food availability effect of CAIs. Household income and food expenditure are considered in accounting for the economic access to food effect of CAIs. The overall HFS effects through the combined pathways of income and production were estimated by including the quantity of beans and maize, household income and food expenditure. The indicators of the aforementioned pathways were included alongside other covariates in the METE outcome equation.

A household had two collective action options to choose from namely, efficiency and livelihood. METE assumes that the rational households will choose a CAI that maximises their expected utility (Equation 3.8):

$$U_{ij}^* = z_j' \alpha_i + \sum_{k=1}^J \delta_{ik} l_{kj} + n_{ij} \quad 3.8$$

where U_{ij}^* is the utility associated with i (i =efficiency and livelihood) to specific household j . z_j' is the variable vectors assumed to influence HFS such as farm and farming factors, infrastructural and institutional factors, asset endowments and household demographics. α_i are the estimated parameters related to hypothesized factors affecting the participation decisions of each CAI i . n_{ij} are the identically and independently distributed error terms associated with CAI i and household j . l_{kj} is the latent factor that accounts for unobserved characteristics associated with household j influencing collective action participation decisions and the HFS effect.

Following Deb & Trivedi (2006b), let i are non-members of the two CAIs and $U_{ij}^* = 0$. While U_{ij}^* is not observable, it can be represented as a set of categorical variables c_j and it can be designated by a vector $c_j = c_{j1}, c_{j2}, c_{j3} \dots c_{jj}$. Also, let $l_j = l_{j1}, l_{j2}, l_{j3} \dots l_{jj}$. The treatment probability follows a mutually exclusive choice as shown below:

$$\Pr (C_{ij} | z_j' | l_j) = g \left(z_j' \alpha_1 + \sum_{k=1}^J \delta_{1k} l_{kj} + z_j' \alpha_2 + \sum_{k=1}^J \delta_{2k} l_{kj} + \dots + z_j' \alpha_1 + \sum_{k=1}^J \delta_{Jk} l_{kj} \right) \quad 3.9$$

where g is a multinomial likelihood distribution, wherein a multinomial logit can be expressed as follows:

$$\begin{aligned} & \Pr (c_{ij} | z_j' | l_j) \\ &= \frac{\exp(z_j' \alpha_1 + \delta_j l_{ij})}{1 + \sum_{k=1}^J \delta_{ik} \exp(z_i' \alpha_i + \delta_i l_{ji})} \end{aligned} \quad 3.10$$

where, c_{ij} is the likelihood of a household to choose a CAI depending on z_i socio-economic attributes of i^{th} farmer and unobserved factors l_{ij} with their associated loadings (δ_j) which represents the unobserved collective action heterogeneity affecting the utility obtained from a given CAI. The expected outcome of HFS is estimated by METE in the second stage as follows:

$$E(y_i | c_j, x_j, l_j) = z_j' \beta + \sum_{i=1}^J Y_i c_{ij} + \sum_{i=1}^J \lambda_i c_{ij} \quad 3.11$$

y_i is the HFS outcome; x_i denotes a vector of exogenous covariates with their parameter estimators β . Y_i are the treatment effects of participating in CAIS ($I=1,2$) compared to the non-members ($i=0$). Collective action participation is endogenous and assumes that c_j is exogenous, it would yield biased and inconsistent estimates of Y_i . Therefore, it is necessary to check for the exogeneity of the HFS in Equation (3.12). When the factor-loading parameters (λ) are either positive or negative, treatment and outcome are also negatively or positively correlated with unobservable attributes implying negative or positive selection with the treatment and the associated parameter vectors. Since the choice of CAI is endogenous, the factor-loading parameters could be biased and inconsistent. Similarly, the inclusion of the indicators of nutritional pathways alongside other covariates in the model could potentially pose an endogeneity problem. We address this issue using the exclusion restriction instrumental variables approach. The instrumental variables must meet the following conditions: they must be sufficiently correlated with a CAI choice variables (z_i); they cannot be correlated with unobservable variables affecting HFS (l_i) and they must be uncorrelated with HFS y_i , except through collective action participation variables (z_i) (Magambo *et al.*, 2022).

The instrumental variables that met these criteria include access to information, communication and technology (ICT), electricity and the total number of CAIs the farmer is aware of. Instrumental variables were validated by implementing the likelihood ratio (LR) the joint significance test of the instrumental variables. However, in this case of cross-sectional data, the study conducts several pre-estimation and post-estimation tests. First, since the multinomial logit model assumes that the likelihood of any treatment outcomes is determined independently of any

other available outcomes, we test for Irrelevant Alternative Assumption (IIA) assumption using the Hausman test (Deb & Trivedi, 2006b). Secondly, the study conducted a post- test of exogeneity for treatment, which tests for the joint hypothesis that the loading parameters (λ) for efficiency and livelihood CAIs are equal to zero ($\lambda_{\text{efficiency}}=0$) and ($\lambda_{\text{livelihood}}=0$) respectively as follows:

$$\begin{aligned} \text{scalar LR} &= 2 * (e(2ll) - e(ll_{\text{exog}})) \\ \text{scalar p} &= 1 = \chi^2(2, \text{LR}) \end{aligned} \tag{3.12}$$

The test follows $\chi^2(q)$ distribution, where q is the number of λ parameters or treatment equations, which in this case are 2, where non-member is the reference category. Before the analysis, the variables were subjected to preliminary tests to check for multicollinearity and test of Hausman's in checking whether the IIA is independent.

3.3 Results and discussion

3.3.1 Descriptive statistics

The variable descriptions and descriptive statistics for the households are presented in Table 3.1. The households sampled included 179 non-members, 64 members of efficiency CAIs and 289 members of livelihood CAIs. Contrary to the livelihood CAIs, the efficiency CAIs constituted of older males, owning larger farm sizes with longer experience in farming and producing more beans. In addition, compared to the livelihood members, the efficiency members showed a high level of awareness of CAIs within their neighborhood, more access to banking services, information and contacts with extension service providers. On the other hand, the livelihood CAIs constituted women with larger household sizes that were located near tarmac roads. The members of the livelihood CAIs also had more sources of household income and engaged more in non-farm economic activities. Given the smaller farm sizes among the livelihood members, engagement in off-farm activities was important for the livelihood members in supplementing household incomes.

Table 3.1: Descriptive statistics and description of variables for the livelihood and efficiency CAIs

Variables	Description	Livelihood (1)		Efficiency (2)		Difference (2)-(1)
		Mean	Std. Dev	Mean	Std. Dev	
<i>Household food security indicator</i>						
FCS	Food consumption score	31.66	11.26	27.25	9.60	-2.91***
<i>Household demographics</i>						
Age	Age of the household head (years)	55.13	13.19	62.72	11.69	4.25***
Household size	Total family size (number)	3.89	1.88	3.29	1.96	-2.28**
Literacy ratio	Household members with secondary education and above	2.54	1.85	2.69	1.87	0.59
Dependency ratio	Ratio of dependents to the family size	1.16	1.29	0.89	0.79	-1.42
<i>Farm and farming characteristics</i>						
Farm size	Size of the farm (acres)	1.03	1.03	1.41	0.87	2.75***
Livestock	Livestock Tropical Units (LTU)	1.84	2.57	2.42	3.89	1.46
Farming experience	Years of farming	22.83	14.77	26.86	14.51	1.98**
Farm labour	Ratio of household members providing farm labour	0.97	0.71	1.055	0.73	0.91
<i>Infrastructure and institutions</i>						
Market	Self-reported walking distance to the nearest market (kilometres/km)	3.35	2.06	3.45	3.61	0.32
Tarmac road	Self-reported walking distance to the nearest tarmac road (km)	1.79	1.48	2.24	2.53	1.87*
Extension	Self-reported walking distance to the nearest extension office (km)	3.43	2.24	3.63	3.34	0.59
Extension contacts	Number of extension contacts	1.02	2.62	3.27	4.18	5.49***
Piped water	The household has piped water (1=yes)	0.51	0.50	0.58	0.50	1.06
Information	Number of sources of agricultural information	2.41	1.17	3.64	1.62	7.03***

ICT	Access to information, communication and technology (ICT)	0.34	0.47	0.30	0.46	-0.65	
Awareness of CAIs	Awareness of the types of CAIs in the neighbourhood (number)	3.24		0.08	4.11	0.14	4.62***
Electricity supply	Household has electricity supply (1=yes)	0.85	0.36	0.88	0.33	0.49	
<i>Household income and assets</i>							
Assets	Total asset value (Kenyan shillings/KES)	123356	431673	115833	279813	-0.13	
Bank account	Household has a bank account (1=yes)	0.45	0.50	0.83	0.38	5.66***	
Credit access	Household access to credit (1 =yes)	0.65	0.48	0.53	0.50	-1.74*	
Income sources	Number of household income sources	1.60	0.74	1.33	0.54	-2.75***	
Farm income	Aggregate income earned from all farming activities (KES)	50991	56814	41739	44452	-1.02	
Off-farm income	Household earns non-farm income (1=yes)	0.55	0.49	0.27	0.45	-4.21***	
<i>Production pathway indicators</i>							
Maize produced	Quantity of produced maize (kilograms)	219	348	297	440	0.40	
Beans produced	Quantity of produced beans (kilograms)	60.15	97.04	110.39	181.60	2.40*	
<i>Income pathway indicators</i>							
Household income	Range of household income (KES)	1.44	0.06	1.66	0.15	1.56	
Food expenditure	Food expenditure per week (KES)	1948	79.10	1625	138.27	-1.79*	

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Std. Dev = Standard deviation

Source: Authors' field data

3.3.2 Food security status of the households

Figure 3.3 shows the overall HFS statuses disaggregated by the collective action membership. Households that belonged to either livelihood or efficiency CAIs were significantly more food secure than non-members.

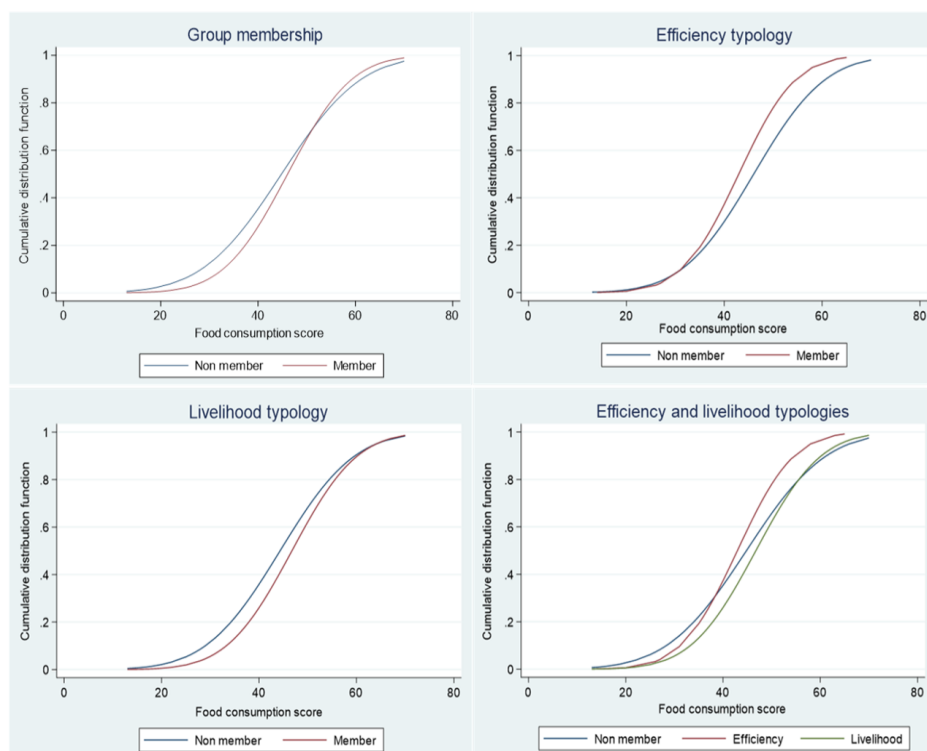


Figure 3.3: Overall statuses of HFS following collective action membership

Source: Authors' field data

The non-members had a higher FCS compared to members of the efficiency CAIs. Similarly, the members of the livelihood CAIs were food secure than non-members. Overall, members of the livelihood CAIs had higher FCS closely followed by the non-members and the efficiency members who reported the lowest FCS.

Figure 3.4 disaggregates the categories of HFS following collective action membership. On the pooled sample, a large proportion of the farmers (about 41.9%) were categorized as transitory food insecure closely followed by food secure households (32%) and chronically food insecure farmers (26.1%). From the results, the collective action members were food secure than the non-members wherein the majority of the farmers were transitory food insecure. Similarly, the majority of the collective action non-members belonged to the category of chronically food insecurity, signifying the importance of CAIs in improving HFS. In comparing the

efficiency and livelihood CAIs, although both livelihood and efficiency are categorized under transitory food secure, the livelihood members revealed significantly and slightly higher food consumption score than their efficiency counterparts (Table 3.2).

The livelihood members also exhibited higher food security where about 60% of its members were classified as food secure compared to the efficiency members (8.8%). This could be partly attributed by the significantly higher expenditure of food by the livelihood members than the efficiency members (Table 3.2). A large proportion of the efficiency members (12.9%) were chronically food insecure than the farmers who were food secure (8.8%).

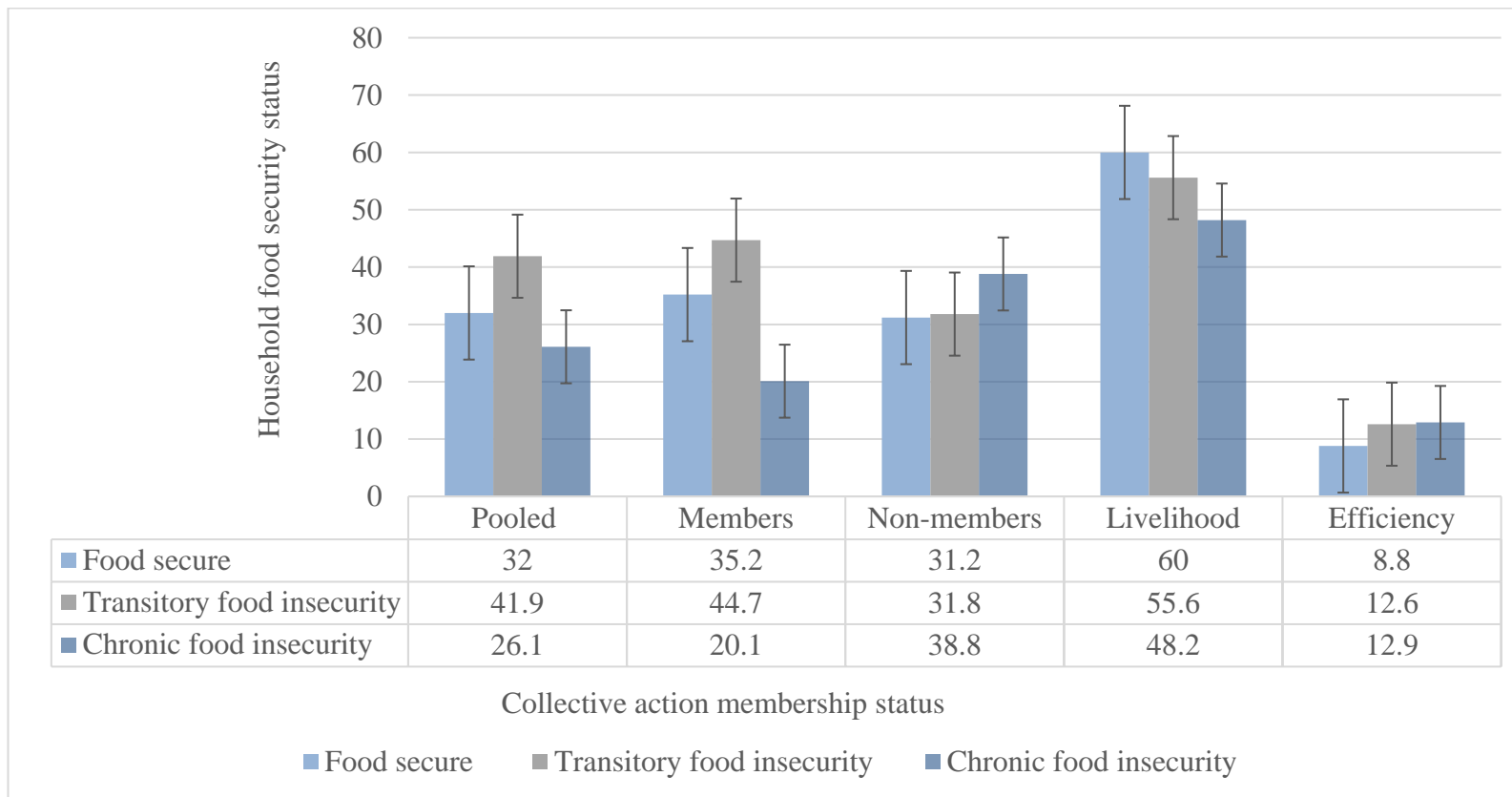


Figure 3.4: Household food security status following collective action participation

Source: Authors' field data

3.3.3 Determinants of food security across collective action initiatives

The multicollinearity test results revealed (see Appendix 1) that the variance inflation factor was 1.98 which is less than the required threshold of 5 (Greene, 2016). Therefore, the study rejected the null hypothesis that the multicollinearity inflates the variance of the predictors. Estimated parameters for determinants of food security are presented in Table 3.2 and 3.3. The study reports the average marginal effects (AME) and the robust standard errors. As shown in Tables 3.2 and 3.3, the AME results of the covariates that explain the status of HFS are different between livelihood CAIs and efficiency CAIs. The Wald χ^2 statistics test are significantly different at the 1% level (Wald $\chi^2(21) = 104.37$; Wald $\chi^2(21) = 57.09$ for livelihood and efficiency CAIs respectively). This implies that disaggregating the data based on the type of CAIs is more appropriate than incorporating collective action as a dummy variable or arbitrarily bundling of CAIs. The results revealed that household size reduces the risk of food insecurity among the efficiency and livelihood members. This finding aligns with Kehinde *et al.* (2021) who found a positive correlation between household size and HFS in Kenya. Household size indicates the availability of agricultural labour that would offset the opportunity costs of participating in collective training, meetings and market days.

The farm size increases the probability of food security by 6.9% while it reduced the likelihood of chronic food insecurity by 15.7%. However, farm size showed a negative and non-significant effect on the status of HFS among the livelihood members. This is because members of efficiency CAIs had larger farm sizes compared to the livelihood members that had limited production capacities due to smaller farm sizes. Land tenure, which is ownership of land with title deeds among the two CAIs increased the likelihood of being food secure for both efficiency and livelihood members. The marginal effects for the efficiency CAIs were more than the livelihood CAIs. This finding could be explained by the fact that due to market-oriented production among the efficiency CAIs, land tenure increases long-term agricultural investment prospects that could enhance production and incomes (Fischer & Qaim, 2012b). On efficiency CAIs, livestock showed positive effects on food security and transitory food security.

Table 3.2: Ordered probit model: Determinants of household food security among efficiency CAIs

	Food secure			Transitory food insecure			Chronic food insecure		
	AME	Std. error	P > z	AME	Std. Error	P > z	AME	Std. Error	P > z
<i>Household demographics</i>									
Age	-0.012**	0.005	0.021	-0.015***	0.005	0.002	0.027***	0.007	0.000
Gender	0.077	0.095	0.420	0.097	0.113	0.391	-0.174	0.203	0.391
Education	0.091**	0.036	0.011	0.115*	0.065	0.075	-0.206**	0.084	0.014
Household size	0.038**	0.016	0.019	0.048*	0.024	0.048	-0.086***	0.033	0.009
<i>Farm and farming characteristics</i>									
Farm size	0.069***	0.025	0.005	0.088*	0.053	0.098	-0.157**	0.067	0.019
Land tenure	0.102***	0.038	0.008	0.130***	0.043	0.003	-0.231***	0.050	0.000
Livestock	0.036**	0.014	0.013	0.046*	0.025	0.066	-0.082**	0.329	0.012
Farming experience	0.004	0.003	0.133	0.005*	0.003	0.050	-0.010*	0.005	0.051
Farm labour	0.190***	0.068	0.005	0.242	0.161	0.134	-0.432**	0.207	0.036
<i>Infrastructure and institutions</i>									
Market	-0.013	0.012	0.293	-0.016	0.020	0.419	0.029	0.031	0.357
Tarmac road	0.012	0.012	0.327	0.016	0.019	0.403	-0.028	0.030	0.358
Extension contacts	0.013*	0.007	0.076	0.017*	0.009	0.053	-0.030*	0.014	0.030
Piped water	-0.011	0.077	0.888	-0.013	0.102	0.892	0.025	0.179	0.890
Information	-0.051***	0.015	0.001	-0.065**	0.036	0.075	0.116***	0.044	0.008
ICT	0.065	0.069	0.344	0.083*	0.066	0.211	-0.148	0.130	0.255
<i>Household income and assets</i>									
Credit access	-0.188***	0.069	0.006	-0.239	0.149	0.109	0.426**	0.190	0.025
Farm income	0.000**	0.000	0.022	0.000***	0.000	0.001	-0.000***	0.000	0.000
Off-farm income	0.102*	0.050	0.043	0.129*	0.099	0.196	-0.231*	0.139	0.098
<i>Production pathway indicators</i>									
Maize produced	-0.000	0.000	0.167	-0.000	0.000	0.254	0.000	0.000	0.190
<i>Income pathway indicators</i>									
Household income	0.044*	0.027	0.098	0.056	0.040	0.167	-0.100	0.615	0.103
Food expenditure	-0.000	0.000	0.577	-0.000	0.000	0.531	0.000	0.000	0.547
<i>Regression diagnostics</i>									
Wald chi2(21)	57.09								
Prob > chi ²	0.000								
Pseudo R ²	0.517								

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1; AME=Average marginal effects; Std. Error =standard error
Source: Authors' field data

Livestock provides animal proteins for own-consumption as well as a diversification strategy where animals can be sold to smooth consumption during food shortfalls. The results on efficiency CAIs further revealed that an increase in age reduces the likelihood of being food secure among the efficiency CAIs while age increases the propensity of being chronically food insecure. Wegi *et al.* (2023) asserts that the negative relationship between the household head age and HFS could be explained by reduced productivity arising from the ageing of the household head. Availability of farm labour increases the probability of food security and transitory food security and decreases the likelihood of chronic food insecurity among the efficiency CAIs. This finding is in line with Lutomia *et al.* (2019) that the availability of farm labour could increase the production of food and market participation.

Farm labour is important particularly among the members of efficiency CAIs given that they practice market-oriented and standardised production that requires intensive labour. Assuming that all other factors are kept constant, access to agricultural information had a negative effect on food security and transitory food security but showed a positive effect on chronic food security among the members of efficiency CAIs. The efficiency members had more access to information than the livelihood members. In most cases, the farmers collectively received income-generation-oriented information on production practices, market dynamics, risk coping and risk aversion strategies. However, limited dissemination of nutritional information in the area could compromise with HFS benefits leveraged. Regarding education, holding other factors constant, education reduced the likelihood of being chronically food insecure while it had a positive effect on being food secure among the efficiency CAIs. This finding aligns with Kassie *et al.* (2014) who found positive effects of education on HFS among female-headed households. Contrary to the livelihood CAIs, extension contacts reduced the risk of food insecurity among the members of efficiency CAIs.

Off-farm income reduces the vulnerability to food insecurity among the members of the livelihood and efficiency CAIs. This finding is plausible and aligns with the field interviews that off-farm engagements supplement farm income and buffer the households during risks and shocks including crop failure, supply chain disruptions and increases in food prices (Mutungi *et al.*, 2023).

Table 3.3: Ordered probit model: Determinants of household food security among the livelihood CAIs

	Food secure			Transitory food insecure			Chronic food insecure		
	AME	Std. error	P > z	AME	Std. Error	P > z	AME	Std. Error	P > z
<i>Household demographics</i>									
Age	-0.001	0.003	0.818	0.000	0.001	0.819	0.001	0.002	0.818
Gender	0.012	0.052	0.824	-0.002	0.011	0.825	-0.009	0.042	0.824
Education	0.020	0.033	0.539	-0.004	0.007	0.538	-0.016	0.026	0.541
Household size	0.020*	0.012	0.099	-0.004	0.003	0.124	-0.016	0.010	0.104
<i>Farm and farming characteristics</i>									
Farm size	-0.005	0.026	0.839	0.001	0.005	0.840	0.004	0.020	0.839
Land tenure	0.098***	0.021	0.000	0.020***	0.008	0.009	-0.078***	0.016	0.000
Livestock	0.001	0.010	0.909	-0.002	0.002	0.909	-0.001	0.008	0.909
Farming experience	0.002	0.002	0.514	-0.000	0.001	0.526	-0.001	0.002	0.513
Farm labour	-0.011	0.037	0.769	0.002	0.008	0.772	0.009	0.029	0.768
<i>Infrastructure and institutions</i>									
Market	-0.011	0.014	0.431	0.022	0.003	0.440	0.009	0.11	0.432
Tarmac road	-0.010	0.018	0.554	0.002	0.004	0.550	0.008	0.014	0.556
Extension contacts	-0.019	0.012	0.126	0.004	0.003	0.167	0.015	0.010	0.126
Piped water	-0.092*	0.049	0.061	0.019	0.012	0.113	0.073*	0.039	0.059
Information	0.023	0.017	0.188	-0.005	0.004	0.206	-0.018	0.014	0.193
ICT	0.282***	0.052	0.000	-0.058***	0.018	0.002	-0.224***	0.046	0.000
<i>Household income and assets</i>									
Bank account	-0.003	0.051	0.947	0.001	0.011	0.947	0.003	0.041	0.947
Credit access	-0.006	0.048	0.903	0.001	0.010	0.903	0.005	0.038	0.902
Income	0.017	0.033	0.609	-0.003	0.007	0.615	-0.013	0.026	0.609
Off-farm income	0.088*	0.047	0.059	-0.018	0.011	0.101	-0.070*	0.037	0.060
<i>Production pathway indicators</i>									
Maize produced	0.000**	0.000	0.018	-0.000*	0.000	0.053	-0.000**	0.000	0.019
<i>Income pathway indicators</i>									
Household income	0.017	0.033	0.609	-0.003	0.007	0.615	-0.013	0.026	0.609
Food expenditure	-0.000***	0.000	0.001	0.000**	0.000	0.024	0.000***	0.000	0.000
<i>Regression diagnostics</i>									
Wald chi2(21)	104.37								
Prob > chi ²	0.000								
Pseudo R ²	0.192								
Log pseudolikelihood	-213.256								

Significance levels ***p< 0.01, **p< 0.05, *p< 0.1; AME=Average marginal effects; Std. Error =Standard error Source: Authors' field data

Access to credit among the efficiency CAIs reduced the probability of the efficiency members being food secure and transitory food insecure by 18.8% and 23.9% respectively while increasing the risk of being chronically food insecure by 42.4%. This observation is consistent with Niles *et al.* (2021) who found that access to credit can increase the vulnerability of households to food insecurity due to inability to repay. This finding can also be ascribed to the probability of the efficiency members investing the credit received in improving cash crop production through the acquisition of improved farm inputs and technologies as well as offsetting the collective marketing transaction costs. Table 3.2 and Table 3.3 results shows that food expenditure had a negative effect on food security and increased the probability of being transitory food insecure among the livelihood CAIs. On the contrary, the efficiency members revealed non-significant food expenditure effects on HFS.

This finding was expected because the allocation of food expenditure was significantly higher for the livelihood members than the efficiency members. However, the negative effects of food security could be attributed to liquidity and budgetary constraints leading to diverting of the income to non-food commodities such as meeting the collective action financial obligations such as repayment of loans and contributions to the savings, credit and informal insurance kits. The quantity of maize produced positively influenced the HFS among the livelihood CAIs, but it revealed a non-significant effect on the efficiency members. This result was unexpected because the efficiency members produced more quantity of maize than their livelihood counterparts. The members of the efficiency CAIs could have opted to sell their maize, unlike the members of the livelihood CAIs that utilised the maize for home consumption to improve the food self-sufficiency of their households. Regarding farm income, it positively influenced food security and reduced the risk of chronic food security among the efficiency members. Contrariwise, farm income did not show any effect on HFS among the livelihood members. Access to ICT positively influenced HFS among the livelihood members. ICT facilitates in co-ordination of group activities such as meetings and collective mobile phone financial transactions such as savings, rotating credit sourcing and reciprocal or collective asset acquisition.

3.3.4 Effect of collective action on household food security

The METE model pre-test and post-test results are shown in the appendices. The Hausman test was used to check the irrelevant alternatives (IIA) independence was insignificant, indicating no evidence of the IIA assumption was violated (Greene, 2016). The instrumental variables were regarded as strong $F(3, 528) = 37.17$; $\text{Prob} > F = 0.000$ since F statistics is ≥ 10 (Magambo *et al.*, 2022). Table 4 presents the effects of collective action on HFS among the efficiency and livelihood CAIs. The full results reflecting the HFS along the nutritional pathways of production and income are shown in the appendices section. Table 3.4 presents a set of results that account for endogeneity and another set that assumes exogeneity, but the strictly interpret results that accounts for endogeneity.

Table 3.4: Household food security effects across the efficiency and livelihood CAIs

Accounting for endogeneity						
Pathway	Efficiency			Livelihood		
	Coefficient	Std. Error	P > z	Coefficient	Std. Error	P > z
Production	0.352***	0.005	0.000	0.577***	0.004	0.000
Income	-0.114***	0.005	0.000	0.385***	0.004	0.000
Combined pathways	0.244***	0.010	0.000	0.453***	0.005	0.000
λ Production	0.012***	0.132	0.000	-0.718***	0.001	0.000
λ Income	0.408***	0.001	0.000	-0.560***	0.001	0.000
λ Combined pathways	0.180***	0.002	0.000	-0.648***	0.002	0.000
Assuming exogeneity						
Pathway	Efficiency			Livelihood		
	Coefficient	Std. Error	P > z	Coefficient	Std. Error	P > z
Production	0.778***	0.004	0.000	-0.031***	0.003	0.000
Income	0.556***	0.007	0.000	-0.211***	0.007	0.000
Combined pathways	0.119	0.262	0.649	0.278	0.245	0.257
λ Production	-0.672***	0.000	0.000	-0.025***	0.002	0.000
λ Income	-0.674***	0.002	0.000	0.103***	0.003	0.000
λ Combined pathways	0.284	0.278	0.307	-0.424	0.297	0.153

400 Halton sequence-based quasirandom draws per observation used

Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Base category = Nonmembers

Source: Authors' field data

The likelihood ratio test values for the exogeneity tests for the results accounting for endogeneity was significant ($p < 0.05$), therefore, the exogeneity's null hypothesis

was rejected and the treatment variable was endogenous across the two nutritional pathways hence this justifies the application of METE model. Relative to non-members, participation in efficiency and livelihood CAIs had a positive effect on HFS. This finding aligns with Shumeta & D'Haese (2018) who found positive effects of production on HFS among the Ethiopia coffee cooperatives. Since most of the farmers in the study area derive the largest proportion of their food from own production, the positive effect of the efficiency and livelihood CAIs could be attributed to the multipurpose nature of CAIs. The CAIs provide a good environment for food production through the acquisition of inputs, particularly chemical fertilizer and improved seeds at a fair price. The CAIs also provide post-harvest loss management education and improved storage of hermetic bags that are important in preserving the staples' quality and quantity. The CAIs also helped the farmers in agricultural planning by synching their production with the weather patterns to minimize crop failure.

The lower effect (of about 22.5%) observed on efficiency CAIs could be explained by the tendencies of selling part of the staple surplus arising from the higher yields. Analogously, the livelihood members compensated for the production gaps arising from smaller land sizes by engaging in non-farm wage employment and small entrepreneurship businesses to generate off-farm incomes that they reinvest in the acquisition of food items. The selection term for the lambda for the efficiency CAIs is positive, implying that the farmers who are most likely to self-select to become efficiency members based on their unobserved attributes are likely to be food insecure through production. Regarding income pathway, the efficiency CAIs were found to have a negative effect on HFS through income and food expenditure. This finding was unexpected because of the high bridging social capital among the efficiency CAIs that facilitate in creating of market linkages for the members to increase production, commercialization of farm produce and household income.

The negative income effect is likely to be ascribed to the spillover influence of the insignificant differences in income between the livelihood members and efficiency members. This difference can arise due to difficulties in accessing the capital outlay for collective marketing, higher rejection rates of the produce due to failure to meet the designated production standards, corruption, low managerial capacity and delayed payments for the farmers' collective sales. Additionally, the efficiency CAIs

purchase additional foods (such as animal protein, cooking oil, sugar and rice) that are not produced from their farms, but the expenditures are not significantly affected by membership in efficiency CAIs. Cash crop production can pose negative implications on expenditure on food and farmers are more likely to spend their income on non-food items such as education, large household asset expenditure and housing. Aligning with Fischer & Qaim (2012a), the negative effect could also probably emanate from the limited control of women over household incomes that could lower their purchasing power of food items, a phenomenon that can be plausible given that the efficiency CAIs are dominated by men.

On the other hand, the livelihood CAIs showed positive effects of income of HFS. This implies that the savings and credit acquired from the group among the livelihood CAIs increase the purchasing power of the diverse diets. This finding is supported by the significantly higher food expenditure incurred by the livelihood members than the efficiency members. On the combined pathways of income and production, relative to non-members, membership in efficiency CAI and livelihood CAIs increased HFS by 24.4% and 45.3% respectively. The overall HFS effects among the two combined pathways were smaller compared to the effects observed on the production pathway. These findings support Shumeta & D'Haese (2018) who found lower overall HFS effects across the combined pathways of income and production among the coffee cooperatives in Ethiopia. The HFS effects were much higher for the livelihood CAIs than the efficiency CAIs due to the trade-off of the negative income effects on HFS among the efficiency CAIs. Similarly, the higher overall HFS effects among the livelihood CAIs arise from the synergistic effects accrued from production and income. Additionally, the higher HFS effects could be attributed to the dominance of women in livelihood CAIs, who according to (Quisumbing *et al.*, 2021) play key roles in securing HFS through production, generation of incomes, domestic work and caregiving responsibilities.

The higher effects along the combined income and production pathways can also be explained by the high bonding social capital in the livelihood CAIs that facilitate in dissemination of nutritional education and experiences that could enhance the nutritional outcomes of the households. The livelihood members also cushioned their households from price hikes by collectively purchasing food items in bulky at fair prices. The high bonding social capital among the livelihood CAIs also facilitates in

provision of informal insurance in the form of cash during shocks such as crop failure and supply chain disruption to smooth consumption. However, from the findings, the lower overall HFS effects along the two combined pathways among the livelihood CAIs compared to the HFS effects along the production pathway would be attributed to the trade-off income effects on HFS. This implies that the synergies between the income effects and production effects were lower probably due to sub-optimal expenditure on food emanating from the diversion of incomes to meeting the collective financial obligations of saving, credit, asset acquisition and informal insurance kits.

3.4 Conclusion and policy implications

This study explored the effects of socio-economic context-specificity of efficiency and livelihood CAIs on HFS along the pathways of production and income. We employed the ordered probit model and METE model in empirical analysis. The findings showed significant differences in HFS status between efficiency and livelihood CAIs. The differentials in HFS across the CAIs were attributed to differences in education, age, livestock ownership, farm size and household size, farm labour, access to information and credit and extension contacts. The differences in HFS can also be accounted for by the heterogeneities in group composition, functions and social capital across CAIs that determine their capacity to leverage HFS benefits along the pathways of production and income. Participation in efficiency and livelihood CAIs had a significant effect on HFS through production. Contrary to the livelihood CAIs, the efficiency CAIs showed a negative HFS effect through income. The overall HFS across the combined pathways of income and production was low for both efficiency and livelihood CAIs due to the trade-offs exhibited through the income effects. However, the effects were lower for the efficiency CAIs than the livelihood CAIs due to the negative income effects exhibited by the former while and the synergies arising from income and production on the latter. The findings suggest the overall performance of both efficiency and livelihood CAIs in leveraging HFS from joint income and production remains tentative. These findings have key implications on the interventions designed to influence HFS trajectories. Therefore, the study debunks a one-size-fits-all policy and program design approaches in promoting the development of the CAIs for improved HFS.

The study suggests a portfolio of collective action policies and interventions that are context-specific in matching the diversity of the households and the differentials of the efficiency and livelihood CAIs and their links to HFS along the production and income pathways. The policies would confer potential synergies, spillover effects and complementarities in strengthening the synergies while mitigating the trade-offs along the income and production pathways between the efficiency and livelihood CAIs. There is a need to incentivize the non-farm livelihood-enhancing economic activities among the livelihood members to fill the household food gaps arising from low production. This is through creating a conducive environment for the livelihood CAIs to easily access affordable loans and credit with flexible terms of payment and affordable interest rates. It is important to establish micro-credit schemes and collective action funds for both efficiency and livelihood CAIs. This would help to tap opportunities for credit sourcing and pooling savings among the livelihood members while promoting collective input sourcing and output marketing among the efficiency CAIs. It is essential to enhance access to information, extension and advisory services and information, communication and technology (ICT) among the members of the livelihood CAIs to improve production. Nonetheless, there is a need for extensive similar studies to extend the empirical findings in broader socio-economic settings. It is also important to employ panel data to ascertain how the transformation trajectories of CAIs influence HFS over time because CAIs are dynamic entities and HFS is highly sensitive to seasons.

CHAPTER FOUR

Bridging The Gap Beyond One Size Fits All Approach: Gender Differentials in Collective Action Participation Among the Smallholder Households in Central Kenya

Abstract

Fostering gender equality can promote socio-economic development in Sub-Saharan Africa (SSA). Collective action is important in advancing gender equality while promoting the development of agriculture and rural economies concurrently. However, an empirical basis exploring how gender gaps manifest in collective action participation is barely established. This study analysed gender gaps in participation in efficiency and livelihood collective action initiatives (CAIs) among men and women smallholder households from central region of Kenya. We employed mixed quantitative and qualitative approaches based on data drawn from 532 randomly sampled households, ten focus group discussions and two key informant interviews. The exogenous switching treatment effects model and multivariate probit model were employed in the empirical analyses. The findings revealed substantial gender gaps in participation in livelihood and efficiency CAIs among male-headed households (MHHs) and female-headed households (FHHs). The gender gaps can be explained by the differences in unobservable and observable characteristics between MHHs and FHHs. The disparities were also attributed to the heterogeneities in organizational characteristics of the efficiency and livelihood CAIs. The participation statuses in efficiency and livelihood CAIs among FHHs would have been higher than they are now if the coefficients on their observed characteristics had been the same as the coefficients on the MHHs's characteristics. Even if that would have been the case, however, the findings indicate that the participation statuses for FHHs would have still been lower than the MHHs due to unobservable characteristics. The findings imply that a 'one-size-fits-all' promotional approach is unsuitable. The study suggests a portfolio of context-specific and gender-responsive policies that could confer potential spill over effects and synergies in addressing gender inequality while developing CAIs concurrently.

Keywords: Gender equality; efficiency collective action initiatives; livelihood collective action initiatives; exogenous switching treatment effect model

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4.1 Introduction

Gender equality is promoted as 'the means and the end' of sustainable development (United Nations, UN, 2016; UN Women, 2022). Right from the household level, gender-responsive approaches are important particularly in sub-

Saharan Africa (SSA) where there are large gender disparities in power, roles and relations between men and women (Lutomia *et al.*, 2019; Kihiu & Amuakwa-Mensah, 2021). For instance, in the SSA region, men's roles in agriculture are regarded as ambiguous while women's contributions to agriculture are barely recognised or at best underappreciated (Gomez *et al.*, 2020). Women are critical agents of change and continue to contribute significantly to agricultural transformation and the socio-economic growth of rural economies (Njuki *et al.*, 2021). In SSA women contribute up to 70 per cent of the labour force in smallholder agriculture (Gomez *et al.*, 2020). Women make substantial contributions to natural resource management, safeguarding livelihoods, household well-being and food security (Njuki *et al.*, 2021).

Nevertheless, compared to men, women are constrained in their access to and decision-making on key production resources such as livestock, land, and control of incomes generated from agriculture (Quisumbing *et al.*, 2021). Due to unequal social norms on the intrahousehold allocation of labour in domestic, reproductive and productive responsibilities, women face high opportunity costs of time in participating in income-generating activities, vocational trainings and extension and advisory services (Diirro *et al.*, 2018). Additionally, women's access to markets is constrained by asymmetric information, high transaction costs and missing linkages (Aziz *et al.*, 2022). Gender-based constraints are exacerbated by limited public intervention as well as legal structures and policy inadequacies that are largely gender-blind or at best gender-neutral (Njuki *et al.*, 2021; Quisumbing *et al.*, 2021). In the recent pursuit for sustainable development, women's engagement and inclusivity in agriculture is important. Key in this regard, there is growing interest and promotion of collective action as a means that can potentially bridge gender inequalities while promoting the development of agriculture and rural economies concurrently (Sulemana *et al.*, 2020; Serra & Davidson, 2021). In SSA, governments, in partnership with donors and development practitioners premise policies and community-driven development programs on a collective action approach (USAID, 2020). Common examples of collective action initiatives (CAIs) in SSA include savings and credit groups, self-help groups, producer and marketing groups, and water and forest user associations (Ingutia & Sumelius, 2022; Hintz & Pretzsch, 2023).

The importance of collective action underpins its novel approach of deploying grassroots innovation and active involvement of households in ameliorating negative externalities in agriculture associated with policy inadequacies, public intervention gaps and market failures such as asymmetric information, high transaction costs and weakly defined property rights (Ma *et al.*, 2023; Zou & Wang, 2022). For instance, collective action helps to enhance effectiveness and efficiency in marketing and production processes by mitigating transaction costs in participating in markets, finance and credit services, and extension and advisory services (Zou & Wang, 2022; Habiyaremye *et al.*, 2023; Kwizerimana *et al.*, 2023). Collective action also provides a safety net or a form of informal insurance that enhances the households' resilience stock in times of risks and shocks such as price hikes, climate variability and crop failures (Malual & Mazur, 2022). In addition, collective action provides a platform for the households to articulate their needs in enhancing their bargaining power in market exchange, policy, and social context (Ingutia & Sumelius, 2022; Hintz & Pretzsch, 2023).

Collective action has been shown to bridge gender gaps by increasing women's control and access of productive resources, participation in markets and value chains, decision-making power, farm productivity and household income (Dohmwirth & Hanisch, 2018; Mwambi *et al.*, 2021; Ravichandran & Farnworth, 2021). Conversely, gender-specific constraints suggest that women may face barriers in participating in collective action or when they take part their benefits may be limited due to inequitable intrahousehold and interhousehold gender dynamics (Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021; Sulemana *et al.*, 2020). Inclusion and gender responsiveness of the CAIs can improve members' collaboration, and increase groups' knowledge, benefits and overall organizational performance (Dohmwirth & Hanisch, 2018). Nevertheless, most of the CAIs in SSA are either at least gender-neutral or gender-blind to the disadvantage of the women (Selhausen, 2016; Nakazi *et al.*, 2017). Yet, minimising gender disparities in agriculture has long been a challenge for development practitioners and policy makers (Njuki *et al.*, 2021; Quisumbing *et al.*, 2021).

In this context, the critical step to fostering gender-responsive CAIs entails an understanding of how different collective action arrangements align with the needs

of men and women vis-à-vis which women and men have invested in particular collective action arrangements and how those who have not invested are excluded. An intrinsic link exists between gender and collective action arising from intra-household and inter-household gender differentials and inequalities in power, resources, and roles in agriculture (Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021). Despite this, the extant studies focus on how collective action shapes gender dynamics to foster or inhibit gender equality while devoting less attention to how gender gaps manifest in collective action participation. There is limited literature available on the nexus between gender and collective action focussing on issues of natural resource management (Leder *et al.*, 2017; Agarwal, 2000), public goods (Mccarthy & Kilic, 2015), marketing performance (Barham & Chitemi, 2009; Dohmwirth & Hanisch, 2018) and gender equality and women empowerment (Raghunathan *et al.*, 2019; Serra & Davidson, 2021). Most of the studies focussing on collective action participation (Fischer & Qaim, 2012b, 2014) pay less attention to the perspective of gender. The studies employ a gender dummy variable denoting whether the household head is female or male.

The studies reveal inconsistencies in the association of women's and men's resource endowments and participation in collective action. In some cases, resource endowments such as land, livestock and income have been found to have a positive correlation to collective action participation (Selhausen, 2016; Nakazi *et al.*, 2017; Ampaire *et al.*, 2020). This implies that resource-constrained individuals particularly women are less likely to engage in collective action. Therefore, closing the gender inequalities is likely to enhance women's participation in collective action. On the other hand, some studies report a negative correlation between resource endowments and collective action (Gyau *et al.*, 2016), implying that resource-constrained men and women are more likely to participate in collective action. This is because of the opportunities that may arise due to changing norms that have led to improvements in women's access to resources, time use, increased movement and decision-making to provide for their households (Ingutia & Sumelius, 2022; Leder *et al.*, 2017). Other cases report an inverted U-shaped correlation between resource endowments and collective action participation (Fischer & Qaim, 2012a, 2014). This implies that both the most resource-endowed men and women and the least resource-endowed men and

women are less likely to engage in collective action because of the limited benefits they are likely to gain compared to their non-participation status.

The inconsistencies point out that differences in collective action participation are not only linked to gender inequalities but also inherent gender differentials among men and women in their needs, preferences, priorities, leadership skills and risk-bearing capacities (Danso-Abbeam *et al.*, 2020; Paudel *et al.*, 2020). Gender inequalities and differentials imply that men and women adopt divergent transaction cost-reducing mechanisms in mobilizing across the CAIs in response to grasping the potential prevailing opportunities such as market access, value chain integration and adoption of improved farming practices (Oxfam, 2013). In addition, divergent transaction costs may pose variations among men and women in taking up collective coping and adaptive strategies they might encounter such as informal insurance to countervail agricultural shocks and risks including volatile markets, price hikes, crop failure and stress such as climate extremes and variability (Loko *et al.*, 2022; Valujeva *et al.*, 2023). The gender differential transaction cost-reduction mechanisms are reflected in the organizational characteristics of the CAIs including gender composition, nature and extent of coordination, level of formalization, social capital and social networking (Bizikova *et al.*, 2020).

Evidence shows that women tend to be concentrated on informal CAIs engaging in livelihood activities such as table banking, informal insurance and credit sourcing while men prefer formal CAIs that pursue efficiency activities including collective input sourcing and output marketing activities (Fischer & Qaim, 2012; Ingutia & Sumelius, 2022). This diminishes the opportunities for women to improve agricultural productivity and household incomes despite playing key roles in agriculture. Women are also less likely to have control over incomes generated from sales of agricultural output, disincentivising their participation in marketing CAIs (Galiè *et al.*, 2019). Mixed-gender CAIs may marginalize women in their engagement in group activities, and decision-making processes due to social norms that limit women from speaking in public (Woldu *et al.*, 2018). Despite women-only CAIs guaranteeing women's full participation in meeting their needs, women-only CAIs may exacerbate gender inequalities in communities (Fischer & Qaim, 2012a). Furthermore, mixed-gender CAIs have been shown to perform better than women-only CAIs (Fischer & Qaim, 2014).

The mixed findings suggest that organizational socioeconomic characteristics affecting collective action among men and women vary contextually. Therefore, this points to the need to further assess the collective action participation patterns arising as a result of variations in organizational characteristics of the CAIs notably from a gender perspective. Despite this, these concepts have not yet received rigorous empirical attention. The context-specificity of the CAIs and gender differentials may pose significant implications on the choice of theoretical and analytical framework, interpretation and generalization of the findings. Nevertheless, extant studies presume that men and women are homogeneous entities by employing an analytical framework that arbitrarily bundles men and women while using a gender dummy variable indicator of whether a household head is male or female (Fischer & Qaim, 2012, 2014; Gyau *et al.*, 2016). In addition, while these studies control for gender, they pinpoint that it is not all about the household head being a male or a female but also the intrahousehold gender dynamics that explain the gender differentials and inequalities in collective action participation.

Yet, the studies presume a unitary household technique wherein resources are aggregated and allocated based on a joint utility function. This approach does not account for the role of heterogeneities in the bargaining power and preferences among household individuals (male and female partners) involved in decision-making on resource allocation (Tyagi & Das, 2018). While the needs and interests of the men and women smallholder households may align more within a single community setting, presuming that men and women are a homogeneous set may yield inconsistent generalizations. This approach dissipates the gender mainstreaming policy discourses and programs' design into a 'one-size-fits-all' and gender-blind approach that can be detrimental to gender equality and empowerment of women objectives as well as the development of CAIs. This study therefore employs gender-disaggregated data to unearth the gendered patterns in collective action by delineating how socio-economic contextual factors condition women's and men's capacities and motivation for participating in CAIs. This is by way of ascertaining the inter-household gender disparities using male-headed households (MHHs) and FHHs as the units of analysis.

In Kenya, there is an increasing importance of women as the heads and breadwinners of their households (USAID, 2020). The FHHs are found in situations where women

are either widows, decide not to marry, separated from their husbands and in polygamous settings where the husband belongs to a different household (Kassie *et al.*, 2014; Danso-Abbeam *et al.*, 2020). Additionally, the study determined how the overall intra-household dynamics influence collective action participation. The overall intra-household gender disparities were captured among the MHHs where both men and women partners are present. This is because the majority of the women are confined within MHHs and the socio-economic contexts may vary among the women in FHH and the women within the MHHs. (Danso-Abbeam *et al.*, 2020). Furthermore, the socio-economic context between men and women even at the intra-household may vary substantially (Doss & Quisumbing, 2020; Quisumbing *et al.*, 2020). Unlike the previous studies, this study measures the intra-household gender dynamics using the Women Empowerment in Agriculture Index (WEAI). WEAI is an internationally validated survey tool based on the index that measures women's inclusion, empowerment and agency, following their adequacy scores in 10 sub-domains that are clustered into five domains of agriculture namely resources, production, income, time and leadership (Sraboni & Quisumbing, 2018; Quisumbing *et al.*, 2021).

Secondly, heterogeneity of CAIs may pose varietal costs (challenges) and benefits (opportunities) among men and women and hence their participation decisions. However, previous studies presume that CAIs are homogeneous, and fail to account for the variations in transaction cost-reducing strategies embedded in their organizational characteristics. In this thesis, we distinguish between the two choices a man or a woman can make in collective action participation namely, market-oriented or efficiency CAIs and community-oriented or livelihood CAIs. The two forms of CAIs are dominant among Kenyan smallholder households (Gyau *et al.*, 2016; Kwizerimana *et al.*, 2023). However, no study has ever explored the link between gender and participation decisions across the efficiency and livelihood CAIs. The livelihood CAIs majorly engage in household livelihood and resilience stock-enhancing activities including pooling of savings through table banking, sourcing of credit either internally or through bank linkages, provision of informal insurance, and reciprocal and collective asset acquisition. Livelihood CAIs are less formalized, dominated by women, and show high levels of social capital and low levels of social networking. The efficiency CAIs majorly seek to ameliorate high transaction costs

and risks in markets and along the value chain through collective sourcing of farm inputs and collective output marketing. The efficiency CAIs are highly formalized and they operate as single entities or as mergers in the form of cooperatives or unions. Efficiency CAIs are dominated by men and are well-socially networked but show low levels of social capital (see section 2.2.1).

Thirdly, the study employed quantitative and qualitative method in exploring gender differential collective action participation using rich household-level and group-level data from the smallholder households from the central region of Kenya. The mixed approach provides profundity of the results by allowing an in-depth exploration of how underlying structural and systemic gender dynamics condition participation decisions across the two forms of CAIs. The quantitative approach employs a multivariate probit model that allows for disaggregation of the non-mutually dichotomous participation decisions across livelihood and efficiency CAIs among MHHs and FHHs. The model also accounts for unobserved interdependence of the livelihood and efficiency CAIs either as complements or as substitutes of each other. The study also applies an exogenous switching treatment regression (ESTER) approach to uncover the gendered patterns in participation across the efficiency and livelihood CAIs. The model allows us to capture a counterfactual situation on the cause and effects of gender in participation across the two forms of CAIs. This is by comparing the scenarios whereby household headship shifts between female to male and vice versa. By estimating the effect of gender, the model captures the potential differences arising from both observable and unobservable socio-economic variations between men and women (Kassie *et al.*, 2014; Paudel *et al.*, 2020).

Based on the rich household-level and group-level data drawn from smallholder households from the central region of Kenya, the study seeks to answer the following two objectives: 1) To analyse the gender differential patterns in participation in efficiency and livelihood CAIs. 2) To analyse the socioeconomic contextual determinants of gender differential participation in efficiency and livelihood CAIs. Identifying the manifestation and drivers of gendered patterns in collective action participation informs the design of more context-specific and gender-responsive collective action program design and promotional policies. This would help in not only developing the CAIs but also in closing gender gaps to unlock women's potential to achieve sustainable development. Closing the gender gaps aligns and contributes

to the recent policies that underpin the concurrent tackling of multiple and interlinked sustainable development objectives of eliminating poverty, and achieving food security and gender equality. The next sections highlight the status of gender inequality in Kenya, the collective action context in Kenya, the nexus between gender and collective action participation and the conceptual framework of the study. Section two describes the methodology concerning the study area, sample size, sampling and data collection, empirical estimation procedure, and empirical models underpinning the study. Section three presents the results and discussion while section four gives the conclusion of the study and draws its implications on policy.

4.1.1 Gender inequality in Kenya

The Kenyan government has incorporated gender equality policies and legal instruments such as the the Maputo Protocol, Kenyan Consitution, the United Nations Convention on Elimination of all Forms of Discrimination against Women (CEDAW) and the Sustainable Development Goals (SDGs) of gender equality (Government of Kenya, 2010; United Nations, 2009; United Nations, 2016). To strengthen gender equality efforts, the government enacted the Agricultural Gender Policy in 2013 to address both systemic and structural gender inequities and their underlying causes in the agriculture (GOK, 2021). These efforts have led to some progress in creating economic development programmes that promote the financial inclusion of women such as the *Uwezo* (translated as enabling) fund, Women Enterprise Fund and Constituency Women Enterprise Schemes. As of 2022, about 3.1 billion Kenyan Shillings (United States Dollars 22 million) had been disbursed in the form of credit to 102,584 women beneficiaries through 11,709 CAIs (KNBS, 2022). Despite the progress, the tangible benefits are yet to be realized, especially for the majority of the women in Kenyan rural areas, and poverty is higher among rural women (KNBS, 2023b).

In the country, 55% of the women work in agricultural informal sector while men comprise about 45%. Despite this, only 27% of the women own land, wherein only one per cent own registered land titles, out of which 5% are registered in joint names (KNBS, 2023). This situation is exacerbated by patriarchal-based customary laws that undermine gender-equitable property inheritance legislation such as the Matrimonial Property Act and Land Act (Republic of Kenya, the constitution, 2010). More women farmers are likely not to be paid their earnings for their work (19%) compared to men

(4%). Women are also less likely to adopt new technologies, participate in input and output markets and are underrepresented in value chains while being overrepresented in the lower pyramid of the non-beneficial tier of the value chains (USAID, 2020).

Compared to men, women are underrepresented in intra-household decision-making on production, which is a preserve for the men since they are perceived to be the sole providers of the households (UN Women and KNBS, 2020). The limitation of decision-making processes among women stretches to the public spheres at the community within the CAIs, in leadership and at wider societal levels. Regarding the intra-household labour allocation, due to disproportionate intra-household distribution of workloads rural women work for long hours, about 15 to 17 hours a day while men work for 6 to 7 hours a day (UN and KNBS, 2020). The time demands in rural settings are exacerbated by limited access to water and fuel wood that forces women to walk long distances in search of water and fuelwood (USAID, 2020). In addition, men and women have equal access to financial services and both show about 39% ownership of bank accounts. The equal access can be contributed to joint ownership of the bank account for the man and woman within the household. Twice as many men as women possess formal savings accounts while three times more men than women have access to formal sources of credit (USAID, 2020). Women and men differ in their access to mobile money services by about 88% and 93% for women and men respectively. Men and women also differ in their education where about 94% of women are literate compared to 91% of men (KNBS, 2022). Additionally, there exists gender inequities in access to information, communication and technology (ICT) where about 49% of men own a smartphone compared to 43% of women. (KNBS, 2022).

4.1.2 Context of collective action in Kenya

In Kenya, the government promotes collective action as the key pathway to develop agriculture and rural development (ASTGS, 2019). The CAIs are established either by the smallholder households or in association with the public-private linkages, to tap the benefits of leveraging physical, human and social capital. Presently, the CAIs range from small informal groups (such as community-based organizations, saving and credit groups and self-help groups) to large formal cooperatives or unions (Mwambi *et al.*, 2020). The informal CAIs constitute the majority of the households that practice subsistence farming. They are community-oriented or livelihood-based

and largely establish and operate on customary principles and ideas of promoting the members' well-being and the community. The livelihood CAIS engages in household livelihood and resilience-enhancing activities such as pooling of savings through table banking, sourcing of credit either internally or through bank linkages, reciprocal and collective asset acquisition and informal insurance (Republic of Kenya, Ministry of Industry, 2019). The formal CAIs practice market-oriented production and they seek to mitigate the negative effects of asymmetric information and high transaction costs in markets and along the value chain through collective acquisition of inputs and extension services and collective farm output marketing (Kwizerimana *et al.*, 2023). In the country, the government and private stakeholders premise their development goals on collective action as an appropriate pathway for reaching local households at the grassroots level (Republic of Kenya, Ministry of Industry, 2019). The CAIs in Kenya operate at different levels, depending on their resource endowments, wherein some formal CAIs, merge to form cooperatives or unions as they expand their social and economic networks, assets and market portfolio (Mwambi *et al.*, 2020). On the other hand, the operations of the informal livelihood CAIs are limited within the grassroots village level.

The elite of rural households typically capture the resources and services while the women and the poor are either excepted or receive minimal benefits (Verhofstadt & Maertens, 2013). Women's lack of access to productive resources often limits their participation in CAIs. For instance, female membership in efficiency CAIs is limited because women are unable to meet entry requirements such as finances, land and skills (Fischer & Qaim, 2014). However, field interviews show that some CAIs offer flexible membership requirements to suit agricultural activities performed by women such as small food crops, animal husbandry, horticulture and marketing. Women are underrepresented in decision-making and in leadership in mixed groups (Fischer & Qaim, 2014). However, men have increasingly become gender-aware and gender-responsive to women's constraints (Ingutia & Sumelius, 2022). Additionally, following the legislation of a one-third gender rule requiring 30 per cent of the leaders to be women (Republic of Kenya, the Constitution, 2010), participation of women in leadership and decision-making processes has significantly improved. Furthermore, the public-private partnership stakeholders are creating CAIs that work closely with

women and help the women to improve their access to resources, thereby enabling them to increase agricultural production.

The public-private partnership stakeholders provide networks of solidarity and mutual support that enhance women's social capital to strengthen their voice in decision-making to negotiate for better prices and contractual terms, access services and resources including markets to sell their produce, credit, finance and extension services (Alemu *et al.*, 2018; Mwambi *et al.*, 2021). The CAIs seldom show success, others fail or collapse while others survive however with dismal performance on accruing the desired welfare outcomes (Republic of Kenya, 2018). This is due to ageing membership, gender disparities in membership, decision-making and leadership, poor internal governance and mismanagement, low creativity and innovation and failure to meet the household's expectations (KNBS, 2022). In line with this, the Kenyan government developed the policy of the Cooperative Societies Act that aims to transform the CAIs into viable entities by supporting their formation and development (Republic of Kenya, 2018). The policy however is universal and does not account for the gender differences and inequalities as well as the heterogeneity of the CAIs.

4.1.3 The nexus between gender and collective action participation

Gender is linked to power differentials that conditions men's and women's entitlements to, and access to resources including human, economic and physical capital (Akter *et al.*, 2017; Phiri *et al.*, 2022). Gender also shapes societal norms and rules on appropriate behaviours and roles of men and women that are embedded at the household, community and wider societal levels (Ragasa *et al.*, 2019). In this context, given the gender-differentiated relative powers, relations and responsibilities, men and women organise in response to the constraints and opportunities experienced in the household and broader social environments (Dohmwirth & Hanisch, 2018; Selhausen, 2016). The constraints and opportunities are conditioned by household characteristics, infrastructural and institutional characteristics and characteristics of the CAIs (Fischer & Qaim, 2012a, 2012b, 2014; Kaaria *et al.*, 2016; Nakazi *et al.*, 2017; Selhausen, 2016; Ampaire *et al.*, 2020). The gender-differentials in the socio-economic attributes imply that women and men differ in their willingness and abilities in their collective action participation.

Evidence shows that wealthier, large-scale and educated males dominate in membership, management and controlling of the market-oriented or efficiency CAIs engaging in collective input sourcing and collective output marketing (Andersson *et al.*, 2022; Pfammatter & Jongerden, 2023). Women are constrained by social norms that limit their ownership of, control over, and use of resources including land, livestock and assets to implicitly engage in CAIs and have their voices heard in decision-making processes, particularly in formal and efficiency CAIs (Nakazi *et al.*, 2017; Woldu *et al.*, 2018). For instance, in Uganda, Selhausen (2016) demonstrated that more equal intra-household power relations through including women in decision-making in agriculture, household incomes and expenditures and joint land ownership enhanced women's engagement in coffee cooperatives. Similarly, in Kenya, Mwambi *et al.* (2020) show that women's capability to participate in formal milk processing producer organizations was limited due to the social norms that limit their ownership of livestock, which is a pre-condition for membership entry. In addition, in Mali, larger farm holdings were correlated with higher levels of participation in efficiency CAIs (Oxfam, 2013). However, households with larger farm sizes may pose more demands on women's labour and therefore increase women's time use, opportunity costs of time and limit their mobility beyond their homesteads (Komatsu *et al.*, 2018).

The socio-cultural expectations and unequal intra-household labour allocation constrain women's mobility and availability of time for participating in group meetings, collective vocational training, advisory and extension services and collective income-generating activities (Doss & Quisumbing, 2020). The time constraints can be severe particularly among female-headed households (FHHs) and young women of reproductive age due to caregiving responsibilities alongside domestic and production roles (Ingutia & Sumelius, 2022). In addition, the social and cultural norms limiting women's engagement in decision-making processes within the households and in the public sphere impede women's participation in leadership roles especially in mixed-gender CAIs (Nakazi *et al.*, 2017). The mixed-gender CAIs tend to skew their interests, needs and priorities toward male farmers while neglecting the needs of female farmers (Nakazi *et al.*, 2017). Despite women-only CAIs guaranteeing women's full participation in meeting the needs of women, women-only CAIs may exacerbate gender inequalities in communities (Fischer & Qaim, 2012a).

Additionally, mixed-gender CAIs can contribute to diverse knowledge, leadership skills and organizational capacities that can enhance the performance of mixed-gender CAIs compared to women-only CAIs (Dohmwirth & Hanisch, 2018).

The gender variations in risk-aversion behaviour imply that women are less likely to take risks associated with collective action than men (Paudel *et al.*, 2020s). For instance, women prefer mobilising with familiar members from their villages, suggesting some level of homogeneity in the neighbourhood or through kinship ties which enhances social ties, trust and reciprocity incentives (Fischer & Qaim, 2012a). In addition, women's risk-aversion behaviour skews their priorities towards household risk-reduction, livelihood-enhancing and food self-sufficiency options (Dhal *et al.*, 2020). As a consequence, women prefer livelihood-oriented CAIs that engage in pooling of savings, sourcing of credit, provision of informal insurance and acquisition of household assets (Dohmwirth & Hanisch, 2018). On the contrary, men are inclined to produce profit-generating crops therefore they prefer CAIs that focus on improving efficiency in production and marketing (Oxfam, 2013; Wakaba *et al.*, 2022). Women also may be dissuaded from engaging in market-oriented CAIs because they are less likely to have control over incomes generated from collective sales of agricultural output (Galiè *et al.*, 2019). Lack of training, information, education opportunities and confidence in speaking in public can negatively influence women's participation in collective action (Nakazi *et al.*, 2017). However, education, training and information among men can influence attitudes and perceptions on gender roles leading to gains in women's time use, access to resources, increased mobility and acceptance of women's ability to represent the interests of their households even in the public sphere (Phiri *et al.*, 2022)

4.1.4 Conceptual framework

Figure 4.1 illustrates the conceptual framework of the study. The framework underpins the intra-household production model (Chiappori, 2014). The model derives its conceptual underpinning from the assumption of the economy that is gendered which contests the assumption of gender impartiality of the economy (Duflo & Udry, 2016). Following the intrahousehold production model, the distribution of resources within the household depends on the bargaining power and preferences of the household individuals resulting in gender gaps and differentials in resource endowments between men and women (Molina *et al.*, 2022). The intra-household

model has been applied to explore intra-household decision-making in a wide range of issues including labour supply (Molina *et al.*, 2022), agricultural technological adoption (Miura *et al.*, 2020), consumption decisions (Duflo & Udry, 2016) and household welfare (Quisumbing & Maluccio, 2000). In this study, it was expected that women and men are differentially endowed and have dissimilar interests, needs, preferences and abilities with regard to participation in the livelihood and efficiency of CAIs. Based on the random utility framework, men’s and women’s collective action participation choices hinge on the concept of ordering of the forms of collective action available based on their respective maximization of expected utility associated with costs and benefits (McFadden, 1982).

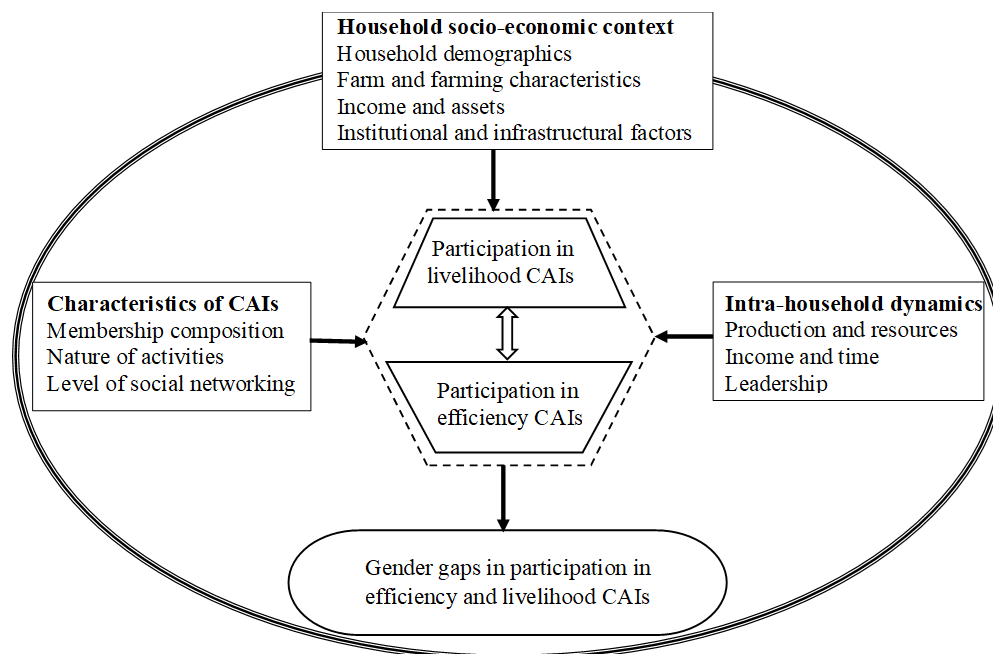


Figure 4.1: Conceptual framework for the gendered collective action participation

CAIs – collective action initiatives; arrows-cause and effect relationship between independent and dependent variables.

Source: Authors’ conceptualization

A man or a woman is incentivised to join in a form of collective action if it optimises his or her perceived utility (U_{ij}^{Pij}), only if the expected utility (U_i) of participating in

a CAI i (C_i^{Pi}) exceeds the perceived utility (U_j) of participating a CAI j (C_j^{Pi}) as expressed in Equation (4.1).

$$(U_{ij}^P) = E_i [U_i C_i^{Pi} X_{Mi}] \geq E_i [U_j C_j^{Pj} X_{Mj}] \quad 4.1$$

where utility (U_i^{Pi}) depends on the expected costs and benefits of participating in CAI i (C_j^{Pj}) and CAI j (C_j^{Pj}) respectively. X_{Mi} and X_{Mj} represent a vector of explanatory gender differential socio-economic variables affecting collective action participation in CAI i and CAI j respectively, including household socio-economic characteristics such as farm and farming characteristics, income and assets household demographics, institutional and infrastructural factors; intra-household gender dynamics including women's decision making in production and autonomy in production, women's access to and control of income, women's time use and leadership; and organizational characteristics of the CAIs including membership composition, nature of activities, level of social capital, level of social networking and formalization. Collective action membership brings both non-economic and economic benefits and costs to the households. The economic benefits include access to output and input markets, savings and credit, informal insurance and fetching better market prices (Ma *et al.*, 2023). The non-economic benefits of membership include the development of social and business networks and relationships (Habiyaemye *et al.*, 2023).

The costs of collective action participation include membership payments and subscriptions; capital investment to meet collective activity requirements such as input sourcing, collective marketing, pooling of savings, credit and asset acquisition; opportunity costs of time in participating in collective activities such as decision-making, marketing days, extension and advisory activities, training and monitoring of the group performance; transaction costs associated with perceived risks such as the vulnerability of individuals to free riding and opportunistic tendencies such as poor governance (Chagwiza *et al.*, 2016; Bizikova *et al.*, 2020; Grashuis & Skevas, 2023). This study hypothesises that the efficiency and livelihood CAIs adopt divergent transaction cost-reducing strategies that generate uneven costs and benefits among men and women. Therefore, it is expected that the willingness and capabilities of women and men to participate in efficiency or livelihood CAIs are differentially distributed.

4.2 Methodology

4.2.1 Study area and data collection

The study was conducted between August and October 2021 in the county of Murang'a within the central region of Kenya. The county stretches within an area of 236km² with 193km² being utilised for agriculture (Murang'a County, 2019). Agriculture entails a source of livelihood to an estimated 70% of the households, owning an average of 0.8 acres of farm holding (Murang'a County, 2019). The agricultural CAIs in the county accounts for about 65% of the aggregate membership of the CAIs in Kenya (KNBS, 2023). In the county, about 67% of the smallholder households belong to at least to one CAI to address the multiple interlinked challenges they face including limited participation in markets, advisory and extension services and financial services (Murang'a County, 2019).

The county government has collaborated with organizations such as Kenya Agricultural and Livestock Research Organization (KARLO), Techno Serve, and National Agriculture and Rural Inclusive Growth Project (NARIGP) to support the growth and development of the CAIs. A total of 353 collective action members were randomly and proportionately sampled alongside 179 non-participants within the proximity. A well-designed and structured questionnaire was used to collect data from the respondents by well-trained enumerators in addition to 2 key informant interviews 10 focus group discussions. The qualitative data was analyzed thematically using excel. Before data collection, a research permit was sought from the research body of the National, Commission for Science, Technology and Innovation (NACOSTI). Additionally, an informed written consent was attained from all the respondents to grant permission for participation in the interviews.

4.2.2 Empirical estimation strategy

The distinguished between the two choices a man or a woman can make in collective action participation namely, market-oriented or efficiency CAIs and community-oriented or livelihood CAIs. These two forms of CAI dominate among Kenyan smallholder households (Gyau *et al.*, 2016; Kwizerimana *et al.*, 2023). They are member-owned and member-controlled entities that take the legal form of self-help groups. To join any of the CAIs, farmers have to pay membership fees and registration fees. The livelihood-based CAIs constitute the majority of the households

that practice subsistence farming. Since annual subscriptions are required to renew registration, most livelihood CAIs operate informally compared to efficiency CAIs. They are largely grounded on customary ideas and principles of promoting the members' well-being. The livelihood CAIs engage in household livelihood and resilience-enhancing activities such as pooling savings through table banking, sourcing of credit either internally or through bank linkages, reciprocal and collective asset acquisition and provision of informal insurance.

The livelihood CAIs constitute members with kinship ties or from the neighbourhoods that operate informally at the grassroots level. The livelihood CAIs may pose risks including failure to remit finance to the saving kit and informal insurance arrangements as well as renegeing in repayment of credit. Contrary to the efficiency CAIs, the livelihood CAIs rarely impose fines for non-compliant behaviours because they uphold informal forms of accountability including trust, reciprocity and reputation. The efficiency CAIs majorly seek to ameliorate high transaction costs and risks in markets and along the value chain through collective sourcing of farm inputs, value addition and collective output marketing. The economic benefits from the collective sale of farm produce are divided among the members depending on the volume of their respective deliveries, after covering the transaction costs.

The efficiency CAIs are highly formalized as formal entities and they operate as single entities or as mergers in the form of cooperatives or unions. Efficiency CAIs are not so dominant among smallholder households because: they require high capital outlay for investing in efficiency activities; they are prone to risks such as high rejection rates of produce due to failure to meet the stringent production standards; defaulting of contractual agreements by the buyers; late disbursement of the payment from collective sales and misappropriation of the collective resources by the group leaders. In minimising transaction risks, the efficiency CAIs employ formal contractual agreements with the buyers in the exchange process. In addition, to enhance organizational and market competitiveness, the efficiency CAIs impose a closed membership policy to lock out the potential entrants who cannot be able to meet the financial obligations and volumes required by the markets. Some households participated in more than one CAIs, however, this was not captured in the empirical modelling.

Figure 4.2 shows a schematic presentation of the empirical workflow. First, the study applies a t-test to test whether the gender gaps in contextual factors across MHHs versus FHHs and livelihood and efficiency members are statistically different from zero. Secondly, an exogenous switching treatment effects regression (ESTER) model will be employed to analyse the gender differentials and inequalities in participation across the efficiency and livelihood CAIs. The model allows us to capture a counterfactual setup of the cause-effect of gender on participation in the two forms of collective action. This is by comparing the scenarios whereby household headship shifts between female to male and vice versa. By estimating the effect of gender, the model captures the potential differences arising from both observable and unobservable socio-economic variations between men and women (Kassie *et al.*, 2014; Paudel *et al.*, 2020). In the ESTER model, the analysis will be decomposed into efficiency and livelihood CAIs.

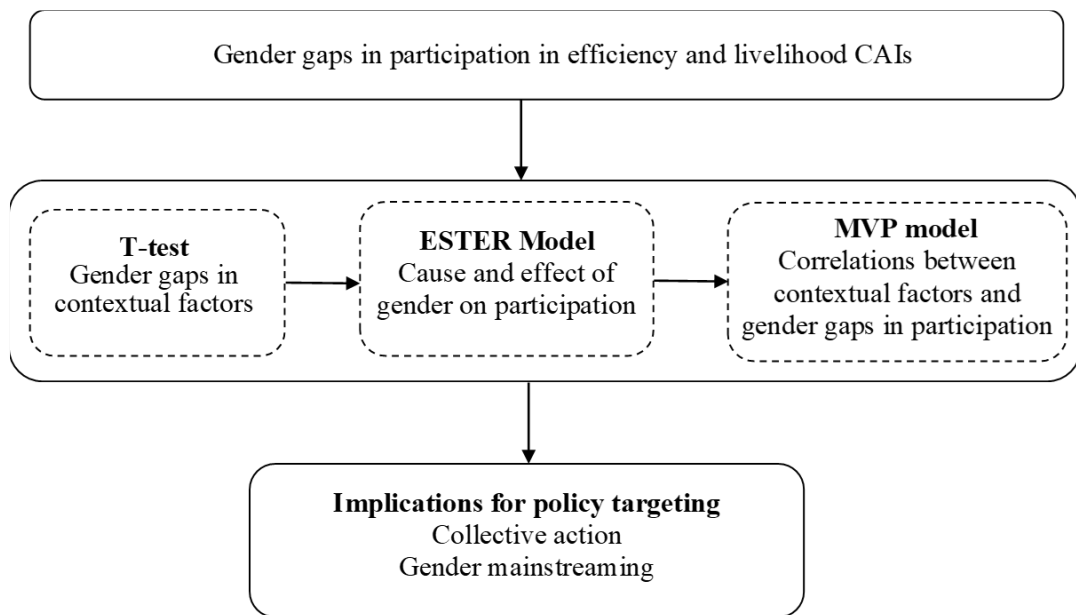


Figure 4.2: Empirical workflow of gendered collective action participation

ESTER-exogenous switching treatment effects

MVP-Multivariate probit model

Source: Authors' drawing

The study also applied the multivariate probit model (MVP) to analyse how the socio-economic contextual factors influence participation in efficiency and livelihoods CAIs among MHHs and FHHs. The model considers both observed and unobserved interdependence of the livelihood and efficiency CAIs either as complements or as substitutes of each other. During analysis, the data is disaggregated into MHHs versus

FHHs and livelihood CAIs versus efficiency CAIs. The variables were drawn from the reviewed collective action literature. The dependent variable is whether a man or a woman has participated in a CAI for the past year. The independent variables include the contextual factors as shown in Appendix 1 and they are education and age, and the dependency ratio. The variables also include farm and farming characteristics such as the farm size, land tenure, farming experience, and farm labour which is defined as the ratio of household members providing agricultural labour and livestock that is measured in tropical livestock units. Other variables are household income, farm income, off-farm income, the value of asset endowments and the availability of bank accounts. Institutional and infrastructural factors include self-reported walking distances to the nearest agricultural market, tarmac and extension service providers.

The WEAI tool captured the intra-household gender dynamics and it was applied to women respondents. The indicators of women's empowerment included production, resources, income, time and leadership which are further classified into sub-domains (Quisumbing *et al.*, 2021). Production indicators include the sub-domains of women's joint or sole decision-making in food crops, cash crops, livestock and autonomy in production. Resources entail women's ownership of, access to and control over production resources including livestock, agricultural equipment, land, consumer durables and credit. Income captures women's joint or sole decision-making over the utilisation of household expenditures and income. Leadership measures women's membership in economic and social groups and comfort in public speaking. Time captures women's usage of time on domestic and productive tasks and satisfaction with the available leisure time.

A woman is considered adequate and assigned a value of 1 if she achieves adequacy in various domains and otherwise. A woman is considered adequate in production if she participates in at least two decisions in agricultural production. Adequacy in autonomy in production is achieved if she can make at least one decision without fear of reprisal from the spouse. Adequacy in ownership of and control of assets is achieved if a woman owns a given asset and participates either in sole or jointly in deciding on the purchase, sale or renting out of the asset. Adequacy in control over income is achieved if a woman participates in decision-making in any major household expenditures. Concerning group membership, a woman is considered

adequate if she belongs to any social or economic group. Regarding public speaking, a woman is considered adequate if she is comfortable public speaking. Adequacy in leisure is achieved when a woman reports being satisfied with her time allocated for leisure. Concerning workload, a woman is considered adequate if she spends 10.5 hours or less on both domestic and productive tasks.

4.2.3 Exogenous switching treatment effects model

The use of the pooled regressing approach with a gender dummy binary of the household head is not an appropriate approach due to its hypothesis of the same effect of covariates on both MHHs and FHHs. This is because the pooled regressing model presumes that the set of variables would have the similar effect on FHH and MHH. This approach does not consider the interactions between the gender variable and other socio-economic attributes in the model. This implies that the set of covariates pose the same effect or share a common slope for coefficients of both MHHs and FHHs (Kassie *et al.*, 2014). Including a gender dummy in the pooled regression technique can only provide an intercept effect or homogenous change in slope assumption where the slope for MHHs and FHHs remains the similar regardless of the sign and the size of other covariates affecting collective action participation. It is therefore necessary to determine the homogenous slope hypothesis by gender of the household head before employing exogenous switching treatment effect regression (ESTER). In this case, we tested the homogenous slope assumption using the Chow test, we rejected the hypothesis of the homogenous slope at a value of 0.1% significance level ($\chi^2(15) = 39.95$; $p=0.000$; and 27.46 ; $p = 0.025$ for efficiency and livelihood CAIs, respectively). ESTER approach estimates two distinct equations for the MHH and FHH as shown in equation (4.2).

$$y_m = x_m\beta_m + u_m \text{ if } G = 1$$

$$y_f = x_f\beta_f + u_f \text{ if } G = 0 \tag{4.2}$$

where, subscript m denotes MHHs and f represents FHHs. The variable y is the outcome indicator, which is participation in either efficiency and livelihood CAIs for the MHHs and FHHs; x and β captures the vectors of socio-economic characteristics and their coefficients, respectively. u denote the randomly correlated error terms with zero and mean constant variance. G is a gender dummy treatment variable set at 0

and 1 for FHHs and MHHs, respectively. Equation (4.2) may not make it possible to directly examine the role of gender in collective action participation for MHHs and FHHs because their characteristics could be different. This issue is addressed by estimating the counterfactual collective action status of each category by evaluating what would have been the probability of participation in either efficiency or livelihood CAIs for FHHs if the coefficients on their socio-economic attributes had the same coefficients on MHHs and vice-versa. The collective action participation decision for each household is assessed by assigning the coefficients of explanatory variables of MHHs to FHHs and FHHs' characteristics coefficients to MHHs. This makes it possible to compare between the expected collective action status under counterfactual and actual scenarios besides being useful in assessing the effects of gender on participation in efficiency and livelihood CAIs. Following Kassie *et al.* (2014), the equations can be expressed as follows:

$$E(y_m | G = 1) = x_m \beta_m \quad 4.3a$$

$$E(y_f | G = 0) = x_f \beta_f \quad 4.3b$$

$$E(y_f | G = 1) = x_m \beta_f \quad 4.3c$$

$$E(y_m | G = 0) = x_f \beta_m \quad 4.3d$$

where, E is the anticipated operator, Equations (4.3a) and (4.3b) denote the actual observed collective action status for MHHs and FHHs respectively. Equation (4.3c) and (3d) are their corresponding counterfactual collective action participation status for the FHHs and MHHs respectively. Employing these conditional expectations, alongside with gender dummy as a treatment variable, it allows us to estimate the causal effect of gender on the status of collective action participation in both efficiency and livelihood CAIs. If MHHs' socio-economic attributes had the same coefficients or returns as the FHHs' socio-economic characteristics coefficients, then the influence of gender on collective action participation (MHHsCA) could be presented as the difference between (4.3a) and (4.3c) equations, as follows:

$$MHHsCA = E(y_m | G = 1) - E(y_f | G = 1) = x_m (\beta_m - \beta_f) \quad 4.4$$

Similarly, if FHHs' socio-economic attributes had the same comparable coefficients as the MHHs, then the influence of gender on FHHs' collective action participation (FHHsCA) is expressed as the difference between (3d) and (3b) as follows:

$$\text{FHHsCA} = E(y_m | G = 0) - E(y_f | G = 0) = x_f(\beta_m - \beta_f) \quad 4.5$$

The MHHsCA and FHHsCA give the expected collective action participation status for MHHs and FHHs, respectively (Table 4.1). Equations (4.5) and (4.6) are equivalent to the average treatment effects corresponding to the treated and untreated, respectively in the gender-focused effect exploration research. MHH and FHH may have different collective action participation statuses, even if they have similar observed socio-economic attributes or even if they have the same coefficients in their respective socio-economic attributes.

Table 4.1: Conditional expectations, treatment effects, and heterogenous effects

	MHHs	FHHs	Treatment effects
MHHs	$E(y_m G = 1)$ (a)	$E(y_f G = 1)$ (c)	MHHCA = (a - c)
FHHs	$E(y_m G = 0)$ (d)	$E(y_f G = 0)$ (b)	FHHCA = (d - b)
Heterogeneity effects	$BH_m = (a - d)$	$BH_f = (c - b)$	

Notes:

^a(a) and (b) = collective action participation status corresponding to MHHs and FHHs.

^b(c) and (d) = the counterfactual participation status for the MHHs and ^cFHHs.

^cG=1 =If the household head is a male; G=0 if the household head is a female.

^d y_m = participation status for MHHs; y_f = participation status for FHHs.

^e BH_m and BH_f = participation statuses corresponding to MHHs and FHHs, respectively, resulting from unobserved factors.

^fMHHCA and FHHCA represent the expected participation decision effects of gender for MHHs and FHHs.

This is due to other endogenous determinants or base heterogeneity effects of collective action participation including inherent skills, preferences, knowledge and risk-bearing capacities. The heterogeneous base effects (BH) can be detected by assessing for any significant deviation in the difference between (4.3a), (4.3d), (4.3c) and (4.3b) as follows:

$$BH_m = E(y_m | G = 1) - E(y_m | G = 0) \quad 4.6$$

$$BH_f = E(y_f | G = 1) - E(y_m | G = 0) \quad 4.7$$

The parameters β_m and β_f are estimated using multivariate probit model as described in the next sub section.

4.2.4 Multivariate probit model

A multivariate probit model (MVP) was employed to complement the ESTER framework in modelling the contextual factors influencing participation choices across the efficiency and livelihood CAIs among MHHs and FHHs. The MVP model is important in disaggregating and accounting for the non-mutually exclusive dichotomous participation decisions across livelihood and efficiency CAIs among MHHs and FHHs while allowing for the interdependence between the choices. This implies that the model jointly models more than one participation decision while accounting for unobserved interdependence or correlations across the efficiency and livelihood CAIs (Greene, 2016). This is through allowing the unobservable error terms to be correlated freely across the livelihood and efficiency CAIs where the selection of a CAI is determined by the choice of the other CAIs to their interdependence (reflected by the correlation of error terms) either as complements (reflected by positive correlation) or as substitutes (reflected by negative correlation) (Greene, 2016). An alternative multinomial probit is limited due to endogeneity constraints which could lead to inconsistencies in interpreting the concurrent effect of independent variables on participation outcome variables.

Based on the conceptual framework, the study expresses that male (MHH) and female (FHH) participation decisions in efficiency and livelihood CAIs are correlated with contextual factors including farm and farming factors, institutional and infrastructural factors, household demographics, income and assets, organizational characteristics of the CAIs and the intra-household gender dynamics associated factors. A farmer is more likely to participate in a specific CAI if the expected utility of its participation is higher than non-participation. For instance, i^{th} household ($i = 1 \dots N$) is facing a decision to participate in the j^{th} CAI or not, where j^{th} represents the choice of efficiency CAIs (EF) or livelihood (LV) CAIs. Let U_j denote the benefits associated with participation in the j^{th} CAI and U_0 otherwise. A household will choose to participate in the j^{th} CAI if $Y_{inj}^* = U_j^* - U_0 > 0$. The net utility from the participation in j^{th} CAI is a latent variable determined by contextual factors (X'_{ijn}), its

coefficients (β_j) and the normally distributed disturbance terms (ε_{ip}). Following Greene (2016), a reduced form of MVP regression is expressed as:

$$Y_{inj}^* = X'_{ijn}\beta_{ijn} + \varepsilon_{ijn}, j = 1, \dots \dots \dots \left\{ \begin{array}{l} 1 \text{ if } Y_{ipj}^* > 0 \\ 0 \text{ otherwise} \end{array} \right. \quad n = 0(\text{livelihood}), 1(\text{efficiency}) \quad 4.8$$

where Y_{ij} represents a binary variable indicating the participation decision of the i^{th} household as regards to the j^{th} collective action form. In the MVP, where the collective action forms are interdependent of each other, the error terms take a multivariate normal distribution (MVN) that has a mean of zero and a variance that is normalized to unity i.e. $(U_{EF}, U_{LV}) \sim \text{MVN}(0, \Omega)$ and symmetric covariance matrix (rho) modelled as follows:

$$\begin{bmatrix} 1 & \rho_{EF,LV} \\ \rho_{LV,AI} & 1 \end{bmatrix} \quad 4$$

4.3 Results and discussion

4.3.1 Descriptive statistics

The descriptive statistics for the socio-economic attributes of the MHHs and FHHs are presented in Table 4.2. The MHHs and FHHs were significantly different indicating the presence of gender gaps in most of the contextual factors. Compared to FHHs, the MHHs were older, were more educated and owned more livestock and assets. Women’s lower endowments in asset ownership could be associated with the social norms that limit women’s ownership of assets such as livestock and land (Quisumbing *et al.*, 2020). It could also be ascribed to the fact that women invest and spend their incomes on household food consumption and family health than asset acquisition (Quisumbing *et al.*, 2021).

The MHHs had more access to information, technology and communication (ICT) and were more familiar with the CAIs within their neighbourhood. Since familiarity with the CAIs within the neighbourhood is an indicator of social capital, women’s limited awareness of the CAIs is an indicator of low social capital endowment. Additionally, there were significant differences in off-farm engagements wherein more MHHs were earning off-farm income relative to their FHH counterparts. Field interviews revealed that men preferred seeking non-farm wage employment while

leaving women behind to provide farm labour. This pattern could be explained by the significantly more farming experience among FHHs than the MHHs. The FHHs also earned higher farm income than their MHH counterparts.

Table 4.2: Descriptive statistics of the gender gaps in socio-economic contextual factors

	Full sample (n=532)		MHHs (n=353)		FHHs (n=179)		t-value
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	
<i>Household demographics</i>							
Age	56.42	13.72	55.85	14.30	57.56	12.45	1.37
Education	2.44	0.82	2.54	0.83	2.26	0.79	-3.64***
Household education	2.44	0.82	2.47	1.78	2.39	2.00	-0.47
Dependency ratio	1.14	1.19	1.13	1.09	1.14	1.38	0.09
<i>Farm and farming factors</i>							
Farm size	1.05	0.96	1.07	1.05	1.02	0.76	-0.52
Land tenure	0.45	0.50	0.48	0.50	0.42	0.49	-1.25
Livestock holdings	1.69	2.53	1.82	2.58	1.43	2.42	-1.69*
Labour equivalent	0.99	0.73	0.89	0.64	1.17	0.84	4.18***
Farming experience	23.79	14.83	21.63	0.77	28.04	14.59	4.82***
<i>Income and assets</i>							
Farm income	49173.27	4113.26	44003.46	48614.27	59457.31	62683.42	2.26***
Household income range	4.28	7.032	4.56	7.29	3.73	6.48	-1.29
Income sources	1.51	0.69	1.54	0.70	1.47	0.67	-1.00
Off-farm income	0.51	0.50	0.54	0.50	0.44	0.36	-2.30**
Asset endowments	112022.30	472216.2	138480.90	568210.4	59844.35	150363.90	-1.82**
Bank account	0.50	0.50	0.51	0.50	0.49	0.50	-0.40
<i>Infrastructure and institutions</i>							
Tarmac	0.23	0.14	1.88	0.07	2.11	1.87	1.63*
Market	3.27	0.09	3.29	0.11	3.21	0.19	0.20
Extension	3.40	0.09	3.38	0.10	3.44	0.21	0.30
Extension contacts	1.04	2.65	1.13	2.83	0.88	2.24	-1.01
Information	2.51	1.32	2.59	1.37	2.40	1.22	-1.35
ICT	0.33	0.47	0.37	0.48	0.24	0.43	-3.06***
Awareness of CAIs	3.27	1.54	3.42	1.49	2.97	0.12	-3.22***

CAIs=collective action initiatives; ICT=Information, communication and technology

Significance levels at *** p< 0.01, ** p< 0.05, * p< 0.1

Source: Authors' field data

The mean differences between the non-members for livelihood and efficiency CAIs are presented in Table 4.3. There were significant differences in age between non-members and efficiency group members, however, the efficiency group members were older than the livelihood group members. The efficiency members showed a higher level of education than the household head and among the household members. The farm size was significantly larger for efficiency group members compared to livelihood group members. Regarding livestock, it was significantly varied across the two groups where the efficiency group members had higher tropical livestock units than livelihood group members. In addition, the livelihood group members had a significantly higher number of sources of household income compared to the efficiency group members.

There were more livelihood collective action members owning bank accounts than efficiency collective action members. There were significant differences between the two categories on the proximity to the tarmac road, wherein efficiency group members were located farther from the tarmac road than the livelihood group members. Conversely, the efficiency group members had more access to information compared to the livelihood group members. The women belonging to efficiency CAIs showed more control over household credit and assets while the livelihood women members had more control over household income.

Table 4.3: Descriptive statistics for the collective action initiatives

	Non-members		Efficiency (1)		Livelihood (2)		Difference (1)-(2)
	Mean	SE	Mean	SE	Mean	SE	
<i>Household demographics</i>							
Age	56.62	14.74	62.39	11.04	55.06	13.26	4.03***
Education	2.21	0.75	2.73	0.93	2.52	0.81	1.81*
Household education	2.16	1.85	2.98	2.12	2.49	1.77	1.91*
Dependency ratio	1.14	1.08	0.83	0.75	1.19	1.31	-1.85*
<i>Farm and farming characteristics</i>							
Farm size	0.98	0.85	1.52	1.00	1.00	0.98	3.74***
Livestock holdings	1.21	1.61	2.53	3.94	1.80	2.56	1.82*
Labour equivalent	1.00	0.76	1.09	0.74	0.96	0.88	1.31
Farming experience	24.69	15.00	24.75	15.12	23.03	14.67	0.83
<i>Income and assets</i>							
Farm income	48817.86	53453.52	35102.89	31801.44	53618.47	59119.83	-2.03**
Household income range	4.12	6.64	5.36	7.92	4.15	7.07	1.19
Income sources	1.44	0.64	1.39	0.56	1.58	0.73	-1.91*
Off-farm income	0.51	0.50	0.38	0.47	0.54	0.50	-3.08***
Asset endowments	106301.2	596719.8	153100	377465.50	106946	399984.60	0.83
Bank account	0.47	0.50	0.92	0.28			7.33***
<i>Institutions and infrastructure</i>							
Market	3.09	1.56	3.45	3.74	3.34	2.02	0.33
Tarmac	2.12	1.21	1.78	1.43	2.30	2.66	2.14**
Extension	3.31	1.78	3.63	0.44	3.41	2.46	0.63
Extension contacts	0.29	1.11	3.31	4.15	1.03	2.65	5.47***
Information	2.27	1.26	3.69	1.61	2.40	1.17	7.25***
ICT	0.30	0.46	0.36	0.48	0.33	0.47	0.39
Awareness of CAIs	2.96	1.73	4.34	0.98	3.23	1.40	5.89***

Intrahousehold gender dynamics

Women's production decisions	0.40	0.49	0.48	0.50	0.46	0.50	0.25
Women's autonomy in production	0.34	0.47	0.46	0.50	0.47	0.50	-0.22
Women asset ownership	0.34	0.48	0.23	0.42	0.21	0.41	0.37
Women's control of assets	0.78	0.42	0.56	0.50	0.69	0.46	-2.11**
Women's income	0.37	0.48	0.67	0.47	0.39	0.49	4.14***
Women's credit control	0.55	0.50	0.59	0.50	0.71	0.45	-1.84*
Women's workload	0.27	0.44	0.22	0.42	0.16	0.37	1.20
Women's leisure	0.74	0.74	0.74	0.44	0.65	0.48	1.29
Women's public speaking	0.37	0.48	0.48	0.50	0.52	0.50	-0.66

Significance levels at *** p< 0.01, ** p< 0.05, * p< 0.1

SE-Standard Error

Source: Authors' field data

4.3.2 Gender gaps in participation in livelihood collective action initiatives

Results on the effects of the gender of the household head on participation in efficiency groups from the ESTER model are presented in Table 4.4. From the result, participation among the FHHs in livelihood collective action participation is generally lower for the FHHs (53.8%) than the MHHs (56.1%). On the treatment effects, if the MHHs had the same level of coefficients as the FHHs, their level of participation would have been reduced by 2.3%. On the other hand, if the FHHs were assigned the same level of resource endowments as MHHs, the gender gaps in participation in livelihood CAIs would have been reduced by about 86%.

Table 4.4: Average probability of participation in livelihood CAIs, treatment, and heterogeneity effects for MHHs and FHHs

Gender of the household head	MHHs	FHHs	Treatment effects
MHH	0.561 (0.014)	0.538 (0.019)	0.023***
FHHs	0.956 (0.011)	0.097 (0.019)	0.858***
Heterogeneity effects	-0.395*** (0.014)	-0.441*** (0.018)	

*** p < 0.01, ** p < 0.05, * p < 0.1 SE = standard error

Source: Authors' field data

The descriptive statistics and field interviews revealed that most women preferred livelihood CAIs compared to efficiency CAIs. This is because the livelihood CAIs practice open membership entry and require low financial entry requirements. The livelihood of CAIs is also attractive to women due to the financial autonomy they stand to gain from the collective pooling of savings and credit acquisition. The livelihood CAIs also enable women to acquire assets such as sewing kits and small livestock which are used to expand their livelihoods, either collectively or individually on a reciprocal basis. However, the patriarchal social norms that limit women's access to resources may limit participation of women in livelihood CAIs due to the constraints in meeting the financial obligations for collective savings kit, informal insurance and credit sourcing obligations.

Additionally, women’s inability to repay credit reduces their chances of participating in livelihood CAIs. Some cases of the livelihood members’ assets being disposed of to repay credit were reported. The livelihood CAIs constituted of women only which made it possible to address women’s time constraints by scheduling collective activities at the convenient times for them. On the base heterogeneity effects, MHHs would be inherently different in their physical capacities, managerial abilities, priorities, preferences and risk-bearing capacities. As hypothesized, if the FHHs would have the same returns in coefficients as MHHs, the gender disparities in participation in livelihood CAI would have been still lower by about 39.5%. On the other hand, if the MHHs had the same unobserved effects as the FHHs, their participation in livelihood CAIs would be lower by 44.1%. This result aligns with the previous gender-related studies (Fischer & Qaim, 2012a) that emphasise the need to promote gender equality by minimising the differentials between MHHs and FHHs to enhance participation in livelihood CAIs.

4.3.3 Gender gaps in participation in efficiency collective action initiatives

Table 4.5 shows the gender differential effects of participation in efficiency CAIs. As expected, the likelihood of participation in efficiency CAIs for MHHs was higher (12.7%) compared to FHHs (6.7%).

Table 4.5: Average probability of participation in efficiency CAIs, treatment, and heterogeneity effects for MHHs and FHHs

Gender of the household head	MHHs	FHHs	Treatment effects
MHHs	0.127 (0.007)	0.067 (0.011)	0.060***
FHHs	0.487 (0.011)	-0.049 (0.008)	0.536***
Heterogeneity effects	0.176*** (0.008)	0.010 (-0.420)***	

*** p< 0.01, ** p< 0.05, * p< 0.1

SE = standard error

Source: Authors’ field data

If the MHHs were assigned the same socio-economic attributes as the FHHs, their participation in efficiency CAIs would have been lowered by 6%. However, if the

FHHs were allotted the same coefficients as the MHHs, their participation in efficiency CAIs would have increased by 53.6%. This observation aligns with the descriptive statistics showing that participation in efficiency CAIs for FHHs was much lower compared to MHHs. Consistent with other findings (Mwambi *et al.*, 2020; Hintz & Pretzsch, 2023), women’s limited access to resources required for participation in efficiency CAIs such as land, livestock, finance, skills, land and labour limits their participation in market-oriented CAIs. Women are also limited in their time which is important for attending technical trainings, group meetings and collective marketing days (Selhausen, 2016; Woldu *et al.*, 2018). On the base heterogeneity effects, if MHHs can be assigned the same unobserved attributes as women, their participation in efficiency collective action could be reduced by 17.6%. Additionally, if the FHHs were allocated the same coefficients of returns in unobservable characteristics as MHHs, participation in efficiency CAIs would have still been lower by 42%, pointing to the need to account for the gender differences in MHHs and FHHs.

4.3.4 Determinants of gender gaps in collective action participation

Table 4.6 shows the multivariate probit results for the determinants of gender gaps in participation in livelihood and efficiency groups among the MHHs and FHHs. Before analysis, the tests were performed. i.e. the multicollinearity test and the Variance Inflation Factor (VIF) which was 1.94. The value is less than the threshold of 5 thus the study rejecting the null hypothesis that the multicollinearity inflates the variance of the predictors (Greene, 2016). The Wald chi-square statistics are statistically significant (Table 4.6), confirming the appropriateness of disaggregating the data based on gender over incorporating the gender of the household head as a binary variable and pooling of the data. The correlation of error terms CAIs is statistically significant at a 1% level, therefore, we reject the null hypothesis that there is no correlation of the error terms. As indicated, the likelihood test ratio test for MHHs and FHHs is statistically significant at a 1% level for FHHs, therefore, the study rejects the null hypothesis of that error terms have zero covariance across the model equations.

Table 4.6. Determinants of gender gaps in in participation in efficiency and livelihood CAIs

	MHHs				FHHs			
	Efficiency		Livelihood		Efficiency		Livelihood	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Farm size	0.015	0.087	-0.023	0.077	0.485***	0.187	0.213	0.154
Land tenure	-0.332*	0.181	0.140	0.156	-0.183	0.542	0.157	0.241
Livestock holdings	0.053*	0.029	0.040	0.032	0.196**	0.099	-0.022	0.389
Labour equivalent	0.083	0.277	-0.186	0.161	0.029	0.334	0.080	0.133
Off-farm income	-0.667***	0.200	0.255*	0.151	-0.189	0.443	0.138	0.247
Bank account	0.771***	0.202	-0.410***	0.157	0.800	0.793	-0.156	0.228
Age	0.023**	0.009	-0.000	0.008	0.066**	0.033	-0.334**	0.015
Education	0.235**	0.103	0.168	0.110	-0.289	0.294	0.310*	0.188
Household education	-0.079	0.063	0.021	0.062	0.057	0.529	-0.096	0.072
Farming experience	-0.018**	0.009	0.000	0.007	0.026	0.019	0.026**	0.011
Marital status	0.398**	0.160	-4.918***	0.358	-0.232	0.449	-0.288	0.185
Tarmac	-0.027	0.084	-0.060	0.056	0.275	0.195	-0.255	0.082
Market	-0.004	0.046	0.026	0.040	-0.155	0.100	-0.159***	0.054
Women's production decisions	0.103	0.300	-0.403*	0.217	0.912	0.687	-1.046**	0.416
Women's autonomy in production	-0.022	0.270	0.592***	0.213	6.872***	1.992	0.078	0.444
Women asset ownership	0.171	0.288	-0.018	0.291	7.184***	1.781	-0.683**	0.317
Women's control of assets	-0.826***	0.196	-0.022	0.157	5.702***	1.265	-0.030	0.292
Women's leisure	-0.164	0.189	-0.020	0.155	-0.081	0.487	-0.187	0.243
Women's public speaking	-0.103	0.167	0.288**	0.142	0.057	0.529	0.389*	0.212
Constant	-2.388***	0.605	4.625***	0.770	0.275***	0.194		
atrho21	-1.693***	0.424			-1.008	0.621		
rho21	0.935***	0.054			-0.765***	0.258		
Wald chi ² (38)	548.63				724.66			
Prob > chi ²	0.000				0.000			
Log pseudolikelihood	-282.945				-114.267			
Number of observations	353				178			

*** p<0.01, ** p<0.05, * p<0.1

MHHs: Likelihood ratio test of rho21 = 0: chi²(1) = 74.9564 Prob > chi² = 0.000

FHHs: Likelihood ratio test of rho21 = 0: chi²(1) = 4.870 Prob > chi² = 0.027

Intrahousehold gender dynamics variables were measured among the women in MHHs only.

The findings regarding the farm size, showed a positive correlation between participation in efficiency CAIs among the MHHs but no association with participation in livelihood CAIs. This finding was expected given that descriptive statistics revealed that the efficiency members have larger farm sizes compared to their livelihood counterparts. The finding is in tandem with Fischer & Qaim (2014) that larger farm sizes incentivise production which makes economic sense for engaging in collective input sourcing and collective marketing. On the other hand, farm size had little role to play in determining participation in livelihood CAIs. This is affirmed by the predominance of women in livelihood CAIs, who practised subsistence farming to enhance household food self-sufficiency. Regarding livestock, it had a positive effect on participation in efficiency CAIs among the MHHs and FHHs but showed no effect on participation in livelihood CAIs among the MHHs and FHHs.

Land tenure showed a negative association with participation in efficiency CAIs among the MHHs but did not show any effect on participation in livelihood CAIs. This result was not expected since land tenure increases the prospects for long-term investments in agriculture. The off-farm income was negatively correlated with participation in efficiency CAIs among the MHHs and FHHs while it showed a positive effect on participation in the livelihood CAIs among the MHHs. Off-farm engagements increase opportunity costs of time for engaging in intensive market-oriented production, technical training and negotiating transactions during market days (Fischer & Qaim, 2014). The positive correlation between off-farm income and participation in livelihood CAIs would be partly attributed to the engagement of men in off-farm activities leaving the women at the homesteads to take care of the agricultural activities. This observation is consistent with descriptive statistics showing that more livelihood collective action members participation in non-farm economic engagements.

In addition, most of the livelihood CAIs among men are inclined to support off-farm entrepreneurial and self-employment opportunities. Off-farm income eases the liquidity constraints farmers face in meeting the financial obligations of the livelihood CAIs including contributions to the savings kit, informal insurance kit, asset acquisition and credit sourcing kit. Ownership of bank accounts had a positive effect on participation in efficiency CAIs among the MHHs but it showed a negative

relationship with participation in livelihood CAIs. A bank account is an indicator of access to financial services, which is a requirement for investing in market-oriented production for disbursement of earnings from collective marketing. Limited access to financial services motivates the farmers to join the livelihood CAIs in facilitating their access to savings and credit. Age was positively correlated with participation of FHHs and MHHs in efficiency CAIs while it had a negative association for livelihood CAIs among the FHHs. The descriptive statistics show that members of efficiency CAIs were older than the livelihood group members. The finding aligns with Selhausen (2016) that older MHHs and FHHs may have accumulated social and physical capital that would incentivise them to join efficiency CAIs.

Education revealed a positive effect on participation in efficiency CAIs among the MHHs and in livelihood CAIs among the FHHs. The result is consistent with Habiyaremye *et al.* (2023) that education enhances the capacity to receive and process information to make informed decisions on collective efficiency-enhancing activities. The positive effect on participation in livelihood CAIs can be explained by the need for knowledge and skills among the FHHs engaging in livelihood CAIs that pursued off-farm entrepreneurial activities such as sewing, motorbike transport businesses and reciprocal construction of houses. Against expectations, farming experience was negatively influenced with participation in efficiency CAIs among the MHHs while it was positively influenced with participation in livelihood CAIs. Farming experience especially on past and current production and marketing trends may incentivize the FHHs to engage in reciprocity incentives in safeguarding household food security in the face of agricultural shocks (Njuki *et al.*, 2021).

The livelihood CAIs provide financial support to their members as a form of informal insurance during shocks such as crop failure and price hikes on food. The savings and credit services cushions the FHHs during crises in smoothing household incomes and consumption. On institutional factors, access to the market was positively influenced with participation in livelihood CAIs among FHHs, but it did not have any correlation with participation in livelihood CAIs and efficiency CAIs for both FHHs and MHHs. Access to markets reduces the transaction costs of purchasing farm inputs and participating in output markets. Concerning intra-household gender gaps, as expected, women's ownership of assets showed a positive correlation with participation in efficiency CAIs among MHHs. Consistent with Selhausen (2016),

joint ownership of assets provides the capital outlay required for collective marketing. Assets are a form of financial capital that incentivises the participation in efficiency CAIs given the capital-intensive nature of these groups for investing in market-oriented production. Women's autonomy in production increased the likelihood of participating in the livelihood CAIs.

4.4 Conclusion and policy implications

The study examined how gender affects collective action participation choices. We employ the multivariate probit model and ESTER model to estimate the gender gaps in participation in efficiency and livelihood CAIs. We explain the varying effects of gender on collective action participation choice mainly from the perspective of the differential socio-economic contexts of the households and the attributes of the CAIs. The findings revealed substantial inter-household gender gaps in participation patterns in both livelihood and efficiency CAIs among MHHs and FHHs. The efficiency CAIs showed larger differences compared to livelihood CAIs because the efficiency CAIs require huge capital to pursue efficiency-enhancing activities. The gender gaps were linked to differences among MHHs and FHHs in farm size, livestock, off-farm income, bank account, education and farming experience. The findings further showed inter-household gaps in participation in efficiency CAIs and livelihood CAIs arising from the intra-household gaps in control of assets and decision-making in production. The participation statuses in efficiency and livelihood CAIs among the FHHs would have been higher than they are now if the returns on their observed attributes had been the same as the returns on the MHHs's attributes. Even if that would have been the case, however, the findings indicate that the participation statuses for the FHHs would have been still lower than the MHHs due to unobservable attributes.

The findings suggest that no one-size-fits-all promotional policy approach is appropriate in developing the CAIs. The study therefore suggests multiple gender-responsive policy interventions that target the socio-economic context-specificity of men and women. The policies considers the opportunities and constraints the CAIs differentially pose to men and women. This would lead to potential spillover effects and synergies that would allow for better development of the CAIs while addressing gender inequalities instantaneously. First, the efficiency CAIs confer opportunities

for improving farm productivity, market participation and household incomes among the households. To tap these opportunities, there is a need to support the farmers with capital to incentivize men and women to participate. In particular, it is recommended that collective action policies set out to promote efficiency-enhancing activities to offer female-targeted flexible membership requirements to suit the agricultural activities that women engage in such as small livestock farming and horticulture. Secondly, there is a need to carry out gender awareness and sensitisation training in collective action settings. This would help to transform the gender norms that promote equal distribution of resources and decision-making among women and men. Otherwise, inclusivity in CAIs can not materialise if underlying socio-cultural issues that result in gender equality are not addressed. Thirdly, it is recommended for policy to focus on inter-household heterogeneities due to the increased role of FHHs as the heads of their households. Fourthly, the livelihood CAIs are important in improving the livelihoods of the farmers alongside household incomes and food security.

It is therefore important to support women with affordable loans that have flexible payment terms to ease the financial constraints related to participation in livelihood CAIs. In addition, opportunities for the provision of credit and accumulating savings should be encouraged by establishing collective action funds and micro-credit schemes. The provision of financial management and entrepreneurial skills are also important in triggering participation in livelihood CAIs in promoting the off-farm economic activities of the households. Nonetheless, the study did not capture the complex and dynamic gendered patterns of the CAIs in accounting for their transformation trajectories in participation in time and space. Women's and men's participation choices depend on their preferences and acceptance of the organizational characteristics of the efficiency and livelihood CAIs. Therefore, further research is important to analyse the men's and women's preferences for the organizational characteristics of the efficiency and livelihood CAIs to generate knowledge on the most preferred CAIs among men and women. In addition, extensive follow-up research is important in different settings to extend the empirical findings in broader socio-economic contexts.

CHAPTER FIVE

Does Collective Action Facilitate or Debilitate Women's Empowerment? Evidence from Smallholder Households from the Central Region of Kenya

Abstract

Collective action is important in empowering women to promote socio-economic development in developing countries. However, the effects of context-specificity of collective action on women empowerment in literature are barely established. This study explored how socio-economic context-specificity of efficiency and livelihood CAIs influence women empowerment. We employed mixed qualitative and quantitative approaches based on the data collected from 532 households, ten focus group discussions and two key informant interviews from the central region of Kenya. The multinomial endogenous treatment model and ordered probit model were employed for empirical analysis. The status of women empowerment across the sub-domains in the two CAIs were variably influenced by education, farm size, age, off-farm income, market, bank account and tarmac road. The efficiency CAIs improved women's empowerment in the sub-domains of income, public speaking and membership in groups while the livelihood CAIs improved women's independent decision-making and autonomy in production, asset control, income control, credit control, workload and leisure. However, efficiency and livelihood CAIs failed to influence women's ownership of assets. These findings suggest the presence of trade-offs and synergies across the women's empowerment sub-domains, implying that 'one-size-fits-all' collective action programs and policies are inadequate. The study contributes to the literature of new institution economics and recommends a portfolio of collective action context-specific and gender-sensitive policies that would strengthen the synergies while minimising the trade-offs across the empowerment domains for optimal women empowerment outcomes. Most importantly, the multiple policies could confer complementarities, synergies and spillover effects in addressing gender inequalities while developing the CAIs concurrently.

Keywords: Women empowerment, efficiency collective action initiatives, livelihood collective action initiatives, multinomial endogenous treatment effect model

Publication information: finalized manuscript for submission

5.1 Introduction

Historically, the manifestation of disparities driven by power dynamics between men and women that are exacerbated by the normalizing of inequality in institutions, social roles and relations, and regulatory and policy frameworks has resulted in gender inequality (Ayamga *et al.*, 2023). In sub-Saharan Africa (SSA), gender inequality and low socio economic status of women have been associated with poverty, food insecurity and lagging in economic development (High Level Panel of

Experts, HLPE, 2020; Kehinde *et al.*, 2021; Lufuke *et al.*, 2023). Gender inequality hinges on the perception of the gendered economy which rebuts the assumption of gender neutrality of the economy (Duflo & Udry, 2016). The gendered economy underpins the intrahousehold production model holding that household decision-making on the distribution of resources does not follow a unitary pattern but depends on the bargaining power of individuals and preferences (Duflo & Udry, 2016; Quisumbing & Maluccio, 2000). For instance, there exists substantial gender inequalities in the agricultural sector in SSA wherein women are constrained in their ownership of, access to and controlling power over key productive resources such as livestock, land and credit, production process and control over incomes generated from agriculture (Diirro *et al.*, 2018; Quisumbing *et al.*, 2021).

Due to unequal social norms on intra-household allocation of labour in productive, reproductive and domestic responsibilities, women face time high opportunity costs of time in participating in agricultural training, advisory and extension services and income-generating engagements (Njuki *et al.*, 2021; Ingutia & Sumelius, 2022). Women are also underrepresented in social networks besides being overrepresented in non-beneficial lowest strata of the value chains (Ampaire *et al.*, 2020). In addition, women's participation in input and output markets is constrained by high transaction costs, asymmetric information and missing linkages (Hintz & Pretzsch, 2023). The gender-based constraints are exacerbated by—the limited public intervention and policy inadequacies that barely recognize the roles of women in agriculture (Aziz *et al.*, 2022). The 2030 sustainable development agenda of the United Nations' emphasizes that in all facets of the SDGs, gender equality and empowerment of women remain paramount to the achievement of the Sustainable Development Goals (SDGs) and inclusive socio-economic development (United Nations, 2016). Empowering women is critical, particularly in Sub-Saharan Africa (SSA) where women are key agents of socio-economic growth and development in reducing poverty, food insecurity and transformation of rural economies and agriculture (Gomez *et al.*, 2020; Lufuke *et al.*, 2023).

In the region, women constitute about 70% of the labour force in agriculture in managing natural resources, crop and livestock production, post-harvest processing, trade and marketing (Gomez *et al.*, 2020). Women also engage in non-farm wage employment and small entrepreneurial activities to earn income and diversify

livelihoods in safeguarding the economic well-being of their households (High Level Panel of Experts, HLPE, 2020). Women are also integral actors in achieving household food security and nutrition through their key domestic roles of caregiving, health care, food provisioning and preparation (Quisumbing *et al.*, 2020). The recently reported progressive feminization of agriculture due to male outmigration in search of employment creates opportunities for women to promote their well-being and agency in their households and communities (Gomez, 2020). In light of this, empowering rural women has been a top priority in development discourse. According to FAO, if women have the similar quality and quantity of productive services and resources as men, the production in their farms would be increased by 20% to 30% (FAO, 2011). Impact evaluation of the project of Feed the Future in Africa and Asia shows that women's decision-making in production, and control over income improves the status of their HFS (Quisumbing *et al.*, 2021).

In recognition of the importance of WE, several strategies have been employed in Kenya to empower rural women. These include legal frameworks guaranteeing gender equality in the inheritance of productive resources such as livestock and land, initiatives aimed at reducing women's unpaid work (such as childcare services), microfinance and cash transfer programmes (Kenya National Bureau of Statistics, KNBS, 2023). Empowering women needs to not only strengthening their economic resilience but also, most importantly, address the root causes of their social vulnerability (Sulemana *et al.*, 2020). In particular, decision-making power is important for women to transform their gender relations and position within their households and in wider society for greater, sustainable and scalable empowerment outcomes (Aziz *et al.*, 2022). Key in this regard, there is growing interest and promotion of collective action as a key pathway for empowering rural women, a trend that aligns with the patterns of development practitioners employing collective action in delivering women's empowerment objectives (Ingutia & Sumelius, 2022).

Guided by principles of self-help, equity and equality in addition to socioeconomic development through cooperation, collective action is perceived as the best rural development programme that can empower women compared to other innovations such as contractual farming (Mwambi *et al.*, 2021). The economic theory underpinning collective action is the provision of public goods through cooperation in response to market and state dysfunction and missing or weak state institutions

(Sulemana *et al.*, 2020). It is propositioned that collectively women would benefit from mobilising and leveraging resources by identifying opportunities and improving access to resources and service provision (extension, markets, labour, credit, vocational training, education, information, technologies and innovations) (Mudege *et al.*, 2015; Dohmwirth & Hanisch, 2018). This would enable women to economically produce and market products by ameliorating the effects of high transaction costs and enhancing their incomes, asset build-up, household resilience and expansion of livelihoods (Mutonyi, 2019; Bizikova *et al.*, 2020; Habiyaremye *et al.*, 2023; Kwizerimana *et al.*, 2023). Collective action also provides a forum for social support, solidarity, information sharing and exchange and raising awareness of women's rights through advocacy and lobbying to represent their voice, choice, and decision-making of their needs and interests (Kumar *et al.*, 2018). Through the mechanisms, hereof, women can develop self-confidence and self-efficacy, visibility in their roles, gain leadership skills which would lead to more equal decision-making over resources and intrahousehold labour allocation (Ayamga *et al.*, 2023; Hillenbrand *et al.*, 2023).

Despite the potential of collective action to empower women, literature reveals inconsistencies in the effect of collective action on women empowerment. For instance, the study by Fischer & Qaim (2012) among small-scale banana-producing farmers in Kenya reported that participation in CAIs had positively influenced the share of women-controlled income if women engaged in mixed groups. Another study by Serra & Davidson (2021) focusing on women honey producers in Ethiopia shows that cooperative membership improved the share of marketed products to women who belong to wealthier households than members from poorer households. However, women's participation in collective action activities such as meetings, technical training and market days increased women's workload given their responsibilities of taking care of the farms and their families. In addition, women who were located far from the market sold a higher share of honey than women located closer to the market. Alemu *et al.* (2018) found that the farmer groups among apple farmers empowered women at the community level but not at the household level leading to backlash of women from their husbands. In Ghana, collective action initiatives (CAIs) economically empowered the women who had access to credit, but

further impoverished those who lack control over the use of the loans due to their inability to repay (Ganle *et al.*, 2015).

Dohmwirth & Hanisch (2018) made a distinction between single-sex and mixed-gender groups in India and found that women-only groups failed to enhance women's decision-making on incomes. At the same time, women experienced entry barriers to mixed-gender groups due to workload-generated time constraints and cultural barriers. Based on economic functions, Mwambi *et al.* (2020) differentiated between processing and bargaining producer organizations in Kenya's milk value chain. The authors found that women's membership in bargaining producer organizations improved women's ownership of cows than women's membership in processing producer organizations. The empowerment benefits were greater for older and educated women. Processing producer organizations failed to empower women since the ability of the women to participate therein was limited due to the social norms that constrained women's ownership of livestock.

The inconsistent findings suggest that the socioeconomic characteristics affecting women's empowerment vary contextually, therefore it is difficult to anticipate the nature and extent effect of women empowerment across the CAIs. According to (Kabeer, 1999), women empowerment indicators have account for the socio-economic context-specificity of the households and the CAIs. Despite this recognition, failure to account for the heterogeneous contextual nature of these concepts remains a significant gap in the literature and yet they can have implications on the choice of the analytical framework, interpretation and generalization of the findings. This study contributes to the discourse of collective action and women empowerment in several ways. First, this study hypothesises that households are heterogeneous in resource endowments and utilization, demographics, farm and farming characteristics, socio-cultural norms, social networking patterns and intrahousehold empowerment gaps (Ampaire *et al.*, 2020). This implies that the households adapt different transaction-cost mechanisms across the CAIs in grasping the potentially available technology adoption and prevailing market access opportunities and coping mechanisms to the agricultural risks and shocks (Innazent *et al.*, 2022).

The differential transaction cost-reduction mechanisms are manifested in the attributes of the CAIs including the level of formalization, nature and extent of coordination, gender composition, level of social capital and social networking (Bizikova *et al.*, 2020). Subsequently, the divergent transaction cost-reducing mechanisms generate varietal household costs (in terms of challenges and trade-offs) and benefits (concerning opportunities and synergies) of participation across the CAIs (Min-Han Tsai & Yir-Hueih, 2022). This could lead to win-loss, win-win or loss situations on the nature and extent of women empowerment benefits leveraged. Despite this recognition, most of the existing studies employ pooled regression analyses with the collective action dummy variable indicating whether a household participates in collective action or not in regressing the influence of collective action on empowering women (Ganle *et al.*, 2015; Badejo *et al.*, 2017; Alemu *et al.*, 2018; Serra & Davidson, 2021). This approach presumes that households are homogeneous entities and the organizational attributes of the CAIs are similar and this may yield inconsistent estimates. This is partly because the pooled regression approach makes it difficult to disaggregate how different CAIs would respond to the promotion policies and household investment strategies in effectively responding to women's gender-based constraints vis-à-vis the promotional strategies and household investment strategies the CAIs might need to optimise the women empowerment benefits (Raghunathan *et al.*, 2019).

As a result, this approach universally bundles collective action programs and policies into a 'one-size-fits-all' approach which can be detrimental to gender mainstreaming objectives. The very few studies that focus on the heterogeneity of the CAIs focus on gender composition (Fischer & Qaim, 2012; Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021) and the nature of activities along the value chain (Mwambi *et al.*, 2020) while paying less attention to other organizational characteristics such as the level of formalization, nature of activities, social networking and social capital. Secondly, while the studies converge that in collective action, social elements (the level of social capital, social networking capacities and gender composition) complement the economic elements (collective input sourcing and collective output marketing) in promoting women empowerment, the studies pay less attention to the social characteristics of the groups. This approach does not reflect the full conceptualization of collective action. Upon perusal on the extant literature,

we have not come across any study that differentiates the empowerment effect of the CAIs based on their social and economic organizational characteristics of the CAIs.

Focussing on economic and social characteristics, this study categorizes the CAIs into two forms namely market-oriented or efficiency CAIs and community-oriented or livelihood CAIs. These two CAIs are similar in that women and men can voluntarily join any of them. They are also owned and controlled by the members. However, differences manifest in their organizational characteristics. Livelihood CAIs operate as informal self-help groups, have small membership sizes, cohere and operate within kinship ties and neighbourhood settings. The livelihood CAIs engage in promoting the households' socio-economic resilience stock through engaging in livelihood-enhancing activities in pooling of savings, sourcing of credit either internally or with bank linkages and providing informal insurance. Members contribute to the savings and credit sourcing kits on a weekly or monthly basis depending on their needs and abilities. The efficiency CAIs on the other hand operate formally in mergers either as cooperatives or as unions. They are well-socially networked with public and private entities in expanding their asset base and market portfolio.

The efficiency CAIs practice market-oriented production and they seek to mitigate the transaction costs along the value chains and in markets through collective sourcing of inputs, value addition and collective marketing. Stringent production standards are employed and additional services such as technical training are provided. Therefore, members incur costs including membership subscriptions, share contributions and capital in meeting production and marketing necessities. Compared to the efficiency CAIs, the livelihood CAIs require less capital outlay and therefore are dominated by the majority of the less resource-endowed households and women. The livelihood CAIs exhibit high levels of bonding social capital while efficiency CAIs are characterised by high bridging social capital. The livelihood and efficiency CAIs have been dominant among Kenyan smallholder households for decades (Republic of Kenya, 2017), but the extant studies have barely compared their influence on women empowerment.

Thirdly, this study employs a Women Empowerment in Agriculture Index (WEAI), an internationally authenticated survey tool based on the measures of women's

inclusion, empowerment and agency, based on their adequacy in 10 sub-domains that are clustered into five domains of agriculture namely production, resources, income, time and leadership (Sraboni & Quisumbing, 2018; Quisumbing *et al.*, 2021). Production concerns women's decision-making on agricultural production and autonomy, resources entail women's ownership and control of assets and credit. Income involves women's control over household incomes, time captures women's allocation of time across domestic and productive work and satisfaction with leisure. Leadership concerns women's leadership position in social and economic groups and comfort in speaking in public (section 2.2.3). It is expected that the heterogeneity of the socio-economic characteristics of the households and CAIs may pose non-monotonic effects on women's empowerment across the sub-domains. Thus, this study unpacks how the efficiency and livelihood of CAIs affect women's empowerment across the empowerment sub-domains.

An unpacking analyses-based approach would unearth the areas of the greatest and/or lowest empowerment gaps and their causal-effect relationships with livelihood and efficiency CAIs. This is an important step in identifying where synergies and trade-offs exist to close women empowerment gaps in optimising women's empowerment outcomes. Fourthly, contrary to the extant studies that used either qualitative (Mudege *et al.*, 2015; Badejo *et al.*, 2017) or quantitative approaches (Alemu *et al.*, 2018; Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021) in fragments. This study uses a quantitative approach based on a MVP that allows us to consider the determinants of non-mutually dichotomous statuses of women empowerment across the efficiency and livelihood CAIs. In addition, while the existing quantitative studies employ matching methods, this study employs a METE model. The model allows us to unravel how livelihood and efficiency CAIs influence women empowerment outcomes. In addition, the METE model can adequately control for endogeneity problems arising as a result of reverse causation of collective action and women empowerment (Deb & Trivedi, 2006a). The model also provides a real delineation of how the linkages between the observed and unobserved household characteristics and the organizational attributes of the two forms of CAIs affect empowerment outcomes. The qualitative approach in the study provides an in-depth exploration of the underlying systemic and structural gender dynamics underpinning

households and community (in collective action) and their influence on women empowerment.

Based on the rich group-level and household-level data from the smallholder households from the central region of Kenya, the study will address three research questions: 1) What is the effect of participation in livelihood versus efficiency CAIs on women empowerment? 2) Do the women empowerment effects differ between efficiency CAIs and livelihood CAIs? 3) How do household socio-economic characteristics affect women empowerment across the efficiency and livelihood CAIs? The insights of the study are useful in providing evidence-based and context-gender-sensitive collective action policies and program design. The next sub-section presents the context of women empowerment and collective action in Kenya, the nexus between collective action and empowerment of women and the conceptual framework. Section two presents the methodology including the study area, data collection, empirical estimation strategies and measurement of variables. Section three presents the results while section four discusses the results. Section five highlights the conclusion and the policy implications.

5.1.1 The nexus between collective action and women empowerment

Although the term empowerment is has numerous interpretations and conceptualizations (Kabeer, 1999; Akter *et al.*, 2017). Figure 5.1 shows the key elements of empowerment of women. In this study, the elements of women empowerment include agency, achievements and resources (Kabeer, 1999). Resources are human, social and economic materials that enhance the capability to exercise choice. Agency is the capacity for ‘self-determination’ in defining one’s goals and acting upon them and it is operationalised as ‘decision-making’ power. Both resources and agency define people's capabilities, which is, of living a life that they have a purpose to value (Galiè *et al.*, 2019). Achievements means the extent to which the individuals’ potential is realized. Empowerment in agriculture is referred to as one’s ability to make decisions on aspects of agriculture and one’s access to social and economic resources important to implement and actualise those decisions (Akter *et al.*, 2017).

This study lays its conceptual foundation on the intra-household production model. This approach underpins the perception of a gendered economy that contradicts the

assumption of gender impartiality of the economy (Duflo & Udry, 2016). The intra-household production model refutes the neoclassical economic assumption of unitary household models to collective household models (Chiappori, 2014). While the unitary approach assumes that resources are allocated based on a joint utility function, collective models allow for inequalities in intra-household decision-making power in the household (Kabeer, 1999). The collective models assume that household members possess varied bargaining and power preferences. Bargaining power is contingent upon the relative resources a woman can control independently or jointly with other household members (Kabeer, 2016). The convergence of these models is that shifts in individual-specific control of resources translate into changes in bargaining power and hence shifts in intra-household resource allocation patterns (Badejo *et al.*, 2017). Collective action provides three key interlinked instrumental aspects that can shift the intra-household bargaining power of women.

First, collective action facilitates in provision of public goods such as information, market linkages, technical training, credit and extension and advisory services that directly impact women's assets, livelihoods and lives (Sulemana *et al.*, 2020). Secondly, collective action presents opportunities for association that would enable women to exercise voice, agency within the household and the community (Ravichandran & Farnworth, 2021). Community association also creates an environment for explicitly challenging social behaviours and norms that constrain women's agency in households and public domains (Alemu *et al.*, 2018).

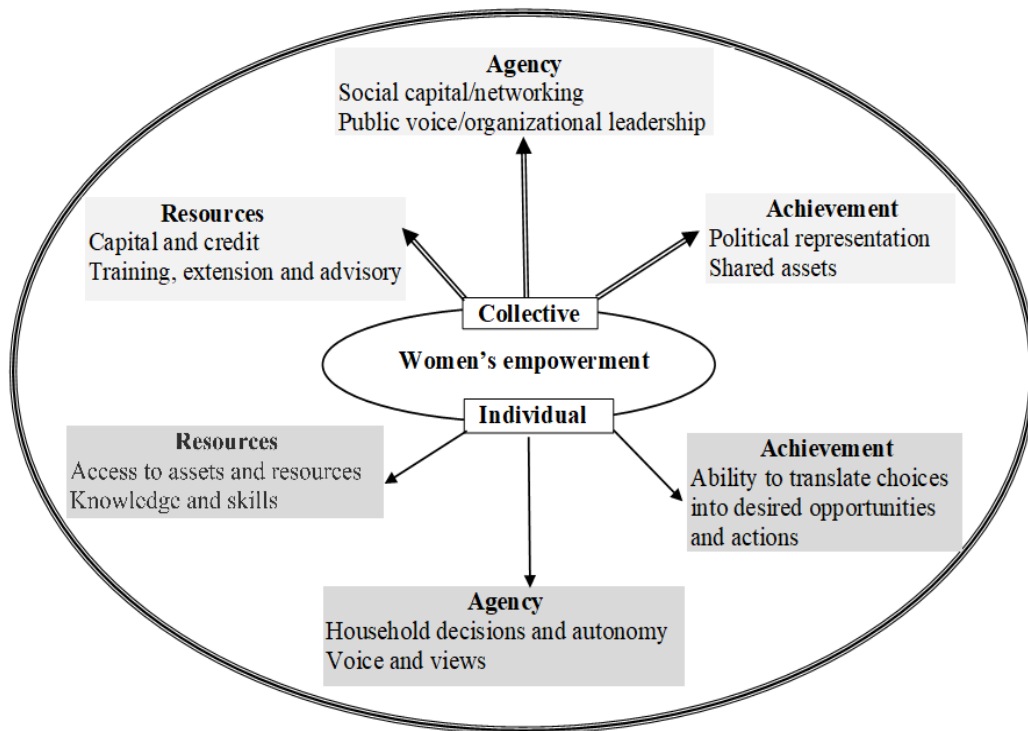


Figure 5.1.: Key elements of women empowerment

Source: Authors' conceptualization

Several studies have been conducted to assess the effect of collective action on women empowerment. In India, Ravichandran & Farnworth (2021), found that participation in women-only groups enhances women's decision-making on income use. The empowerment effect was a result of the skills, training and leadership skills acquired from active participation in a group. However, the empowerment in control over incomes was skewed towards women who were educated, with higher social status and who had experienced more control over dairy incomes prior. On the other hand, women in mixed-gender groups did not show any effect on control over incomes because of the top-down approach employed by the mixed cooperatives which made it difficult to challenge the existing social norms. Women in women-only groups experienced increased mobility as a result of female leadership that took into consideration of women's needs in its group operations such as scheduling of meetings and training.

Mwambi *et al.* (2021) assessed the empowerment effect of membership in processing and bargaining PO in the Kenyan milk value chain. The authors found that general household membership in both producer organizations increased women's decision-making in control of resources, sale and purchase of land and cows, production, use

of credit and control of dairy income. However, household membership in both producer organizations did not have any effect on ownership of land and cattle due to entrenched norms in the ownership of livestock. The bargaining POs enhanced the decision making of women on the sale and purchase of cattle while processing POs did not have any effect on these domains. The finding might be attributed to women's limited membership in processing POs due to their high costs of participation. Dohmworth & Hanisch (2018) assessed the effects of collective action on WE in India by comparing mixed-gender and single-sex groups. The authors reported that compared to mixed-gender groups, members in women-only groups reported enhanced decision-making in control over the use of incomes, participated more in training and meetings and had lower time use, however, they did not increase their leisure time. The improved time use was attributed to improved labour allocation and the adoption of technologies in farming that reduced women's workload. Women in women-only cooperatives enhanced women's land ownership while some women in mixed-gender cooperatives owned land registered under their names.

In Ethiopia, Alemu *et al.*, (2018) the SHG improved women's collective power but failed to translate to individual empowerment notably in the control over income and resources. This was attributed to intensified efforts of males to assert control over household resources and incomes thus leading to the 'backlash effect.' The study by Fischer & Qaim, (2012b) in Kenya, based on cross-sectional data from small-scale banana producing smallholder farmers, showed positive WE in incomes. From the findings, group membership increased female-controlled income share, when women participated in mixed groups. Oxfam (2013) conducted a study on the effect of various collectives on WE in Ethiopia, Mali and Tanzania. In Mali, women increased their mobility as a result of numerous activities involved in production and marketing processes leading to high opportunity costs of time. The study further showed that while women in mixed groups enhanced their participation in group activities, they faced technical barriers in collective marketing. Similarly, in Mali, despite the strong social cohesion in informal groups that intensified women participation in collective marketing, they did not benefit the same extent as men due to technical and social barriers as well as time constraints.

However, the long history of local social networks increased the norms of reciprocity and interpersonal trust, thus permitting greater participation of women in leadership

positions which provided an enabling environment for government support. The mixed findings on the effect of collective action on women empowerment can be explained by the underlying varying contexts and social norms of the communities and the socio-economic attributes of the households (Dohmwirth & Hanisch, 2018; Ravichandran & Farnworth, 2021).

The study contributes to this discourse by examining how the effect of collective action participation influences women empowerment and whether the effects are dependent upon the type of CAI or the organizational characteristics of the CAIs. Figure 5.2 shows the conceptual framework. The study hypothesises that the socio-economic households' demographics, incomes and assets, institutional and infrastructural factors and farm and farming factors and empowerment gaps differentially influence the farmers' adaptation of transaction cost-reducing mechanisms across the efficiency and livelihood CAIs. The divergent transaction cost-reducing mechanisms are manifested in the organizational characteristics of the efficiency and livelihood CAIs.

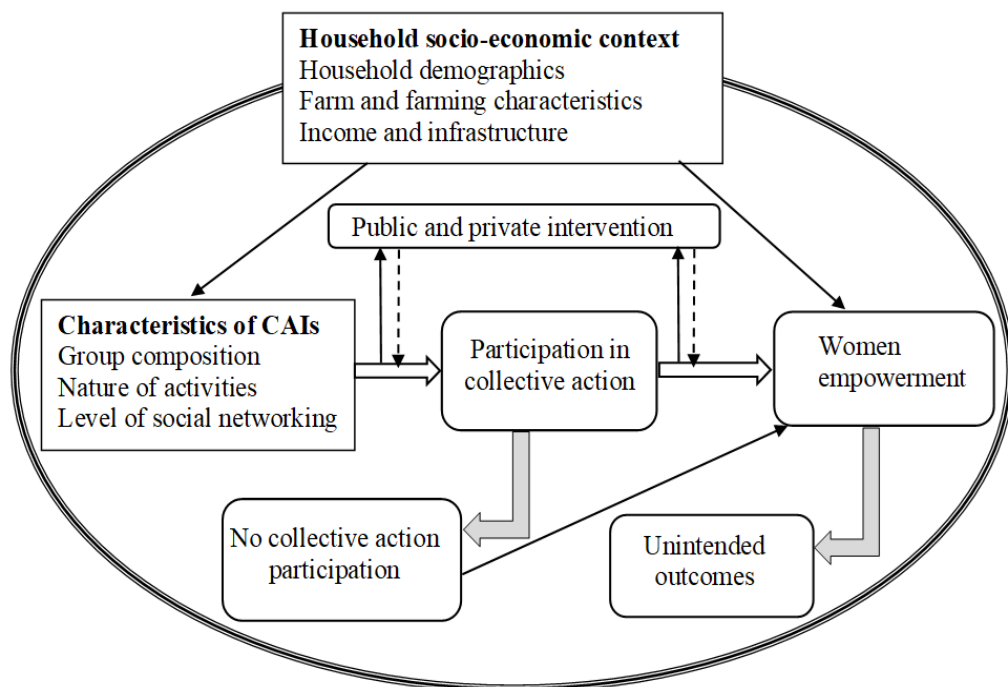


Figure 5.2: Conceptual framework linking collective action and women empowerment

Source: Authors' conceptualization

The varietal transaction cost-reducing mechanisms are in turn expected to pose differential cost challenges and trade-offs) and benefits (opportunities and synergies)

across the households. Therefore, it is expected that the nature and extent of women empowerment leveraged are not homogeneously distributed across the livelihood and efficiency CAIs. The empowerment outcomes include unintended outcomes including backlash of women, engendering and reinforcement of gendered social norms at the intrahousehold and community levels. Explanatory variables affecting women's empowerment were drawn from the reviewed literature herein. Arrows indicate the cause-effect relationship between independent and dependent variables.

5.2 Methodology

5.2.1 Study area and data collection

The study was done in Murang'a County within the Central region of Kenya. The county lies between latitudes of 0° 34' South and 1° 7' South and Longitudes 36° East and 37° 27' East. The county constitutes of seven sub-counties namely: Gatanga, Kiharu, Kangema, Kandara, Kigumo Maragua and Mathioya. It covers an area of 236 km² of which 193 km² is utilised for agriculture (Murang'a County, 2019). The county is dominated by agricultural CAIs that account for almost 65 per cent of the aggregate membership of CAIs in Kenya. A total of 532 households were drawn from both collective action member and non-member households using multistage and proportionate sampling approaches. In the stage one, two sub-counties were selected i.e. Kandara and Gatanga following their predominance of the CAIs. In the stage two, five wards were proportionately and randomly selected namely, five wards and two wards from from Kandara and Gatanga sub-counties respectively.

In the third stage, several CAIs were proportionately and randomly sampled to ensure the representativeness of the CAIs in the county. Following the lists generated by the ward agricultural officers, we randomly sampled 353 collective action members and 179 non-members. A well-designed and structured questionnaire was used to collect cross-sectional data from the respondents. In addition to ten focus group discussions and two key informant interviews were collected using interview guides. The qualitative data was analysed according to the themes using excel. The interviews targeted only the dual-headed households with adult men and women spouses present. The data collected included socio-economic demographics, farm and farming characteristics, assets and incomes, infrastructural and institutional factors and women empowerment indicators. Before data collection, a research permit was

issued from the NACOSTI. An informed consent was obtained from all the respondents to grant their permission for the interviews.

5.2.2 Multivariate probit model

A multivariate probit model is applied to jointly analyse the determinants of women empowerment across the sub-domains for the efficiency and livelihood participating households while allowing for unobservable disturbances to be correlated freely (Greene, 2016). This is through accounting for the unobserved correlations or interdependence of the non-mutually exclusive binary outcomes (empowered versus disempowered) of the women's empowerment across the sub-domains across the efficiency and livelihood CAIs. A woman's empowerment in one domain is conditioned by empowerment statuses of other empowerment sub-domains due to their interdependence either by conferring complementary, synergistic or spillover effects (captured by positive correlation) or as substitutes by posing trade-offs across the sub-domains (captured by negative correlation).

A woman is likely to be empowered or not as a result of participating in the j^{th} CAI or not, where j^{th} is the choice of efficiency or livelihood CAIs. Let K_j denote the empowerment status of a given sub-domain associated with the participation of the j^{th} CAI and K_0 otherwise. Based on the conceptual framework, determinants of women empowerment across the two forms of CAIs are correlated with contextual factors including farm and farming factors, household demographics, and institutional and infrastructural factors as expressed in Equation (5.1).

$$Y_{ipj}^* = X'_{ip}\beta_j + \varepsilon_{ip} \begin{cases} 1 & \text{if } Y_{ipj}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (j=\text{PR, AS, IC and WK}) \quad 5.1$$

where, Y_{ipj}^* is a binary latent dependent variable indicating the empowerment status of the i^{th} woman as regards to the j^{th} collective action form, X'_{ip} is a vector of contextual factors related to the i^{th} woman. As indicated in Equation (5.1), four distinct MVP were estimated for the women empowerment domains of production (PR), asset ownership (AS), income control (IC) and workload (WK). The descriptions of the factors are shown in Table 5.2. β_j is a set of the study parameters, and ε_{ip} are the normally distributed error terms each having a mean of zero, and

variance-covariance matrix Y , where Y takes values of 1 on the diagonal correlations $p_{LE} = p_{EL}$ as off-diagonal elements (Greene, 2012) as expressed below:

$$\begin{bmatrix} 1 & \rho_{PR,AS} & \rho_{PR,IC} & \rho_{PR,WK} \\ \rho_{AS,PR} & 1 & \rho_{AS,IC} & \rho_{AS,WK} \\ \rho_{IC,PR} & \rho_{IC,AS} & 1 & \rho_{IC,WK} \\ \rho_{WK,PR} & \rho_{WK,AS} & \rho_{WK,IC} & 1 \end{bmatrix} \quad 5.2$$

The ρ (rho) denotes the pairwise correlation of the random effects of the women's empowerment equations estimated in the model. The parameters of the model are estimated using the simulated maximum-likelihood method (Greene, 2012). The validity of the MVP was tested using the LR test in checking the null hypothesis that there are no correlations across the error terms $p_{21} = p_{31} = p_{41} = p_{32} = 0$. This suggests that the use of MVP is appropriate in this context.

5.2.3 Multinomial endogenous treatment effects model

To estimate the influence of collective action on women empowerment we employed we applied the METE (Deb & Trivedi, 2006a). METE is appropriate because it uses a two-step joint estimation process in addressing endogeneity problems arising from the reverse causality between women's empowerment and collective action participation. The first step entails a multinomial logit model that estimates the households' collective action participation decisions across the livelihood and efficiency CAIs. The second step is a METE that evaluates the effect of collective action participation on women empowerment. A household has two choices of CAI namely efficiency and livelihood. METE framework presumes that households are rational and will choose a CAI that maximises their expected utility as shown below:

$$U_{ij}^* = z_j' \alpha_i + \sum_{k=1}^J \delta_{ik} l_{kj} + n_{ij} \quad 5.3$$

where U_{ij}^* is the expected utility associated with i (i =livelihood and efficiency) to household j . z_j' is the vector of variables expected to affect women empowerment such as farm and farming characteristics, household demographics, asset endowments, incomes and institutional and infrastructural factors. α_i denotes estimated parameters related to hypothesised socio-economic factors affective

participation decisions of each group i . n_{ij} is the identically and independently distributed error terms aligning to CAI i and household j . l_{kj} represents the latent factor accounting for unobserved factors associated with household j that affect collective action participation decisions and women empowerment effect. Following Deb & Trivedi (2006b), The treatment probability follows a mutually exclusive choice as expressed below:

$$\Pr (C_{ij} | z_j' | l_j) = g \left(z_j' \alpha_1 + \sum_{k=1}^J \delta_{1k} l_{kj} + z_j' \alpha_2 + \sum_{k=1}^J \delta_{2k} l_{kj} + \dots + z_j' \alpha_1 + \sum_{k=1}^J \delta_{Jk} l_{kj} \right) \quad 5.4$$

where i are non-members of the two CAIs where $U_{ij}^* = 0$. While U_{ij}^* is unobservable, it can be denoted as a set of binary variables c_j and it can be designated by a vector $c_j = c_{j1}, c_{j2}, c_{j3} \dots c_{jJ}$. $l_j = l_{j1}, l_{j2}, l_{j3} \dots l_{jJ}$. g denotes a multinomial probability distribution whereby a MNL can be written as follows:

$$\Pr (c_{ij} | z_j' | l_j) = \frac{\exp(z_j' \alpha_1 + \delta_j l_{ij})}{1 + \sum_{k=1}^J \delta_{ik} \exp(z_i' \alpha_i + \delta_i l_{ji})} \quad 5.5$$

On Equation (5.5), c_{ij} is the probability of the household choosing a CAI based on socio-economic characteristics z_i of the i th farmer and unobservable factors l_{ij} with their relative loadings δ_j which represents the unobserved heterogeneity of the efficiency and livelihood CAIs that affect their respective utilities. The expected outcome of women empowerment is estimated by METE in the second equation as shown in Equation (5.6).

$$E (y_i | c_j x_j | l_j) = z_j' \beta + \sum_{i=1}^J Y_i c_{ij} + \sum_{i=1}^J \lambda_i c_{ij} \quad 5.6$$

y_i is the women empowerment outcome; x_j are the vector of exogenous covariates with their associated estimators β . Y_i represent the treatment effects of participating in CAIs ($i=1,2$) compared to the non-members ($i=0$). Collective action participation

is endogenous and presumes that c_j is exogenous, the equation would yield biased estimates of Y_i . Therefore, there is a need to perform the test for exogeneity of the women empowerment outcomes in Equation (5.7). When the factor-loading parameters (λ) are either negative or positive, the treatment and the outcome are also negatively or positively correlated with unobservable characteristics that indicate a positive or negative selection with the treatment and its associated parameters. Since the choice of a CAI is endogenous, the factor-loading parameters could be inconsistent and biased. We address the endogeneity issue using the exclusion restriction instrumental variables approach (Habiyaemye *et al.*, 2023). The instrumental variables must meet the following criteria: They must be sufficiently correlated with treatment choice variables (z_i); they should not be correlated with unobservable variables influencing the outcome (l_i) and they must not be correlated with women empowerment y_i except through collective action participation variables (z_i) (Magambo *et al.*, 2022).

The instrumental variables that met these conditions include access to electricity, and information, communication and technology (ICT). The instrumental variables were validated by implementing the likelihood ratio test of their joint significance. Since the multinomial logit model assumes that the likelihood of any collective action participation outcomes is determined independent of any other available choices, we test for independence of irrelevant alternatives (IIA) using the Hausman test (Deb & Trivedi, 2006b). We also conducted a test of exogeneity of treatment which tests for the joint hypothesis that the loading parameters (λ) for the livelihood and efficiency CAIs are jointly equal to zero ($\lambda_{\text{livelihood}}=0$) and ($\lambda_{\text{efficiency}}=0$) respectively as follows:

$$\begin{aligned} \text{scalar LR} &= 2 * (e(2ll) - e(ll_{\text{exog}})) \\ \text{scalar p} &= 1 = \chi^2(2, \text{LR}) \end{aligned} \tag{5.7}$$

The test follows $\chi^2(p)$ distribution, where p is the number of λ of treatment equations, which in this case are 2 namely efficiency and livelihood CAIs with the base category being non-members.

5.2.4 Measurement of outcome variables

The treatment variable in the study entails empowerment of women. Women empowerment is measured by indicators termed as domains that are further

categorised into sub domains. Table 5.1 shows the women empowerment domains with their indicators and inadequacy weights. WEAI is a survey-based index reported at the regional or country-level, based on individual-level data collected through interviews in dual-headed households where both man and woman partners are present. WEAI measures the five domains of empowerment namely, production, income, resources, leadership and time. Production and income sub-domains are indicators of power of decision-making over livestock and farming and control over household expenditures and income and autonomy in production. Resources measure an individual's access to, ownership of, and decision-making power over resources such as livestock, land, credit, consumer durables and agricultural equipment and control over household credit. Leadership is a measure of holding leadership positions in economic and social groups or within the community. It also entails women's comfort in speaking in public. Time captures the allocation of time among the domestic, caregiving and productive tasks and satisfaction with leisure. The empowerment domains take a binary value of zero if a woman is adequate or 1 if a woman has achieved adequacy. Adequacy in workload is achieved if a woman spent ≤ 10.5 hours on the day following the survey and 0 otherwise. Adequacy in the five empowerment domains including production, resources, income, leadership and time. Overall women empowerment index was not generated.

Table 5.1: Empowerment dimensions, indicators, survey questions, method of aggregation, and inadequacy cut-off

Domain	Sub-domain	Survey questions	Aggregation method	Inadequacy cut-off
Production	Input in production decisions	How much input a woman has in making decisions about food cropping, cash crop farming and livestock raising? To what extent do you feel you can make your own decisions about food cropping, cash crop farming and livestock raising	Achievement in two	Inadequate if: a woman engages but does not have some input in decisions, or she does not make the decisions nor she could.
	Production autonomy	Regarding food crops, cash crops and livestock farming I act the way I do to prevent others from thinking poorly of me.	Achievement in at least one	Inadequate if always true.
Resources	Asset ownership	Do you own any agricultural land, mechanized equipment, large consumer durables, large livestock, small livestock, poultry	Achievement in any but not small assets-poultry, consumer durables and non-mechanized equipment	Inadequate if owns the asset but she does not own it jointly or solely
	purchase, transfer and sale of assets	Who would you say can decide most of the time whether to sell, give away, loan or rent agricultural land, mechanized equipment, large consumer durables, large livestock, small livestock, poultry	Inadequate if the household owns a specific asset but she does not engage in any decisions about it.	Adequate if she makes at least one decision jointly or solely except on poultry and no-mechanized equipment
	Access and control over credit	Has anybody in your household acquired any loans or borrowed cash/in-kind in the past one year from mobile money or credit from CAIs?	Achievement in any	Inadequate when household has no access to credit; used credit but woman did not make any decisions on the credit
Income	Decision making on income	How much input a woman has in decisions on the use of income earned from non-farm economic activities and agricultural activities?	Achievement in any exempt minor expenditures in household	Inadequate when a woman engages in an activity but has no input about the income earned from the activity.
Leadership	Group membership	Does the woman hold any leadership positions in the social or economic groups or in the community?	N/A	Inadequate if does not hold any leadership position

	Public speaking	Do you feel comfortable in speaking up in public about anything important to you, your family or your community?	N/A	Inadequate if not comfortable in speaking in public
Time	Workload	Twenty-four-hour recall on time spent in productive, domestic and caregiving activities.	Workload = time used in primary activity +(0.5) time used on childcare.	Inadequate if worked for >10.5 hours on the previous day
	Leisure	Generally, how satisfied are you with your time for resting	N/A	Inadequate if not satisfied

Source adapted from (Akter *et al.*, 2017)

5.2.5 Measurement of treatment variables

The treatment variables of the study include whether a household participates or not in either efficiency CAIs or livelihood CAIs. The two forms of collective action differ in their socio-economic characteristics as discussed in section 1.2.

5.3 Results

5.3.1 Descriptive statistics of the households

The descriptive statistics of the households among the members of efficiency and livelihood CAIs are shown in Table 5.2. The non-members sampled constituted of 108 households while the livelihood and efficiency member households were 196 and 49 respectively. The findings show that compared to the livelihood group members, the members of the efficiency CAIs were older, more educated, and had larger farm sizes with longer farming experience. In addition, the efficiency members had more accessibility to information and extension contacts. The members of efficiency CAIs had more access to bank accounts implying access to financial services. The bank accounts are important in transacting in collectively sourcing inputs and receiving

Table 5.2: Descriptive statistics of the households

Variable name	Livelihood (1)	Efficiency (2)	Mean Difference (2) –(1)
Age	54.71	62.27	3.62***
Household education	2.49	2.87	1.33
Dependency ratio	1.13	0.78	-1.88***
Household size	4.14	3.29	-2.83***
<i>Farm and farming factors</i>			
Farm size	0.98	1.47	2.90***
Livestock holdings	2.00	2.16	0.35
Labour	0.85	1.03	1.78*
Farming experience	20.68	23.53	1.26
<i>Income, assets and wealth</i>			
Farm income	23475.24	23409.90	-0.01
Household income	4.51	5.86	1.12
Income sources	0.12	1.39	0.72
Off-farm income	0.59	0.33	-3.32***
Wealth index	2.05	1.96	-1.16
Asset endowments	127447.20	157210.20	0.41
Bank account	0.43	0.90	-6.24***
<i>Infrastructure and institutions</i>			
Tarmac	1.72	1.98	1.05
Market	3.35	3.09	-0.78
Credit	0.64	0.49	-1.90
Information	2.42	3.67	6.09***
Extension	3.40	3.28	-0.40
Extension contacts	1.00	3.39	4.85***
ICT	0.38	0.43	0.57

Km=kilometres; ICT=information, communication and technology;
Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Source: Authors' field data

payments for the collective sales made. The livelihood members on the other hand had more dependants and engaged more in off-farm economic engagements. The differences between livelihood and efficiency CAIs suggest that there is a bias in selection. Failure to consider this selection bias could imply that we would underestimate or overestimate the effect of collective action on empowerment of women.

5.3.2 Descriptive statistics of the women empowerment sub-domains

Figure 5.3 presents the results comparing the women empowerment domains disaggregated among the non-members, efficiency and livelihood members. From the graph, livelihood members showed higher adequacy in almost all domains except workload, closely followed by non-members and members of the efficiency CAIs who had the lowest empowerment adequacies in all the domains. Compared to the members of the efficiency CAIs and livelihood members, the non-members had lower workloads, spending less than 10.5 hours on domestic and productive tasks. A similar pattern was observed on women's satisfaction with leisure time. About 52% of the women in livelihood CAIs reported being satisfied with their leisure time against 35.7% and 12.3% of the women non-members and efficiency members respectively. About 43% of the livelihood group's women showed adequacy in their time use compared to 11.8% of the women members in efficiency CAIs. On production, about 57% of the women belonging to livelihood CAIs were empowered in decision-making about agriculture compared to the non-members (30.6%) and members of the efficiency CAIs (12.3%). There was a huge disparity in women's empowerment in autonomy in production wherein 61.2% of the women in livelihood CAIs had autonomy in production compared to the non-members and efficiency members at 26.4% and 12.3% respectively. Concerning asset ownership 44.9% of the women non-members and members of the livelihood CAIs. Efficiency CAIs showed the least proportion of women owning assets. Large differences were observed on women's control over household assets where the women who were empowered in decision-making over assets constituted 54.3%, 36.7% and 9% of the livelihood CAIs, non-members and efficiency members respectively.

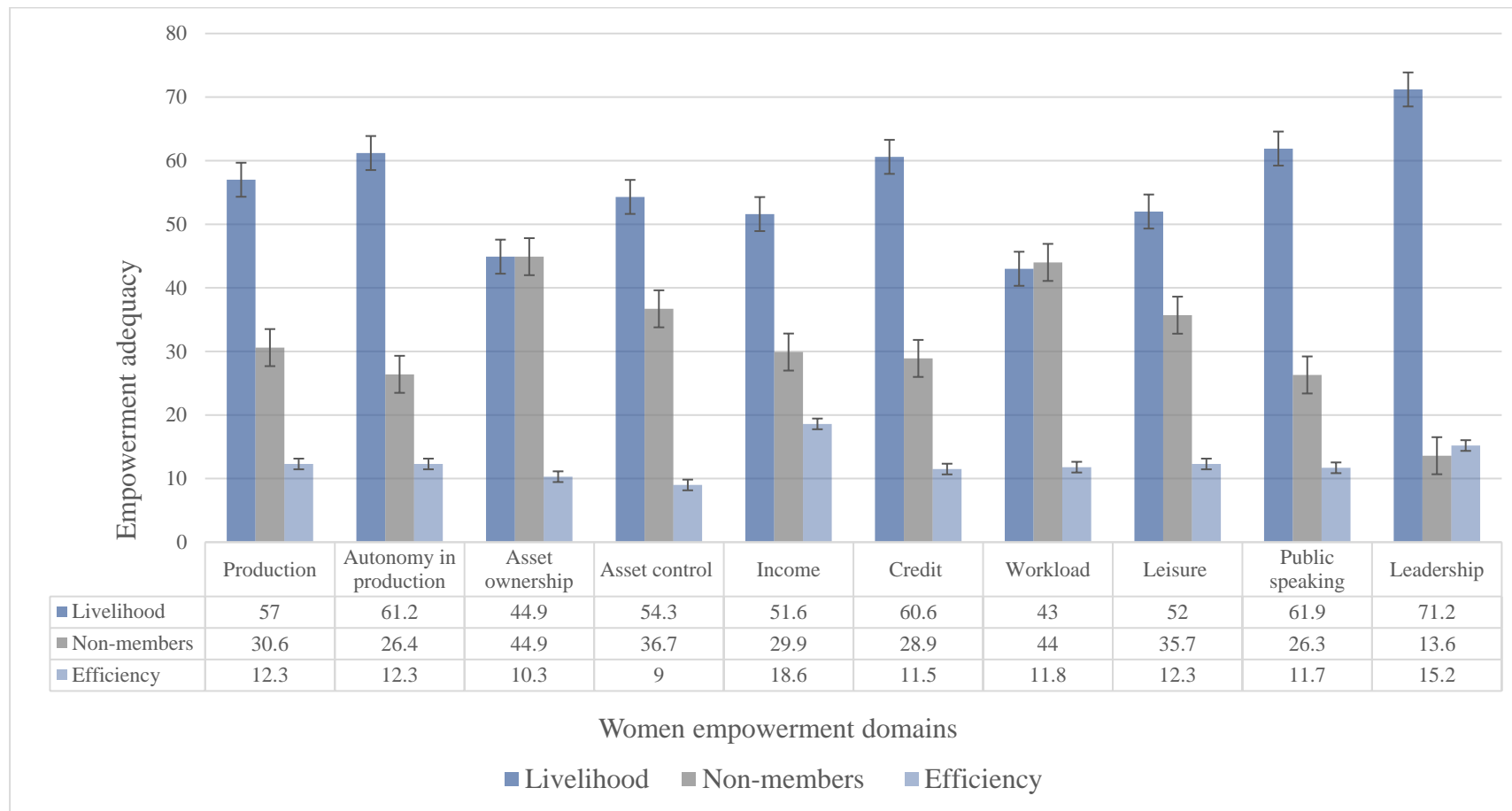


Figure 5.3: The status of women empowerment

Source: Authors' field data

About 60.6% of the women whose households had membership in livelihood CAIs participated in making decisions over credit whereas the non-members and livelihood CAIs constituted 28.9% and 11.5%. On community leadership, a larger proportion of women belonging to the livelihood CAIs were empowered in their comfort in speaking in public and taking leadership positions in the community.

5.3.3 Determinants of women empowerment across collective action initiatives

Table 5.3 and Table 5.4 present the multivariate probit results for the determinants of women empowerment across the efficiency and livelihood CAIs respectively. These findings delineate the determinants of the differences in the empowerment domains. Before analysis, the multicollinearity test and the variance inflation factor were calculated and the VIF was 1.62, which was less than the threshold of 5 thus we rejected the hypothesis that multicollinearity inflates the variance of the predictors (Greene, 2016). The Wald chi-square statistics were significant at confirming the appropriateness of disaggregating the women empowerment domains over bundling the domains into a single empowerment index denoted as a dummy variable of whether a woman is empowered or not. The correlation of error terms is significant at 1% level, therefore the study rejects the null hypothesis that there is no correlation of error terms. As indicated, the LR for efficiency and livelihood CAIs is significant, therefore the study rejects the null hypothesis of zero covariance of error terms across the model equations. Age had a positive relationship with women's decision-making over incomes among the efficiency CAIs but age did not have any correlation with women's control over incomes among the livelihood CAIs.

Regarding education, it revealed a negative correlation with women's workload among the livelihood members but education did not show any association with women's workload among the efficiency CAIs. Education also positively influenced women's decision-making in production among the efficiency members. However, education did not show any relationship with women's production decisions among the livelihood CAIs. Education showed a negative association with women's control over assets among the efficiency CAIs while it did not show any effect on women's decision-making over assets among the livelihood CAIs. Farm size is incentivising production. The results show that livelihood and efficiency participating households with larger farm sizes increased women's control over incomes.

Table 5.3: Determinants of women empowerment among the efficiency CAIs

	Production			Asset ownership			Income control			Workload		
	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z
Age	-0.018	0.116	0.119	0.013	0.011	0.224	0.011	0.012	0.376	-0.009	0.013	0.487
Education	0.132	0.149	0.378	-0.080	0.138	0.563	0.060	0.140	0.665	-0.300*	0.167	0.072
Farm size	-0.190	0.130	0.144	-0.151	0.121	0.211	0.341***	0.129	0.008	-0.313*	0.174	0.072
Farming experience	0.007	0.010	0.468	0.006	0.010	0.582	0.001	0.011	0.935	0.003	0.0110	0.758
Labour	0.218	0.135	0.106	-0.228	0.157	0.147	0.149	0.124	0.229	-0.479**	0.203	0.018
Off-farm income	-0.146	0.205	0.475	0.044	0.217	0.841	-0.473**	0.219	0.031	-0.584**	0.252	0.021
Bank account	-0.105	0.207	0.612	0.243	0.204	0.234	0.025	0.217	0.908	0.116	0.240	0.630
Market	0.113*	0.063	0.074	-0.028	0.062	0.656	-0.015	0.067	0.827	0.005	0.707	0.944
Tarmac	-0.071	0.075	0.345				0.150*	0.084	0.076	0.099	0.096	0.305
Constant	0.119	0.704	0.865	-0.917	0.703	0.192	-1.467**	0.714	0.040	0.924	0.769	0.229
<i>Regression diagnostics</i>												
Wald chi ² (65)	77.60											
Prob > chi ²	0.000											
Log pseudolikelihood	375.57											

*** p< 0.01, ** p< 0.05, * p< 0.1

Coef=Coefficient; SE=Standard error

Source: Authors' field data

Table 5.4: Determinants of women empowerment among the efficiency CAIs

	Production			Asset ownership			Income control			Workload		
	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z	Coef.	Robust SE	P > z
Age	-0.029	0.031	0.342	0.045	0.036	0.216	0.082***	0.031	0.008	-0.070	0.058	0.223
Education	0.551*	0.329	0.092	-1.463**	0.622	0.019	-0.119	0.265	0.652	-0.111	0.380	0.770
Farm size	0.357	0.241	0.138	-0.338	0.520	0.516	0.622***	0.211	0.003	0.395	0.237	0.096
Farming experience	0.001	0.025	0.964	0.014	0.023	0.548	-0.056**	0.023	0.013	0.040	0.046	0.375
Labour	-0.351	0.408	0.390	-0.056	0.516	0.913	0.615	0.412	0.136	0.227	0.579	0.696
Off-farm income	0.402	0.547	0.463	0.953	0.794	0.230	0.039	0.533	0.941	-1.125*	0.618	0.069
Bank account	0.244	0.503	0.628	0.557	0.523	0.287	1.158**	0.523	0.027	0.834	0.915	0.362
Market	0.102	0.148	0.493	-0.367	0.289	0.108	0.015	0.158	0.925	0.150	0.207	0.468
Tarmac	0.175	0.212	0.408				0.390*	0.230	0.091	-0.478*	0.249	0.055
Constant	-0.961	1.686	0.569	-0.489	2.244	0.827	-4.908**	2.123	0.021	2.056	2.164	0.342
<i>Regression diagnostics</i>												
Wald chi ² (65)	249.06											
Prob > chi ²	0.000											
Log pseudolikelihood	-76.044											

*** p< 0.01, ** p< 0.05, * p< 0.1

Coef=Coefficient; SE=Standard error

Source: Authors' field data

Availability of labour among the livelihood members reduced women's workload while labour did not show any influence with women's workload among the efficiency collective action members. Off-farm income is a diversification strategy for the households and it showed a negative association with women's workload for both livelihood and efficiency CAIs. The efficiency members that had off-farm income showed women's increase in workload, however, off-farm income did not have any effect on women's workload. Accessibility to the tarmac road was positively correlated with women's control over incomes for the livelihood and efficiency of CAIs. However, the efficiency of CAIs that had good accessibility to the tarmac road showed a negative correlation with women's workload. Similarly, access to the market increased women's decision-making power over production among the livelihood CAIs, however, the efficiency of CAIs did not have any relationship with women's production decisions. Ownership of bank accounts was negatively linked with women's control over incomes among the efficiency CAIs but it did not show any effect on women's decision-making over incomes among the livelihood CAIs.

5.3.4 Effect of collective action on women's empowerment

Table 5.5 reports the results on the effect of participation in efficiency and livelihood typologies on empowerment of women across the domains following household participation across the efficiency and livelihood CAIs. The Hausman test for checking IIA was not significant, therefore we reject the null hypothesis that the IIA assumption was violated. The likelihood ratio test ratio of the instrumental variables is significant ($F \geq 16.31$), a value which is more than 10 (Greene, 2016), making the instrumental variables appropriate. The Hausman test was used to crosscheck for the independence of IIA, which was not significant, indicating no evidence that the IIA assumption was violated (Greene, 2016). The exogeneity test of the treatment variable employing the likelihood test ratio across all the women empowerment domains was performed.

The value of the likelihood ratio test was significant across all the domains ($p < 0.10$) therefore we rejected the null hypotheses of exogeneity and concluded that the treatment variable across all the women empowerment domains was endogenous.

Table 5.5: Women empowerment effects across the efficiency and livelihood CAIs

	Efficiency			Livelihood		
	Coefficient	SE	P value	Coefficient	SE	P value
<i>Production</i>						
Production	-0.107***	0.003	0.000	0.276***	0.005	0.000
Production autonomy	-0.256***	0.005	0.450	0.288***	0.004	0.000
λ production decisions	0.417***	0.001	0.000	-0.284***	0.002	0.000
λ Autonomy in production	0.420***	0.001	0.000	-0.297***	0.002	0.000
<i>Resources</i>						
Asset ownership	-0.424***	0.008	0.019	-0.406***	0.005	0.486
Asset control	-0.484***	0.011	0.020	0.060***	0.016	0.430
Credit control	-0.275***	0.003	0.000	0.353***	0.003	0.000
λ Asset ownership	0.256***	0.003	0.000	0.336***	0.002	0.362
λ Asset control	0.387***	0.002	0.000	-0.193***	0.006	0.000
λ Credit control	0.393***	0.001	0.000	-0.220***	0.001	0.000
<i>Income</i>						
Income control	0.407***	0.002	0.000	0.280***	0.002	0.000
λ Income control	-0.358***	0.000	0.000	-0.292***	0.000	0.000
<i>Time</i>						
Workload	0.305***	0.004	0.000	-0.169***	0.002	0.000
Leisure	-0.151***	0.003	0.000	0.278***	0.002	0.000
λ Workload	-0.364***	0.001	0.000	0.151***	0.001	0.000
λ Leisure	0.141***	0.001	0.000	-0.441***	0.001	0.000
<i>Leadership</i>						
Public speaking	0.084***	0.002	0.000	-0.193***	0.002	0.000
Leadership	0.087***	0.014	0.000	-0.162***	0.007	0.000
λ Public speaking	0.147***	0.001	0.000	-0.451***	0.001	0.000
λ Leadership	0.027***	0.003	0.000	0.335***	0.003	0.000

400 Halton sequence-based quasirandom draws per observation used

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1; Reference category = Non-members

Relative to non-members, efficiency CAIs reduce women's decision-making in agriculture by 10.7% while livelihood CAIs increase women's decision-making in production by 27.6%. The coefficient on the lambda of the production decisions was significant and positive for efficiency CAIs implying that households that select to participate in efficiency CAIs based on their unobserved socio-economic attributes are more likely to improve women's decision making in production. The lambda of the production on the livelihood CAI was negative implying that household's participation in livelihood CAIs based on unobservable characteristics would reduce the decision making of women in production. Regarding autonomy in production, compared to non-members, participation in efficiency CAIs showed a positive effect on women's independent decision-making in agriculture. On the other hand, the livelihood CAIs increase women's independence in production by 28.8%. The lambda on autonomy in production shows participation in efficiency CAIs based on unobservable attributes would increase women's independent decision-making in agriculture. The livelihood CAIs show that unobserved characteristics that affect participation in livelihood CAIs are likely to reduce women's autonomy in production.

Regarding resources, participation in efficiency and livelihood CAIs reduced the chances of women's ownership of assets by 42.4% and decision-making over assets by 40.6%. On asset control, while efficiency CAIs showed a negative effect on women's decision-making about assets, livelihood CAIs had a positive effect on women's control of assets. The coefficient for the lambda on efficiency CAIs was positive and significant for asset ownership implying that participation in efficiency CAIs based on unobservable factors would increase women's ownership of assets by 8.8%. Relative to non-members, efficiency CAIs decreased women's control over credit by 27.5% compared to livelihood CAIs which increased women's decision-making about credit by 35.3%. Based on the lambda of the livelihood CAIs, the findings further show that the unobservable attributes among the livelihood members would increase women's control of credit. However, the unobservable characteristics among the livelihood CAIs are likely to negatively affect women's decision-making over credit.

Concerning income, relative to non-members, participation in efficiency CAIs increased women's control over household incomes by 40.7% and 28% respectively.

An increase in control over income is 12.7% more points among the efficiency members than livelihood CAIs. The lambda for income control on the efficiency CAIs shows a significant and negative coefficient, indicating that the latent characteristics among efficiency members are likely to decrease women's control over income. Similarly, households that participate in the livelihood CAIs on account of their unobservable characteristics are likely to decrease their control over household income. In regard to leadership, women's participation in efficiency groups increased the confidence of women in speaking in public by 0.08% while livelihood groups reduced the confidence of women in speaking in public by 19.3%. Participation in efficiency CAIs had a positive effect on women's leadership roles in the community while the livelihood CAIs revealed a negative influence on women's leadership. Concerning time, participation in efficiency groups increased women's workload by 30.5% while livelihood CAIs reduced women's workload by about 16.9%. Similarly, efficiency CAIs reduced the satisfaction of women with their leisure time by 15.1%, while livelihood groups increased the satisfaction of women with their leisure time by 27.8%.

5.4 Discussion

5.4.1 Determinants of women empowerment across collective action initiatives

Age was positively correlated with women's control over incomes among the efficiency CAIs but it did not have any association with women's decision-making over incomes among the livelihood CAIs. The descriptive statistics confirm that members of efficiency CAIs are older than members of the livelihood CAIs. Age is an indicator of endowment in physical, human and social capital that can boost women's decision-making skills over income (Diirro *et al.*, 2018). Education showed a negative association with women's workload in livelihood CAIs, however, education did not show any correlation with women's workload among the members of efficiency CAIs. Education enhances the abilities to perceive, understand and interpret information which leads to women making informed choices on the distribution of their workload. Educated women members of the efficiency CAIs showed higher decision-making power in production. This finding is plausible and consistent with Gyau *et al.* (2016) who found that education in collective market-oriented production is important in adhering to the stringent production standards and marketing procedures.

On the other hand, the educated livelihood women members did not show any change in decision-making on production. This could be explained by the dominance of subsistence-oriented production that did not require many skills. In addition, due to smaller farm sizes, most of the members of livelihood CAIs engaged in off-farm wage activities. Access to the market increased women's decision-making on production in livelihood CAIs, however, efficiency CAIs did not show any association between market access and production decisions. This finding is similar to Dohmwirth & Hanisch (2018) that with greater importance of agriculture to the household and increased formalized market transactions men take control over farming.

On women's control over assets, education showed a negative association with women's decision-making on assets among the efficiency members, but it did not show any effect on women's control of assets among the livelihood CAIs. This finding can be explained by the social norms underpinning women's control over assets in SSA societies. As women become more educated men tend to be more assertive in controlling assets in securing their position as the heads and providers of the households (Alemu *et al.*, 2018). This finding contradicts Hoop *et al.* (2019) that educated women are more likely to gain more control over household assets. The livelihood and efficiency of members with larger farm sizes increased women's control over incomes. Farm size is related to a higher degree of commercialization which heavily involved women in providing labour for both production and marketing leading to spillover effects on control over household incomes generated from agriculture. These results contradict Fischer & Qaim (2012) that women's control over incomes was greatly reduced as a result of the intensified commercialization of bananas among large-sized farms.

Ownership of bank accounts reduced women's control over incomes among the efficiency CAIs, but bank accounts showed no correlation with women's decision-making power over incomes among the livelihood CAIs. The result is in tandem with Alemu *et al.* (2018) that as agricultural transactions become more formalized, men assert their control. The availability of farm labour among the livelihood members reduced women's workload, however, labour was doing not influence with women's workload among the efficiency CAIs. The availability of farm labour among the livelihood members reduces the burden of women due to their engagement in productive, reproductive, domestic and off-farm economic activities (Komatsu *et al.*,

2018). Both efficiency and livelihood CAIs showed that off-farm income increases women's workload. Off-farm income increases opportunity costs of time for women by posing more demands on their labour in diversifying their household livelihoods. This finding aligns with Fischer & Qaim (2014) that economic off-farm engagements increase women's time use in addition to the labour-intensive standardised production.

The field interviews show that members of both CAIs were engaging in either collective or individual entrepreneurial economic activities such as motorbike transport businesses, knitting and dress-making businesses and value addition. While the households belonging to the efficiency CAI emphasised the importance of off-farm incomes in smoothing capital constraints for market-oriented production the livelihood members reported that off-farm income cushions the households by smoothing incomes and consumption during food shortfalls. The off-farm incomes were also paramount in supplementing household incomes given that the livelihood members had smaller farm sizes and practised subsistence-oriented production. The efficiency CAIs that had accessibility to the tarmac road showed a negative correlation with women's workload. Accessibility to the tarmac road is an indicator of transaction costs for output and input market engagement (Gyau *et al.*, 2016). Therefore, proximity to the tarmac reduces the time and transaction costs of transporting both farm outputs to the market and inputs to the farm.

5.4.2 Women empowerment effects across livelihood and efficiency typologies

Livelihood members were likely to have more decision-making power on production closely followed by non-members and efficiency CAIs that showed a small proportion of women participating in making decisions over production. The livelihood CAIs improve decision-making in agricultural production by 27.6% while livelihood CAIs reduced women's decision-making power in production by 10.7%. The findings can be attributed to the fact that women in livelihood participated more in subsistence and food crop farming contrary to the efficiency CAIs that practice more of cash crop market-oriented production that was perceived as a male domain. The decision-making in production was more pronounced for educated women who participated in agricultural market. The results align with Alemu *et al.* (2018) and Fischer & Qaim (2012) that the social norms that limited women's decision-making

on production led to men taking over control from women as the household's production shifts from subsistence-based to market-oriented.

Regarding the autonomy in production, efficiency CAIs had negative effects on women's autonomy over production. However, livelihood CAIs positively impacted women's autonomy over production. In efficiency CAIs, most of the training and market days were attended by men, limiting women's opportunities for implementing the lessons learnt in meeting the market production requirements. The high opportunity costs of time-constrained women's participation in technical training and market days give men autonomy in production over women (Nakazi *et al.*, 2017). On the other hand, women's dominance in livelihood CAIs and their roles in safeguarding household food security confers the autonomy of women in production which was manifested in their preference for subsistence food-self-sufficiency production, unlike men who tend to be skewed to household income-enhancing production of cash crops. In regards to assets, the livelihood and efficiency of CAIs negatively influenced the ownership and decision-making of women over assets. While the livelihood members enable women to acquire assets, the assets are perceived as belonging to men.

Participation in efficiency CAIs and livelihood CAIs reduced women's control over household production assets by 63.3% and 17.6% respectively. The negative effect on control over assets was lower by 46.7% more in efficiency CAIs. The social norms in Kenya that men are the household heads and make key decisions on resource allocation limit women's control over assets. As women become more educated, men assert more control over assets due to the perception that education empowers women to become a threat to men's position as household heads and providers. Additionally, market-oriented production requires assets as a form of capital (Fischer & Qaim, 2014) and as men engaged in economic activities, in this case efficiency-enhancing activities, they asserted more control over assets because they felt that their role as household providers was threatened (Alemu *et al.*, 2018). However, among the livelihood CAIs women gain some autonomy over assets especially the poultry and goats which are acquired either on a reciprocal basis among the members or as collective investments.

Otherwise, large production assets such consumer durables such as televisions and sewing machine and large livestock belong to men. On credit control, participation

in efficiency CAIs increased women's credit control by 27.5% while efficiency CAIs lowered women's decision-making over credit by 35.3%. These assertions can be confirmed by the larger proportion of livelihood members who reported adequacies in control over credit than efficiency CAIs. The financial services provided by the livelihood CAIs including the pooling of savings and sourcing of credit influence women's household decision-making and autonomy over credit. Participation in efficiency and livelihood CAIs increased women's control over household income. However, the effects for efficiency CAIs were larger by 19.9% more points than the livelihood CAIs. In particular, larger effects on control over income among the efficiency CAIs were observed among the older women with larger farm sizes and access to bank accounts and tarmac roads. Among the livelihood members, women with larger farm sizes and access to tarmac experienced more decision-making powers over income. This result is contrary to Alemu *et al.* (2018) that as women engaged in the collective sale of apples, men asserted more control over assets.

Concerning the workload, the efficiency members reported higher workloads than the livelihood members. Participation in efficiency increased workload. The same observation is affirmed by the satisfaction of women with their leisure time, where efficiency and livelihood groups reduced women's leisure time. Efficiency groups are labour demanding in attending technical training, market days, extension and advisory services and on-farm labour in producing market-oriented standardized products. However, education, farming experience, availability of farm labour and engagement in off-farm income facilitated in reducing women's workload. The livelihood CAI reduced women's workload and increased their satisfaction with leisure time because the livelihood groups constituted majorly of women, who scheduled their group activities at their own convenient times. In both forms of CAIs, households' engagements in off-farm economic activities increased women's workload. Regarding women's comfort in speaking in public, efficiency members had a positive effect on women's comfort in speaking in public while livelihood negatively influenced women's confidence in speaking in public.

Similarly, efficiency had a positive effect on women's comfort in leadership in the community while livelihood CAIs had negative effects on women's leadership. This is because, in efficiency CAIs, women exercised their agency in associating with their male counterparts in decision-making and the sharing of knowledge, skills and

experiences within the groups had spillover effects to the wider community. Additionally, women's engagement in multiple activities and interactions with trading partners, and public and private supporting agencies improved women's social capital, social skills, production and marketing skills improved women's leadership skills. The focus group discussions revealed that in as much as social norms limited women from holding leadership positions, the women perceived as confident and with leadership skills were selected for leadership positions. This was confirmed in some efficiency CAIs that had elected women in leadership positions across the entire cooperatives, both at the village level and up to top management levels. In general, efficiency CAIs delivered synergies in women empowerment across the domains of income and leadership while livelihood CAIs were effective in empowering women in the domains of income, time use and production. To tap the opportunities of the collective action in empowering women it is important to optimise the synergies and minimise the trade-offs across the CAIs through gender mainstreaming and other policy interventions as discussed in the next section.

5.4.3 Synergies and trade-off effects of collective action on women empowerment

Aligning with the hypothesis of the study, collective action can facilitate or debilitate women's empowerment based on the context-specificity of the socioeconomic characteristics of the households and CAIs. These results support the previous studies (Badejo *et al.*, 2017; Diiro *et al.*, 2018; Dohmwirth & Hanisch, 2018; Mwambi *et al.*, 2021; Ravichandran & Farnworth, 2021), suggesting the presence of synergies or spill over effects and trade-offs across the sub-domains. Table 5.6 shows the synergies and trade-offs of empowerment of women effects across the sub-domains following participation in efficiency and livelihood CAIs. The efficiency CAIs showed the trade-off effects across the domains of production decisions, autonomy in production, asset ownership, asset control, credit control, workload and leisure while the synergies were observed across the sub-domains of income control, public speaking and membership in groups. Concerning livelihood CAIs, the synergies were accrued across the sub-domains of production decisions, autonomy in production, asset control, credit control, income control, workload and leisure. However, the trade-off effects were manifested in asset ownership, public speaking and membership in groups.

The synergies imply that the systemic and structural power dynamics across the efficiency and livelihood CAIs differentially influence women’s empowerment. Therefore, the synergistic effects are not guaranteed nor the trade-offs are irremediable. For instance, unlike the livelihood CAIs, the trade-off effects were more dominant in efficiency CAIs.

Table 5.6: Trade-off and synergistic women empowerment effects

Domain	Efficiency	Livelihood
Production decisions	○	+
Autonomy in production	○	+
Asset ownership	○	○
Asset control	○	+
Credit control	○	+
Income control	+	+
Workload	+	○
Leisure	○	+
Public speaking	+	○
Membership in groups	+	○

Source: Authors’ field data

This pattern could be explained by women’s exclusion as exhibited by the dominance of men in efficiency CAIs that probably facilitate in engendering the already existing social norms and attitudes that could limit women’s recognition and representation in improving their collective and intrahousehold agency. In addition, the low bonding social capital among the efficiency CAIs debilitates the groups’ reciprocity incentives and cohesiveness subsequently impedes the transformation of the existing gendered social norms. Due to time constraints, the efficiency of CAIs’ operation on a large-scale limits women’s opportunity for improving their agency that can accrue as a result of attending meetings, market days and training.

The study recommends multiple possible policy targeting interventions that may strengthen the synergies while counteracting the trade-offs along the linkages between collective action and women empowerment. The multiple policies would provide complementarities, synergies and spillover effects in concurrently empowering women and developing the CAIs. First, there is a need to improve infrastructure notably tarmac roads to minimize the transaction costs of accessing markets in improving the agency and access to resources of women. Secondly, the study recommends that further recommends that the mixed-gender groups that are

better targeted to the needs of women may increase women's empowerment through providing group micro-credit schemes, transport services and input acquisition to ease some of the women's constraints. Thirdly, there is a need to carry out gender awareness and gender sensitisation training to help reverse and transform the gendered social norms in women's decision-making and equitable intrahousehold labour allocation. Otherwise, participation in collective action may not lead to women's empowerment if the underlying social issues that lead to gender disparities are not addressed.

Fourthly, the private and public partnerships supporting the CAIs need to uphold participatory learning and action in the collective laying of strategies and actions. This would facilitate improving gender relations through providing a levelled ground and a safe space for both women and men. Additionally, the policymakers and development partners need to be aware of the potential synergies and trade-offs in designing the collective action and program design that seeks to empower women. Finally, there is a need to pair or complement collective action with other community development programs that seek to empower women for optimal women's empowerment outcomes.

5.5 Conclusion and Policy Implications

This study explored the effects of heterogeneity of livelihood and efficiency CAIs on empowerment of women across the domains of production, resources, income, time and leadership. The study shows that the efficiency and livelihood of CAIs can facilitate or debilitate women's empowerment depending on the context-specificity of the attributes of the households and the CAIs. The statuses of women empowerment across the domains in the two CAIs were heterogeneously influenced by varied household characteristics including farm size, off-farm income, age, education, market, bank account and tarmac road. The women empowerment outcomes were also heterogeneously across the sub-domains. The efficiency of CAIs empowered women through the synergies of control over income and membership in groups but negatively influenced women's making on production, autonomy in production, household income, workload and leisure. The livelihood CAIs empowered women through the synergies of improving women's sole decision-making on production, autonomy in production, asset ownership, income control,

workload and leisure. Both CAIs failed to challenge the traditionally existing gender inequalities in asset ownership.

In contributing to development policy, the study suggests some policies and interventions that are context-specific with the two forms of CAIs. The multiple policies would be important in strengthening the synergies while minimising trade-offs across the empowerment domains for optimal women empowerment outcomes. Furthermore, the multiple policies would provide spillover, synergies and complementary effects that can concurrently facilitate in developing the CAIs while empowering women. The results of this study challenge the studies that either focus on one specific CAI, arbitrarily pooling different forms of CAIs or aggregating the women empowerment domains over disaggregating the indicators into sub-domains. We argue that these approaches provide an in-depth and informed insight into understanding women's empowerment. Nonetheless, this study relied on cross-sectional data that did not capture the complex and dynamic transformations of the CAIs and the gender dynamics and their effects on empowerment of women over time. Furthermore, the highly context-specific nature of these findings calls for broad-spectrum studies to extend the empirical findings in broader different socio-economic settings. This would help in designing collective action policies and programs that are appropriate towards empowering women.

CHAPTER SIX

Women's Empowerment Through Collective Action Boosts Household Food Security Among Smallholder Farmers in Central Kenya: Rethinking the Entry Points Beyond One-Size-Fits-All Approach

Abstract

Achieving optimal household food security (HFS) outcomes and equity in the distribution of nutritional benefits within the household, there is a need to pair women empowerment programs and other agricultural intervention programs. This study seeks to fill a gap in the literature by assessing the moderating effect of collective action on empowering women in influencing household food security (HFS). The study employed a mixed method approach and endogenous switching regression model based on the household-level and group data drawn from the smallholder households in Murang'a County, Kenya. The study compared two typologies of collective action initiatives (CAIs) namely efficiency and livelihood. The results revealed that in the pooled sample, women's empowerment in production, income and asset ownership had a positive effect on HFS. However, workload and public speaking revealed negative effects on HFS. On the efficiency CAIs, except production, the negative effects were observed across the sub domains of income control, asset ownership, workload and public speaking. The findings further revealed that among the livelihood CAIs, production and public speaking income control and workload positively influenced household food security and asset ownership negatively influenced HFS. The varying effects of HFS across the women empowerment sub domains suggest that trade-offs and synergies exist. The synergies and trade-offs are dependent on the socio-economic context-specificity of the CAIs. Therefore, the application of a 'one size fits all' solution is inadequate in designing the nutritional and collective action policies and program design. The study contributes to knowledge in new institution economics and suggests multiple gender-sensitive and nutrition-sensitive policies that can confer spillover effects, complementarities and synergies in addressing the triple objectives of developing the CAIs, improving women empowerment and HFS.

Keywords: Collective action, women empowerment, household food security, endogenous switching regression.

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6.1 Introduction

In Kenya, despite improved food production coupled with a reduction in food Import Dependency Ratio (IDR), chronic food insecurity remains a developmental challenge affecting 26.9 per cent of the country's population (Food and Agriculture Organization, FAO, 2023; Kenya National Bureau of Statistics, KNBS, 2023). Similar to other sub-Saharan African (SSA) countries, a strong gender perspective has been associated with food insecurity (Lutomia *et al.*, 2019; Kassie *et al.*, 2020).

This has led to a renewed interest in developing agriculture as a source of inclusive socio-economic growth and food security specifically from a women's empowerment perspective. The rationale for focusing attention on gender inequality in agriculture is underpinned on collective household bargaining models which postulates that households' decision-making on the allocation of resources does not follow a unitary pattern (Duflo & Udry, 2016; Quisumbing & Maluccio, 2000). The intrahousehold distribution of resources depends on the preferences and bargaining power of individuals, leading to gender gaps in the distribution and control of resources (Molina *et al.*, 2022).

For instance, considerable gender inequalities exist in the agricultural sector in terms of asset ownership, control of productive resources and inputs and returns generated from agriculture (Aziz *et al.*, 2022; Ayamga *et al.*, 2023; Lufuke *et al.*, 2023). Additionally, engagement of women in production, reproduction and domestic roles increases their opportunity costs of participating in extension and advisory services, collective action groups and income-generating opportunities (Njuki *et al.*, 2022). The agricultural market failures such as asymmetric information and high transaction costs coupled with poorly developed infrastructural systems, geographical dispersion and policy inadequacies expose women to risks of being marginalized further (Sulemana *et al.*, 2020). In SSA, such evident underlying gender disparities are a cause and outcome of the disproportionate population of women suffering severe food insecurity representing 10.6% compared with 9.5% of men (FAO, 2023). In addition, women's low socio-economic status and gender gaps in vulnerability and adaptation to covariate and idiosyncratic shocks, food production, household incomes and livelihoods and access to healthcare services contribute to food insecurity and diet-related diseases (Ayamga *et al.*, 2023).

Empowering women is critical especially in SSA given that women constitute up to 70% of the labour force in agriculture, accounting for about 65% of the food consumed in the region through engaging in crop and livestock production, post-harvest management, trade and marketing (Gomez *et al.*, 2020; Lufuke *et al.*, 2023). Women also safeguard food security and nutritional options for their households through their participation in the non-farm sector in small entrepreneurial undertakings and wage employment to generate incomes for their households' dietary needs (Njuki *et al.*, 2021; Quisumbing *et al.*, 2021). Additionally, women perform

tasks including caregiving, food preparation and provisioning, and community activities such as collective action (Padmaja *et al.*, 2019). Despite the low socio economic status of women, they still reinvest as much as twice more of their earnings as men in their households' well-being in aspects of education, food and healthcare (Kehinde *et al.*, 2021). Against this background, tackling food insecurity and malnutrition through women's empowerment via agricultural development interventions has been at the forefront as a global priority and as a critical issue of the African Union's nutrition strategy of the 2015 to 2025 policy dialogue (Mobarok *et al.*, 2021). Most importantly, to ensure the optimality of HFS outcomes and equity in the distribution of nutritional benefits within the household, there is a need to pair women empowerment programs and other nutrition-specific interventions. This would help to identify and develop nutrition-sensitive interventions and monitor the impact of agricultural interventions to empower women.

Recently, there has been a growing emphasis on research seeking an in-depth understanding and clarity on the relationships between agriculture, agricultural development interventions and/or nutrition-specific programs and their casual-effect relationships on household food security (HFS) from the gender lens. For instance, Heckert *et al.* (2019) study in Burkina Faso employed context-appropriate measures of empowerment, experimental trials and structural equation modelling and found that empowering women in purchasing decisions and healthcare decisions through a nutrition-sensitive program reduced child wasting. In Africa and Asia Quisumbing *et al.* (2021) study in Asia and Africa based on WEAI through a nutrition-sensitive intervention found that women's workload, satisfaction with leisure time, overall empowerment score and greater intra-household gender equality were correlated with children's nutritional outcomes. However, women's empowerment accounted for a small proportion of variations in nutritional outcomes where women's age and education, household wealth, institutions and gender norms accounted for the largest variance in women's dietary diversity and HFS. In addition, women's workload, and satisfaction with leisure were correlated with better nutritional outcomes. However, women's long working hours increased women's energy expenditure compromised with women's nutritional status.

Ayamga *et al.* (2023) study in Sierra Leone advocates that empowerment of women through natural resource management and nutrition intervention improved food

security and nutrition due to women's increased decision-making and an alteration in social settings where men took part in domestic household tasks. In Nigeria, Kehinde *et al.* (2021) reported that women's empowerment through enhancing the laws on security of land tenure and property rights was correlated with HFS. In the study, women's workload, control over assets and income, group membership, and overall gender parity positively reduced the severity of household food insecurity. However, women's decision-making on household credit and production increased the severity of food insecurity. Additionally, household heads with more extension contacts, crop diversity and larger share of farmland on purchase increased the likelihood of being food secure, large farm sizes were associated with increased severity of food insecurity. In Kenya, Kassie *et al.* (2020) employed context-specific women empowerment indicators using (WEAI) and found that empowerment of women paired with adoption of technology optimally improved women's dietary intake.

In Malawi, Ragasa *et al.* (2019), explored the effects of gender parities on access to agricultural information and their effects on HFS. The study reported that education assets, livelihood supplementary strategies and access to information correlate with HFS. However, lower nutritional status was observed among the female-headed households due to difficulties in accessing markets, organizations, labour and income-generating opportunities. In dual-headed households, attending technical training increased women's opportunity costs of time limiting the implementation of the lessons learnt. The studies report inconclusive and heterogeneous findings and recommend the need for more similar future studies that employ context-specific empowerment domains and suitable approaches for analysis to unveil the hypothetical underlying cause-effect associations. These studies focus on the integration of women in value chains (Njuki *et al.*, 2021), nutrition-specific interventions including Feed the Future Initiative (Quisumbing *et al.*, 2020, 2021), Enhanced Homestead Food Production (Heckert *et al.*, 2019); technological adoption (Kassie *et al.*, 2020) and natural resource management (Ayamga *et al.*, 2023). The current study uses data collected in 2022 from the farmers in Murang'a County in the central region of Kenya to assess the effect of empowerment of women on HFS in combination with collective action participation.

The importance of collective action underpins its concerted, multi-faceted and synergistic integral roles in supporting smallholder farmers through ameliorating the

public intervention gaps, policy inadequacies and market failures (Hintz & Pretzsch, 2023; Kwizerimana *et al.*, 2023). This study conducted in Kenya revealed that based on economic functions, collective action initiatives (CAIs) can be classified into two categories namely efficiency and livelihood CAIs. The efficiency CAIs focussed on reducing transaction costs in marketing and production through collective input sourcing and collective output marketing. The livelihood CAIs engaged in livelihood-enhancing and risk-reduction activities through pooling of savings, provision of informal insurance, reciprocal asset acquisition and sourcing of credit either through the group or through bank linkages. The efficiency CAIs constitute the minority of the membership (17.6%) while the livelihood CAIs account for the majority of the membership (82.4%). This is because the latter: requires huge capital outlay to invest in efficiency-enhancing activities; and is prone to risks such as high rejection of farm produce due to the failure to meet the required production standards; defaulting of the contractual agreements by the potential buyers and; mismanagement and corruption. While the livelihood CAIs are dominated by women, and exhibited low levels of formalization and high social capital, the efficiency livelihoods were dominated by males, operated on a wider geographical scale, were highly formalized and showed high bridging social capital.

This study was succeeded by another more recent exploration of the effect of efficiency and livelihood CAIs on empowerment of women employing the WEAI domains of resources, time, production, income and leadership. The study revealed mixed and inconclusive findings wherein the statuses of women empowerment were heterogeneously influenced by the socio-economic attributes of the CAIs and the households. The livelihood CAIs showed a positive influence on women's decision-making on production, time and income while the efficiency CAIs improved women's leadership and decision-making on income. However, both livelihood and efficiency CAIs failed to improve women's access to and control over resources. Another succeeding study explored the effects of the livelihood and efficiency CAIs on HFS through production and income. The results revealed that membership in both livelihood and efficiency had a positive effect on HFS. While efficiency CAIs showed a negative effect on HFS, livelihood CAIs translated to HFS. On the combined pathways, the livelihood CAIs showed larger effects compared to the efficiency CAIs due to the trade-offs observed along the income and production pathways.

The study attributed the differentials in HFS outcomes to the heterogeneous organizational attributes of the CAIs and the socio-economic characteristics of the households. The two studies conclude that the effects of collective action on women's empowerment and HFS are context-specific. Despite the insights, the studies took a disjointed approach that does not holistically take into account the relationship between women empowerment, collective action and HFS. This study therefore interrogates how women's empowerment influences HFS through the moderating effects of collective action participation. The study underpins a proposition that collective action is an intervening factor that alters, by improving HFS due to the synergies and spill over effects accrued along the nutritional pathways of income, production and women empowerment itself. The study contributes to extant literature in several ways. First, the very few reviewed studies that have explored how women's empowerment affects HFS do not control for potential heterogeneity which can lead to inconsistent findings and generalizations. Potential endogeneity can arise as a result of reverse causality when similar variables that influence HFS may also influence empowerment of women, yielding inconsistent estimates and generalizations. Other than Heckert *et al.* (2019) who used experimental data, other studies applied correlations rather than causal effects in estimations (Sraboni & Quisumbing, 2018; Galiè *et al.*, 2019; Quisumbing *et al.*, 2020, 2021). Following Kassie *et al.* (2020), this study controls for potential endogeneity issues by applying an endogenous switching regression approach.

Secondly, this study acknowledges one extant study that explored whether collective agricultural commercialization has moderates on women's status in influencing the relationship between empowerment of women and HFS (Fischer & Qaim, 2012a). The study reported that collective action had a negative effect on women's control over incomes, and this did not have any effect on household calorie consumption and a negative relationship on dietary quality. The study concluded that negative control over income outcomes of collective action was countered when women become members themselves, and the positive effects were larger among the most-resource constrained women. Unlike this study, the current study focused on agricultural commercialization collective action groups, this study will disentangle and test for the interactions between participation in efficiency and livelihood CAIs and empowerment and HFS status. This approach unearths how the socio-economic

heterogeneities and context-specificity conditions their collective strategies in agricultural undertakings to moderate the effects of HFS through women empowerment.

This argument is based on the hypothesis that households are not homogenous in their demographics, resource endowments and utilization, needs, social-networking patterns, and intra-household and inter-household empowerment gaps (Min-Han Tsai & Yir-Hueih, 2022). Therefore, the households adopt differential transaction-cost mechanisms in capturing the available market and technological adoption opportunities as well as coping mechanisms to agricultural shocks and risks (Habiyaemye *et al.*, 2023). These heterogeneities are reflected in the organizational characteristics of the CAIs such as gender composition, level of formalization, functions, level of social capital and social networking. The heterogeneities of the households and CAIs pose different costs (challenges and trade-offs) and benefits (synergies and spillover effects) that would lead to win-loss, win-win or loss situations on the nature and extent of HFS leveraged. These concepts have remained obscure in literature resulting in the arbitrary bundling of both the collective action and nutrition-specific promotional policies into a one-size-fits-all model. This approach makes it difficult to disentangle how the interventions would respond from the promotional policies and households' investments in influencing the HFS benefits leverages vis-à-vis the promotional policies and household investments these two interventions might need to optimise the HFS outcomes.

Thirdly, the study (Fischer & Qaim, 2012a) focused on only a single women empowerment indicator-income, which does not reflect the full conceptualization of women empowerment. This study employs WEAI, an internationally validated survey-based index tool that measures women's inclusion, agency and empowerment, following their adequacy scores in 10 sub-domains clustered into five domains of agriculture, namely resources, production, leadership, income and time (Sraboni & Quisumbing, 2018; Quisumbing *et al.*, 2021) (Table 1). Production captures women's decision-making and autonomy in agricultural production. Resources concern women's ownership of assets, control of assets and credit control. Income is associated with women's control over household income. Leadership measures women's leadership position in the CAIs and community and comfort in speaking in public. Time entails women's allocation of time on domestic and

production tasks and satisfaction with leisure. It is expected that the heterogeneity of the socio-economic characteristics of the households and CAIs can pose variations on the nature and extent of the HFS outcomes accrued across the sub-domains. Thus, this study unpacks the effects of women's empowerment across the sub-domains for the livelihood and efficiency participating households. An unpacking analyses approach would uncover the areas of the lowest and/or HFS gaps and their causal-effect relationships with the efficiency and livelihood CAIs.

Lastly, the reviewed studies employ either quantitative (Fischer & Qaim, 2012; Sraboni & Quisumbing, 2018; Heckert *et al.*, 2019; Kassie *et al.*, 2020; Quisumbing *et al.*, 2021) or qualitative (Ayamga *et al.*, 2023) methods in isolation. This study employs mixed quantitative and qualitative approaches in exploring the importance of gender dynamics in moderating the collective action effect on women's empowerment and the consequent HFS benefits. This study contributes to the discourse of collective action, women empowerment and HFS by addressing four research questions: First, what is the effect of women empowerment on HFS? Second, how does collective action influence HFS? Third, how does collective action moderate the influence of women empowerment on HFS? Fourth how do the HFS effects differ across the efficiency and livelihood CAIs? The study is important in identifying where trade-offs exist and synergies to close women empowerment gaps for improved HFS outcomes. This would help in formulating evidence-based and context-specific nutrition-sensitive agricultural policies and programs.

6.1.1 The status of household food security in Kenya

Kenya's 2010 constitution articulates that every individual (including children) has the right to food in acceptable quantity and quality (Republic of Kenya, ROK, 2010). In the country, the overall self-sufficiency ratio (SSR) of food increased from 88% in 2020 to 90% in 2021 (KNBS, 2022). Over the same period, the total IDR of food declined to 12.7 per cent from 14.5 per cent in 2020 (KNBS, 2022). Despite that, the Global Hunger Index (GHI) report ranks Kenya as at a level of alarming hunger country with a GHI Score of 22 (Global Hunger Index, 2023). In the country, 27.8% of the population experience undernourishment, 17.6% and 4.9% experiencing children under five years exposed to stunting and wasting (FAO, 2023) (Table 6.1). The food poverty incidences in Kenya are so high with about 81.1% of the population

being unable to pay for a healthy diet (FAO, 2023). In the country, 1 out of 3 people subsist on less than the required daily capita calorific threshold of the recommended 2250 kilocalories, a trend that has been on the upturn by about 8.8% between the years 2014 to 2022 (FAO, 2023; KNBS, 2022). The food poverty incidence disproportionately affects rural areas where 38.9% of the people lives below the poverty line, and 24.4% in the urban areas (KNBS, 2022).

Table 6.1: Status of food security in Kenya

Food insecurity or malnutrition	Percentage
Undernourishment	27.8
Severe food insecurity	26.1
Obesity among adults	7.1
Anaemia among women of reproductive age	28.7
Wasting of children (< five years old)	4.9
Stunting of children (<five years old)	17.6
Overweight of children under five	3.8
Low birthweight	10
Exclusive breastfeeding of infants	31

Source: (FAO, 2023; KNBS, 2022).

In the country, there are significant disparities in food and nutritional security indicators across the 47 counties depending on their agro-ecological zones, weather patterns as well as technological and infrastructural developments (KNBS, 2018). In Kenya’s Vision 2030 (2018-2022 third term medium plan), the government had committed to reducing food insecurity and malnutrition by 2022. The government seem to have slightly achieved its target notably wasting among children aged under five which slightly reduced by 8 per cent from 2020, and wasting prevalence of 4.9 per cent which was less than the SSA average of 6.0 per cent (FAO, 2023). Macronutrient and micronutrient deficiencies are also prevalent notably Zinc, Iron and among children iodine among children (KNBS, 2018). Among adults, a higher number of women, about 11.1 per cent suffers overweight compared to 2.8 per cent of men (United Nations Children's Fund, UNICEF, 2019). A large share of women of reproductive age of about 28.7 per cent are experiencing anaemia, which is a serious national concern (FAO, 2023).

6.1.2 Collective action, women empowerment and food security-The nexus

Research highlights six main pathways that agriculture influences HFS: first, food availability from own-farm-production; second, income from the selling surplus of agricultural items and earnings from agricultural wage employment; third, variations in food prices attributed to supply and demand forces, and three pathways related to gender including: fourthly, empowerment of women and social status arising from enhanced access and intra-household control over farming resources, income and expenditure on health and caregiving; fifthly, women's balance between time allocated for caregiving, household maintenance and income-earning activities and lastly, women's status of health and nutrition and through engagement in agriculture through contact with toxic farming chemicals and their status of nutritional through energy use (Kassie *et al.*, 2020; Quisumbing *et al.*, 2021). Figure 6.1 presents a framework for exploring the relationships between collective action, empowerment of women and HFS. In the figure, the arrows indicate the effect of the collective action interventions and on the process of empowering women to influence the HFS.

The study identifies four pathways through which women's empowerment through collective action can improve HFS: engagement of women in agriculture to improve production; generating income through the selling of production surplus, group savings, credit and asset accumulation; behavioural change to improve nutrition and health knowledge and awareness and; building social accountability, lobbying and advocacy for the government's health programs that may improve HFS. The framework does not present many intermediaries mutually reinforcing feedback loops. The core components that lead to the achievement of outcomes include acting collectively, leveraging social capital, and promoting empowerment of women as shown in Table 6.2. empowerment of women and its influence on women's access control over resources can be associated with women's agency in decision-making and intrahousehold provision of food. Collective action facilitates access to resources including physical capital (land, livestock, assets), human capital (education) and social capital (participation in groups) (Sraboni & Quisumbing, 2018).

Underpinning the household collective bargaining models, we presume that the resources a woman can control determines her intra-household bargaining power (Padmaja *et al.*, 2019).

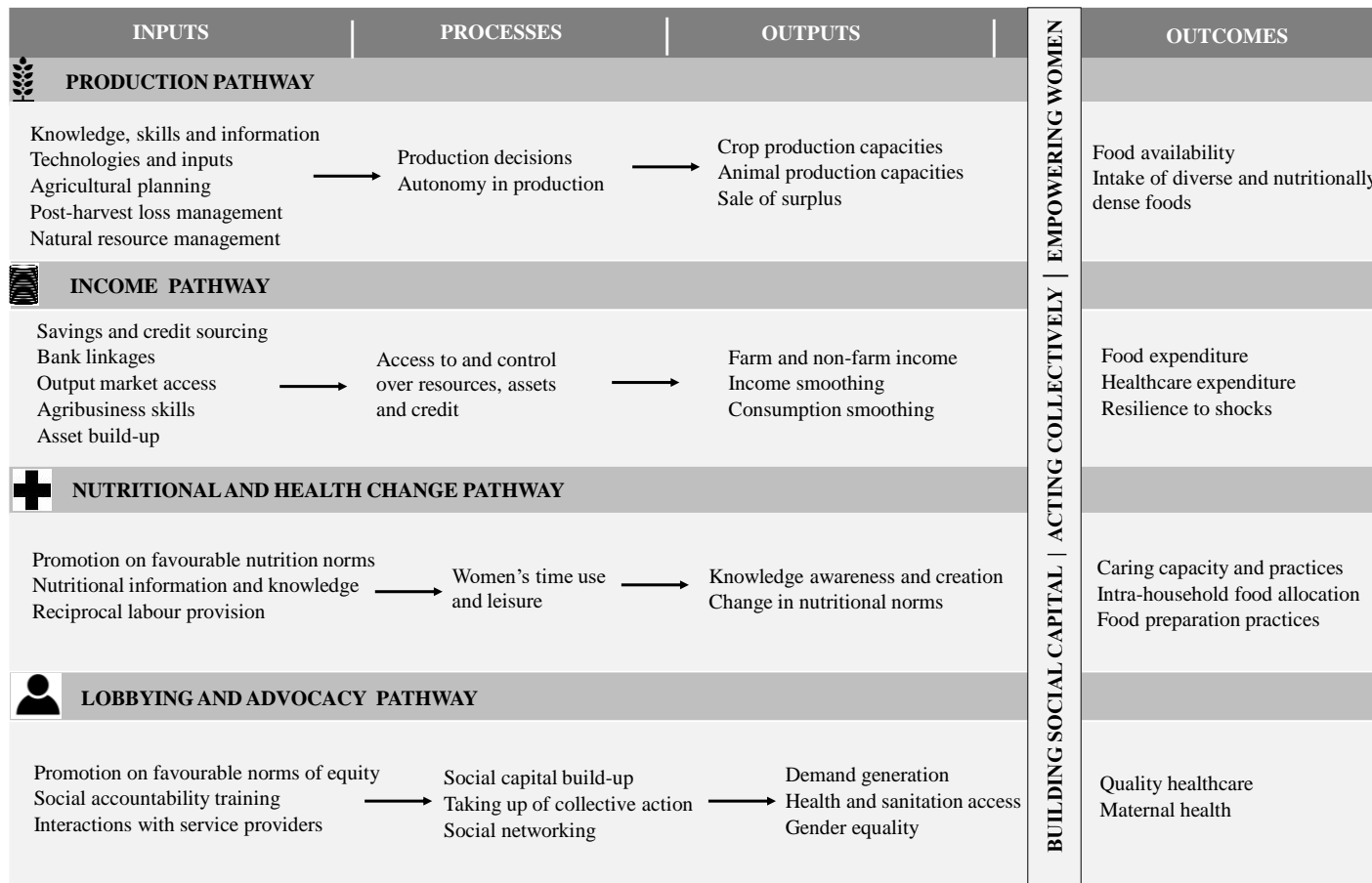


Figure 6.1: Conceptual framework linking collective action, women empowerment and HFS
 Source: Adapted from (Kumar *et al.*, 2018).

Table 6.2: Cross-cutting aspects that promote HFS through collective action and women’s empowerment

Building social capital	<ul style="list-style-type: none"> • Collective action provides a safe space to voice women’s opinions and interests, peer-to-peer learning and sharing of experiences that builds trust and cohesion. • CAIs facilitate cohesiveness through social activities such as supporting each other during sickness, death, weddings and family thanksgiving ceremonies that build up social capital. • CAIs serve as platforms for service delivery (such as input and output market access, extension and advisory services and technical training), provision of credit with the group as collateral, pooling savings and asset accumulation. Social capital helps build human and economic capital.
Acting collectively	<ul style="list-style-type: none"> • Some collective action development-based programs advocate for collective action. Participatory learning and action (PLA) facilitate in collective identification of problems, planning strategies, acting together and assessing the outcomes (Kumar <i>et al.</i>, 2018). • The emphasis of the PLA approach builds the community’s capacity to act collectively through group mobilization, problem-solving, trust and confidence-building (Sseguya <i>et al.</i>, 2018). • For example, changing gender equity norms and nutritional norms can have implications on HFS and this requires multiple actors at various levels including husbands and village elders. • Collective action also promotes community awareness campaigns and workshops coupled with lobbying and advocacy that helps disseminate skills, knowledge and rights of women in facilitating empowerment of women.
Promoting women’s empowerment	<ul style="list-style-type: none"> • Reducing gender gaps in agriculture has received worldwide attention (High Level Panel of Experts, HLPE, 2020). • To benefit from the collective services, women need some level of agency to be recognised within their households and their communities (Sraboni <i>et al.</i>, 2014). • Collective action promotes women’s strategies for improving agency in economic independence, balanced allocation of intra-household labour, vying for leadership positions within the communities, building perceptions, attitudes and norms of women’s autonomy and promoting bargaining skills with husbands (Sulemana <i>et al.</i>, 2020). • The disempowered women gain support from their husbands and the community, and women’s agency improves in making agricultural decisions that improve the nutritional outcomes of their households.

Source: Own field data and literature

The women's bargaining power in turn influences their ability to decide when, what, how to produce and how to provision health, food and non-food commodities within the household (Quisumbing *et al.*, 2021). The CAIs improve access to markets, management of agricultural resources and access to improved agricultural practices that could mitigate all-year-round food fluctuations due to seasonal variability (Valujeva *et al.*, 2023). For instance, Kwizerimana *et al.* (2023) show that participation in collective action improves farm yields and income by 40.64% and 32.95% respectively. Sraboni *et al.* (2014) also found that the number of groups a woman participates in had a positive correlation with household dietary diversity and calorie availability.

Collective action holds a potential for labour savings attributed to the provision of reciprocal labour among the group members (Leder *et al.*, 2017). The freed-up labour could be reallocated to improve productivity and income (through non-farm engagements), potentially increasing the availability of food within the household. Alternatively, collective action can increase labour requirements due to the reallocation of labour to agricultural training, group meetings and collective marketing days (Fischer & Qaim, 2014). These activities can improve food availability and incomes for purchasing food. Women's control over household income and credit has been a positive influence on improved dietary intake (Quisumbing *et al.*, 2020). Participation in collective savings and credit sourcing either within the group or through bank linkages with the group as collateral is expected to improve household income and asset built-up (Sseguya *et al.*, 2018). The incomes and assets improve household food intake and consumption smoothing in the face of adverse shocks (Nosratabadi *et al.*, 2020). Both farming -related and non-farm-related assets can generate income, which could be spent on the non-food and food commodities that affect HFS directly or indirectly such as education, clean water, sanitation and healthcare, with several long-term nutritional implications (Kumar *et al.*, 2018). On behavioural change, the provision of nutritional and health information has shown clear effects on household nutritional effects (Niles *et al.*, 2021).

Concerning the behaviours such as intrahousehold food allocation that are highly dependent on cultural and social norms, peer-to-peer learning and exchange encourages the transforming of norms (Padmaja *et al.*, 2019). Behavioural change

regarding empowerment of women includes hygiene and sanitation, dietary diversity, food preparation practices, childcare practices, and access to and utilization of healthcare services (Kumar *et al.*, 2018). In addition, improvements in women's intrahousehold labour allocation increases time for cooking, purchasing dietary diverse foods, attending to health check-ups and provision of household hygiene (Komatsu *et al.*, 2018). Promotion of health-care and nutritional behaviours change and women's availability of time leads to improved household diets, dietary and caregiving practices and better child nutritional and maternal health outcomes. Resource-constrained women may not be aware of what social and health governmental programs are at their disposal, and their entitlements as beneficiaries of these services (Hoop *et al.*, 2019). Lobbying, advocacy, training and creation of awareness to facilitate their access to these services and ensuring the service quality increases the opportunities to improve the nutritional outcomes of the households.

6.1.3 Conceptual framework

This study underpins the entitlement theory (Sen, 1990; Frediani, 2010). The entitlement theory explains the ability of individuals to access food through the legally in the society. The theory hinges on the concepts of endowments and entitlement set. An individual's endowment refers to the control of resources and assets including labour power. Entitlement means to the set of goods and services that an individual can acquire in a society based on the opportunities and rights he or she faces including: own-labour entitlement (the capability to sell labour skill or to purchase or produce food) production-based entitlements (ability to produce food), trade-based entitlement (ability to purchase food), and inheritance and transfer entitlement (access of food from the government or any other individual and society). Following the intrahousehold production model, the intrahousehold distribution of resources depends on the bargaining power and preferences of individuals, leading to gender gaps in entitlements (Molina *et al.*, 2022). In this case, the entitlement theory seeks to explore how collective action mediates women's empowerment (that is entitlements) to influence HFS.

Figure 6.2 presents a conceptual framework for exploring indirect and direct links between collective action, empowerment of women and HFS. This framework proposes three testable hypotheses (H) associated with the study's research questions (R).

- H1 and R1: What is the influence of empowerment of women on HFS? A positive association is hypothesised.
- H2 and R2: How does collective action influence HFS? The study hypothesises a positive relationship.
- RQ3 and H3: What is the role of collective action in moderating the influence of empowerment of women on HFS? The study posits that empowerment of women enhances HFS through the effects of collective action participation.

The first hypothesis pathway posits that empowerment of a woman directly influences HFS. This is through women’s traditional caregiving roles in the households’ nutrition through the attainment, selection, preparation and allocation of food among household members (Aziz *et al.*, 2022). Therefore, women’s empowerment is likely to improve HFS for women and their households. The hypothesis two concerns the effect of collective action participation on HFS through the effects of production, behavioural change and income pathways.

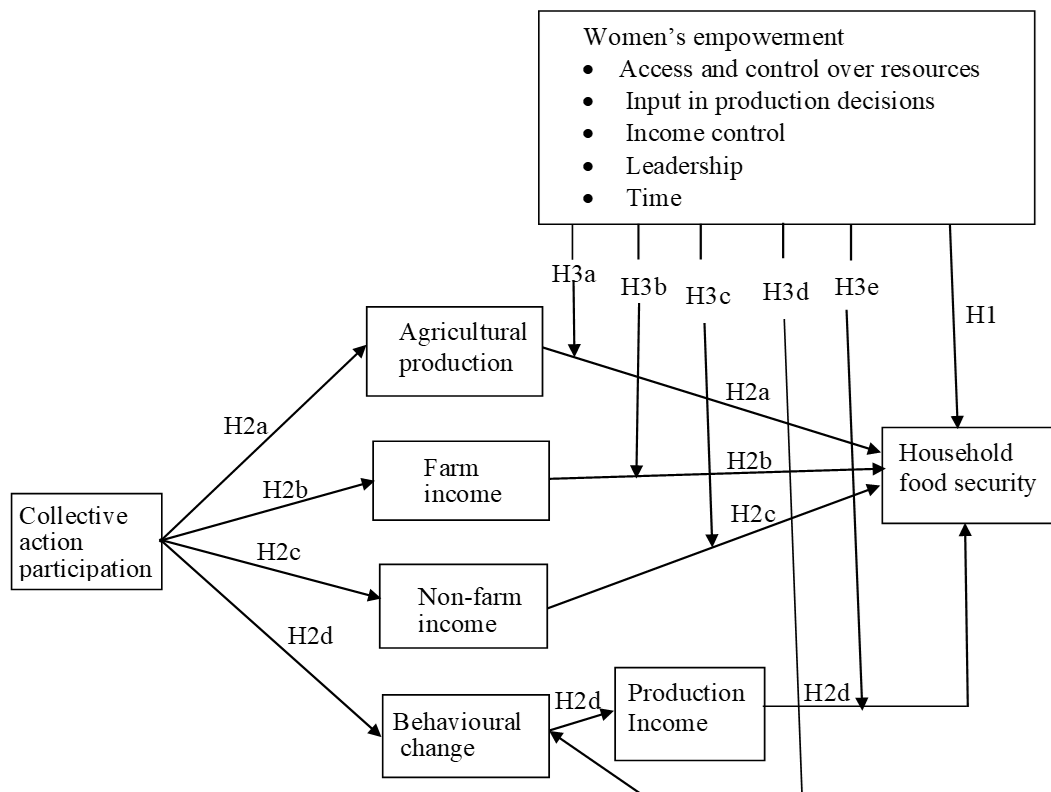


Figure 6.2: Hypothetical framework showing the associations between collective action, empowerment of women and HFS

Source: Adapted from (Kassie *et al.*, 2020)

Increased yields from collective action participation can increase availability of household food from own household production (H2a) as well as increase income from the sale of surplus (H2b pathway). Incomes can also be utilised to increase the purchasing power of quality and quantity food. Regarding the third pathway (H2c), collective action provides non-farm income-generating benefits such as credit sourcing, pooling of savings, asset accumulation and provision of informal insurance not only improves food expenditure but also smoothing of income and consumption during food shortfall. The fourth pathway (H2d) concerns the role of collective action in influencing behavioural change. Women endowed with skills in healthcare caregiving, food preparation practices and intrahousehold food allocation are expected to improve HFS. The third hypothesis is about the role of collective action in moderating the influence of empowerment of women on HFS. Evidence from low-income and rural and settings imply that there exists variations in patterns of resource allocation and preferences between men and women on non-food and food items wherein women regard more on household nutritional status (Doss, 2012; Udry, 2016; Doss & Quisumbing, 2020). Women with greater decision-making in household resource allocation and production decisions are more able to trickle collective action-induced food availability to family members (H3a). Where women are empowered, their control over household farm and non-farm incomes resulting from collective action is more likely to increase in the quality and quantity of the food eaten (pathway H3b and H3c).

Pathway H3d shows an indeterminate hypothesis that women's workload and decision-making power affect labour requirements in collective action leads to women re-allocating their time to collective activities or production and engagement in income-generating activities, or if instead, women spend more time on domestic caregiving tasks and leisure. Finally, H3e highlights the interaction of women's empowerment (for example in production decisions, income control and leadership through taking up of collective action and social capital build-up) in determining whether any increased production and income translates to an improvement in HFS.

6.2 Methodology

6.2.1 Study area and data collection

The study's data was collected in 2022 in Murang'a County within Central Kenya. The data was drawn following various stages. In stage one, two out of eight sub-counties that are predominating were selected. The sub-counties included Kandara and Gatanga. In the stage two, five wards were proportionately and randomly selected namely, two from the Gatanga and five from Kandara. With the aid of the lists obtained from agricultural extension officers, in charge of cooperatives, 532 farm households were surveyed, consisting of 353 collective action members and 179 non-members. Out of 532 households, 353 female respondents in dual-headed households were interviewed to provide data for the computation of WEAI and household food security. Data was collected by well-trained enumerators who were well versed with the local language. The data was restricted to the dual-headed households where the questionnaire was used to either male or female heads of the households.

The questionnaire on WEAI was administered to women while men were not interviewed due to budgetary constraints. The data for HFS was also drawn from women since they play important roles in household food provisioning and preparation. The household questionnaire gathered information on farm and farming characteristics, demographic characteristics, access to development services such as markets, extension and tarmac roads, membership in collective action, organizational characteristics of the CAIs, household incomes and assets, WEAI sub-domains and data on a seven-day's recall of food consumption to capture HFS status. In addition to that, we conducted two key informant interviews and ten key focus group discussions constituting either women-only, men-only or mixed-gender households. The data was collected based on the interview guides and analysed in excel thematically.

6.2.2 Empirical estimation strategy

Assessing the effect of empowerment of women on FCS individually and in interaction with collective action participation requires creating a counterfactual: What would be the status of FCS if an empowered woman was otherwise disempowered; or what would the FCS have been for a disempowered woman participating in collective action had she not participated? The creation of accurate

counterfactual outcomes encounters a challenge of sample selection wherein disempowered women and empowered women (collective action participants and non-participants households) may systematically vary in terms of observed socio-economic attributes (such as age, development services, extension services, education and income) and unobserved characteristics (including risk preference, risk-bearing capacities, motivation and inherent skills). These factors concurrently influence women's empowerment (treatment variable) and the household's collective action participation status (herein termed as intervening variables). If measures are not taken to account for such systematic differences, the analyses are likely to yield inconsistent estimates.

This study employs three strategies to counter the problem of selection bias. First, several explanatory variables that affect both outcome variables and treatment were included. Secondly, the study captured collective action-specific unobserved heterogeneities that can influence women's empowerment outcomes. The heterogeneities include gender composition, level of social capital, level of social networking and nature and scope of coordination. The third measure involved the application of the endogenous switching regression (ESR) model, which uses instrumental variables as employed in studies by (Kassie *et al.*, 2020; Habiyaemye *et al.*, 2023). The ESR model is a two-step estimation specification where the first equation entails specifying treatment variables with choice models to produce parameters for selection, which are then incorporated in the stage two to correct potential bias in selection. The second stage involves an outcome model to analyse the effects of empowerment of women and collective action participation on HFS.

6.2.3 The stage one: Status of women empowerment

The study established four classes of treatments (W_{it}) based on empowerment of women in several sub-domains and the household's collective action participation status. These treatments (t) include: First treatment 0 where t is equal to 0 denoting the women that are disempowered for the households that did not participate in collective action; secondly, treatment 1 where t is equal to 1 for the women who are empowered for the households without membership in collective action; Thirdly, treatment 3 where t is equal to 3 for empowered women of the households that participated in collective action and; finally treatment 4 where t is equal to 4 denotes

the disempowered women that belong to the households that had membership in collective action. The four treatments were modelled using a multinomial logit model since treatment variables are multinomial in nature.

$$W_{it} = \alpha W_{it} + \beta Z_{it} + \varepsilon_{it}, t = 0, 1, 2, 3 \quad 6.1$$

The symbol t represents treatment status, i denotes individual women within a household, W_{it} is the status of women empowerment, X is the vector of socio-economic characteristics influencing women's empowerment. Z entails a vector of variables that affect empowerment of women and collective action participation status and not the HFS variable ε is the error term, and α and β are parameters that will be estimated. In this study, vector Z used in regressing the determinants of women's empowerment across different sub-domains includes the instrumental variables of dependency ratio, spousal age difference, spousal education, and household farm labour. The age and education differences between the male and female decision-makers are used as instrumental variables for the indicators of income, production, workload, ownership of assets and public speaking.

The variations in age and education variables are indicators of human capital. They have been employed as to reflect the bargaining of women in the intra-household (Quisumbing & Maluccio, 2000; Diiro *et al.*, 2018; Sinharoy *et al.*, 2018; Kassie *et al.*, 2020). The ratio of household members who are dependants, below the age of ten and the ratio of household members providing farm labour are the instruments used in the workload and leisure sub- domain (Kassie *et al.*, 2020). The identifying variable for collective action participation includes the respondents' knowledge of the number of CAIs in the village. This variable is an indicator of the farmers' exposure to the CAIs.

6.2.4 The stage two: Effects of empowerment of women on food security

The stage two of ESR framework models the association between the outcome (FCS) and a set of variables including farm and farming factors, institutional and infrastructural factors household demographics and incomes and assets. The four treatment classes highlighted in section 2.2.1 results to four outcome's equations shown in Equation (6.2).

(6.3a) which is the actual observed HFS status and Equation (6.3c) that is the counterfactual HFS status.

$$\begin{aligned}
 ATT &= E(Y_{i1}|W_{i1} = 1; X_{i1}\delta_{i1}) - E(Y_{i0}|W_{i1} = 1; X_{i1}\delta_{i1}) \\
 &= (\beta_1 - \beta_0)X_{i1} + (\Phi_1 - \Phi_0)\delta_{i1}
 \end{aligned}
 \tag{6.4}$$

$(\beta_1 - \beta_0)$ and $(\Phi_1 - \Phi_0)\delta_{i1}$ respectively the effect of observable and latent factors on HFS outcomes.

6.2.5 Estimation procedure

The study estimated three HFS equations. In the first stage, the determinants of collective action on women empowerment are assessed using the MNL model as described in the ESR model. In the second step, the effect of HFS is estimated across the different sub-domains of women empowerment. HFS is a continuous variable while women empowerment sub- domains are binary variables depicting whether a woman is empowered or not in a given sub-domain. In stage one, the status of empowerment of women is estimated using the explanatory variables and instrumental variables discussed in section 6.2. Then the estimated values obtained are incorporated in the second specification model of HFS. In the third estimation procedure, the influence of indicators of empowerment of women is calculated to ascertain the women empowerment effect on HFS. The five domains of women's empowerment enter the HFS equation as binary variables as discussed in section 2.2.4. Similar specification stages were followed in estimating the treatment and outcome equations for collective action membership in general and membership in efficiency and livelihood CAIs.

6.2.6 Measurement of treatment variables

To measure collective action, a household was considered a participant if they had membership in a CAI for at least one year. General membership or participation implied that the household participated in collective action irrespective of the type. In addition, the HFS effects arising from women empowerment linkages were disaggregated by the type of CAIs (namely efficiency CAIs and livelihood CAIs) that were considered. The study employed WEAI to derive the women empowerment indicators including production which concerns women's joint or sole decision-making in production in livestock cash crops food crops, and autonomy in production.

Resources entail the access to, ownership of, and controlling power over production resources such as livestock, consumer durables, land, credit and agricultural equipment. Income concerns joint or sole control over the use of household expenditures and income. Leadership captures women's membership in social or economic groups and comfort in public speaking. Time is the women's of time to domestic satisfaction with leisure time and provisioning productive tasks.

The empowerment sub-domains take a value of 1 if a woman has adequacy and otherwise in various sub-domains. A woman is regarded as adequate in control over production if she has an achievement in at least two decisions in agricultural production and achievement in autonomy in production if she has an achievement in at least one decision. Regarding ownership of assets, an achievement in sole or joint ownership of large assets. Adequacy in control over resources is achieved if a woman owns a specific asset and participates in making decisions about it. Concerning credit, a woman is regarded as empowered if she makes decisions on household credit. Adequacy in control over incomes is achieved if a woman engages in making decisions in any major household expenditures. For group membership, a woman is considered adequate if she participates in any social or economic group. Adequacy in workload is achieved if a woman ≤ 10.5 hours on the previous day following the survey and 0 otherwise. Adequacy in leisure is achieved when a woman report being satisfied with her time allocated for leisure.

6.2.7 Measurement of outcome variables

The Food Consumption Score (FCS) was employed as a measure for HFS. FCS is a worldwide validated measure with a weighted score of the food frequency and dietary diversity of the food groups eaten within a recall period of seven days before the survey (World Food Programme, 2015). Food Consumption Score is suitable because it captures the quality and quantity of food consumed by a household. The household FCS was calculated by multiplying the weights of the respective food groups with the frequency of foods eaten. The food groups include fruits, pulses, meat/egg/fish, staples, vegetables, sugar and oil. The sum scores were then used to determine the FCS, with the maximum score value of 112 which implies that the household ate each group of food every seven days preceding the survey. Scores of food consumption of 0 to 21, 21.5 to 35 and more than 35 that were classified as chronic food insecurity, transitory food insecurity and food secure respectively. The two last categories of

chronically food insecurity and transitory food insecurity were combined to two classes of food insecure and food secure.

6.3 Results and discussion

6.3.1 Descriptive statistics

Table 6.3 shows the descriptive statistics of the collective action initiatives. Compared to the livelihood members, the efficiency CAIs were older, more educated, and owned larger farm sizes and livestock. The efficiency members also had more access to the tarmac road, information and extension services. Contrary to the efficiency members, the livelihood members had larger household sizes and more dependants. In addition, the members of the livelihood CAIs engaged more in off-farm engagements and had more access to banks and more household income sources.

Table 6.3: Descriptive statistics of the collective action initiatives

	Livelihood (1)		Efficiency (2)		Difference (4) –(2)
	Mean	Std. Error	Mean	Std. Error	
FCS	32.40	0.81	29.39	1.40	1.71
<i>Household demographics</i>					
Age	55.06	0.78	62.39	1.41	4.03***
Education	2.52	0.19	2.73	0.05	1.81*
Household education ratio	2.49	0.10	2.98	0.27	1.91*
Dependency ratio	1.19	0.08	0.83	0.11	-1.86*
Household size	3.92	0.11	3.11	0.25	-3.06***
<i>Farming characteristics</i>					
Farm size	1.00	0.06	1.52	0.13	3.74***
Livestock holdings	1.80	0.15	2.53	0.51	1.82*
Labour	0.96	0.04	1.09	0.09	1.32
Farming experience	23.03	0.96	24.75	1.94	0.83
<i>Household incomes</i>					
Household income	4.15	0.41	5.36	1.01	1.19
Income sources	1.58	0.04	1.39	0.07	-1.91*
Off-farm income	0.54	0.03	0.33	0.06	-3.08***
Wealth index	2.08	0.03	1.95	0.07	-1.87*
Bank account	1.56	0.03	1.08	0.04	-7.33***
Tarmac	1.79	0.08	2.30	0.34	2.14**
Market	3.34	0.12	3.45	0.48	0.33
Information	2.41	0.07	3.69	0.21	7.25***
Extension	3.41	0.13	3.63	0.44	0.63
Extension contacts	1.03	0.16	3.31	0.53	5.47***
ICT	0.33	0.03	0.36	0.06	0.39
<i>Empowerment domains</i>					
Production	31.35	0.67	29.05	1.25	-0.91
Autonomy in production	0.60	0.04	0.53	0.07	1.70
Income control	0.62	0.03	0.49	0.07	-0.89
Asset ownership	0.52	0.04	0.59	0.07	-0.22
Asset control	0.09	0.02	0.10	0.04	3.10***
Credit control	0.68	0.03	0.45	0.07	1.87*
Workload	0.67	0.03	0.53	0.07	-0.85
Leisure	0.14	0.03	0.19	0.06	-1.23
Public speaking	0.66	0.03	0.76	0.06	0.13
Leadership	0.5	0.04	0.49	0.07	-1.67

Source: Authors' field data

On women empowerment, the livelihood CAIs showed significant differences in the number of women endowed making decisions on household credit and assets

6.3.2 Correlation between women's empowerment and household food security

Figure 6.3 presents the association between HFS and empowerment of women sub-domains based on collective action participation. Continuous women empowerment indicators were preferably used because the dummy indicator variables showed minimal changes in HFS. Decision-making in production is negative and linear for the aggregate sample, non-members, efficiency members and livelihood members. An increase in decision-making power among the collective action non-members drastically reduced the FCS.

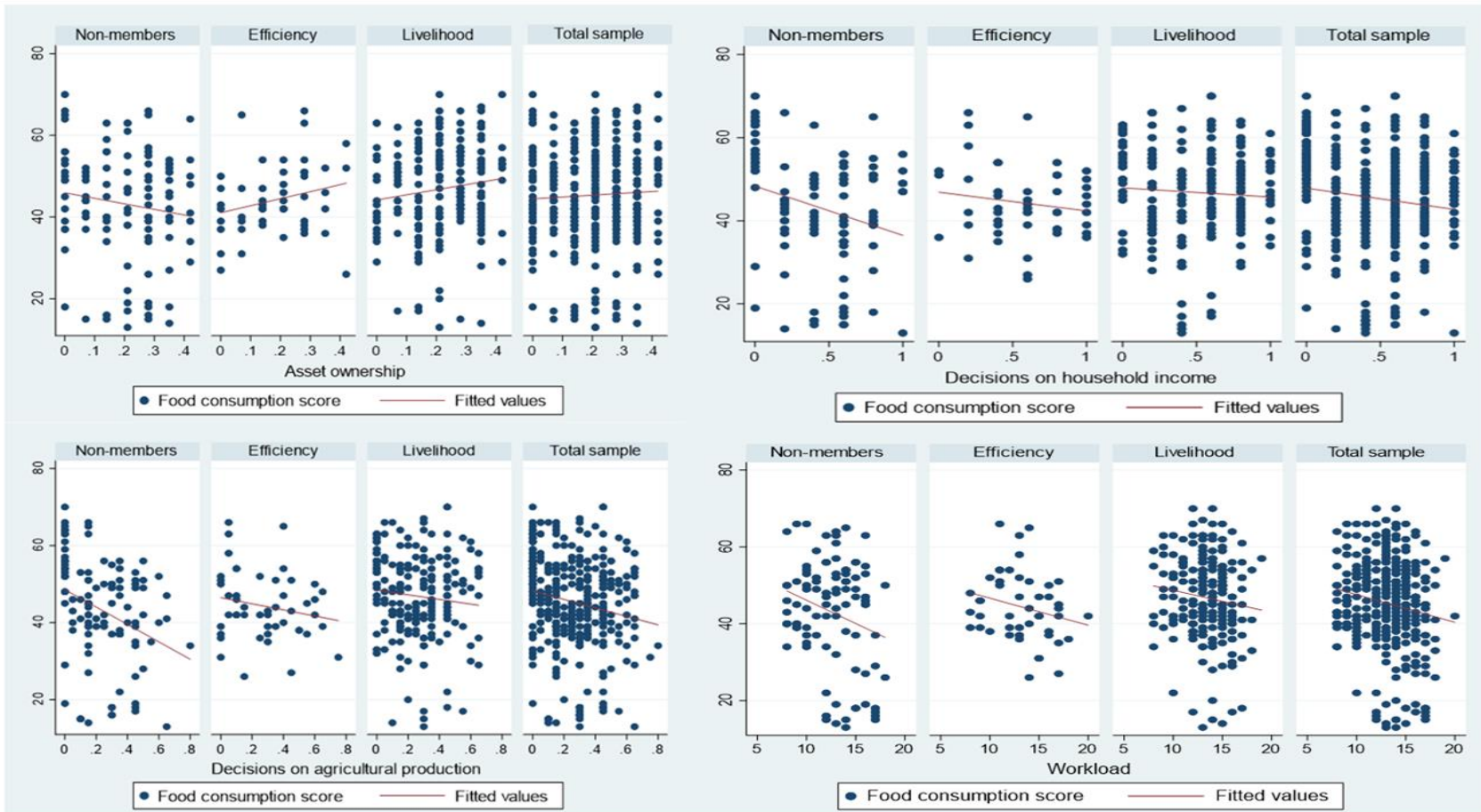


Figure 6.3: The relationship between collective action participation and HFS following collective action participation
 Source: Authors' field data

However, there was a gradual but steady and somewhat constant effect of production decisions on HFS among the livelihood and efficiency CAIs. As shown in Figure 6.3, the women allocated a minimum of about 8 hours and a maximum of around 18 hours a day in domestic and production activities. The women who worked for more than 12 hours a day were particularly of the reproductive age childcare responsibilities. An increase in workload decreased the households' FCS across the four household categories with the maximum HFS achieved when women work for about 12 hours a day. The results further show a positive and linear correlation between women's asset ownership and FCS for the livelihood and efficiency of members. However, FCS was negatively associated with asset ownership among the collective action non-members. Income showed a negative and linear relationship between FCS and women's decision-making on household income for the aggregate sample and non-members. However, there was a gradual and almost constant effect of income decisions on HFS among efficiency and livelihood participating households. The patterns in the scatter plots in Figure 6.3 reveal correlations that do not account for the endogenous interactions between collective action, women empowerment and HFS.

6.3.3 Effect of women's empowerment on food security through collective action

Table 6.4 shows findings for the treatment effects of the moderating effect of collective action on HFS through women's empowerment employing the ESR approach. The results report the effects of empowerment of women status and its interactions which collective action non(participants) in terms of actual effects, counterfactual effects and ATT. However, the results on disaggregated participation in efficiency and livelihood CAIs reports only the actual, counterfactual and ATT effects among non-participants and participants due to the limitations of the sample size. In Table 6.4, the ATT results reveal that empowerment of women in agriculture across all the sub-domains has mixed effects on HFS across the empowerment sub-domains for collective action members and non-members. For example, the ATT of 23.995 represents a 67% and 64% increase in FCS as a consequence of women's decision-making collective action member households and non-members respectively.

Table 6.4: Effect of women’s empowerment interaction with collective action participation on household food security

		Actual		Counterfactual		Average treatment effects (ATT)		
		Coeff. Mean	SE	Coeff. Mean	SE	Coeff. Mean	SE	t-value
Production	Empowered participants	35.673	0.503	11.678	0.648	23.995	0.640	37.503***
	Disempowered participants	29.783	0.459	40.447	0.388	-10.663	0.463	-23.053***
	Empowered non-participants	32.953	1.319	11.736	0.609	21.216	0.877	24.188***
	Disempowered non-participants	26.354	0.467	55.029	1.062	-28.675	0.749	-38.283***
Income control	Empowered participants	33.049	0.585	11.227	0.446	21.822	0.368	59.369***
	Disempowered participants	30.528	0.430	56.317	0.518	-25.79	0.309	-83.432***
	Empowered non-participants	32.047	0.977	35.500	0.567	-3.452	0.551	-6.260***
	Disempowered non-participants	25.928	0.779	15.732	1.427	10.195	0.779	13.089***
Asset ownership	Empowered participants	31.632	0.328	8.093	0.773	23.539	0.865	27.202***
	Disempowered participants	31.676	1.483	10.774	1.005	20.902	1.502	13.919***
	Empowered non-participants	29.008	0.639	46.350	2.399	-17.342	2.388	-7.262***
	Disempowered non-participants	29.783	1.659	9.819	1.267	19.964	1.568	12.734***
Workload	Empowered participants	31.880	0.401	40.836	0.540	-8.957	0.525	-17.059***
	Disempowered participants	30.970	1.326	19.201	1.047	11.768	1.062	11.080***
	Empowered non-participants	30.583	0.625	12.692	1.720	17.891	1.667	10.732***
	Disempowered non-members	27.338	1.690	12.211	1.125	15.126	2.064	7.328***
Public speaking	Empowered participants	31.209	0.489	44.907	0.758	-13.698	0.531	-25.804***
	Disempowered participants	32.571	0.631	38.637	0.707	-6.066	0.660	-9.184***
	Empowered non-participants	30.672	0.679	36.375	0.439	-5.703	0.863	-6.603***
	Disempowered non-participants	26.077	0.879	12.650	0.879	13.426	1.307***	10.276***

*** p< 0.01, ** p< 0.05, * p< 0.1

SE = standard error

Source: Authors’ field data

Contrariwise, women's power in decision-making on production revealed negative effects on FCS for both disempowered participants and non-participants. This finding is supported by the previous studies (Quisumbing *et al.*, 2021; Lufuke *et al.*, 2023) that found a positive correlation between decision-making power of women in production and household dietary diversity score (HDDS) and women's dietary diversity score (WDDS).

The decision making of women on production affects the resource allocation on production to improve the quantity and quality of farm output for production of own food and sale of surplus. on HFS. This study is in line with (Kassie *et al.*, 2020) who found that women's control over household incomes improved WDDS.

On income, women's control of incomes for collective action participating households revealed a positive effect on FCS. This study aligns with (Kassie *et al.*, 2020) who found that women's control over household incomes improved WDDS. However, the control over income for disempowered members and empowered participants showed negative effects on FCS while disempowered non-members showed positive FCS. The positive effects could be explained by the increased ability of women to prioritize household food expenditure (Galiè *et al.*, 2019). Conversely, the negative effects could be attributed to the household budgetary constraints that lead to the diversion of income to other essential household non-food items such as home improvement, asset acquisition, health and education (Aziz *et al.*, 2022). One woman respondent retorted "*I can spend the only a small amount of money I have for food, otherwise my husband's money is used for investing in improving our economic status such as purchasing livestock.*" The mixed effects of income on HFS would be attributed to the organizational characteristics of the CAIs that will be discussed in the subsequent sections. Women's ownership of assets increased the FCS for collective action members. These findings align with those (Sraboni & Quisumbing, 2018) that found a positive correlation between women's assets and children's dietary diversity.

Collective action provides income-generating opportunities for asset build-up that are a form of livelihood strategy that women can utilise to cushion their households during food shortfalls. The workload of women significantly reduced FCS for collective action members which is 8.96 points and 11.77 points for women that

worked for less than 10.5 hours and more than 10.5 hours respectively. On the contrary, women's workload among the non-participants showed significantly higher FCS of 17.89 points and 15.13 points for women working for more than 10.5 hours and less than 10.5 hours respectively. The FCS was lower for the women among the collective action members due to extra collective action responsibilities such as attending meetings in addition to productive and domestic work. This compromises with HFS due to the reduction of women's time for domestic and food preparation responsibilities such as skipping some care tasks, reducing the frequency or substituting domestic tasks. The women may opt to use unsafe nearby water, forgo boiling drinking water and skip preparing food in sanitary conditions (Komatsu *et al.*, 2018). Women also may face time constraints to collect firewood for cooking, visit the market to purchase dietary diverse foods, and prepare nutritious and healthy meals, affecting the household FCS. The field interviews revealed that cultural norms prohibit men from performing domestic tasks such as cooking, childcare, fetching water and childcare. One male respondent said "*in our community, it is an abomination and degrading for a man to do housework. Men's work is to look for money and provide for the family.*"

However, some respondents were of contrary opinion advocating for sharing of household responsibilities. For instance, one male respondent reported "*these days things have changed we share responsibilities for our home to progress. If I have hands what can prevent me from fetching water and preparing food? If my wife is busy, I can always take care of our child, I see nothing wrong there.*" Concerning public speaking, it showed negative effects on HFS. The negative effects were higher for collective action members than non-members. However, the disempowered non-members reported positive HFS. This finding is in line with (Alemu *et al.*, 2018) that women were empowered in decision-making in the community in groups but in the households, women received backlash from their husbands due to fear of taking over men's role as home providers. This finding was unexpected because public speaking empowers women to voice their challenges, and needs and share their experiences in improving production, livelihood and welfare of their families.

6.3.4 Women's empowerment effects on food security among efficiency members

Table 6.5 shows the results on the effects of women empowerment on HFS through the interaction of participation in efficiency CAIs. The results report the actual, counterfactual and ATT effects among collective action participants and non-participants due to the limitations of the sample size. Participation in collective action increases FCS through decision-making of women in production by 9.56 points while women's control over production reduced FCS by 4.18 points among the non-members. This finding contradicts with (Galiè *et al.*, 2019) who found a negative relationship between decision-making of women in production and women's HFS in Tanzania.

The multiplicity of services offered by the efficiency CAIs such as collective input provision, collective marketing, provision of extension and advisory services and technical training empowered women to increase food produced in terms of quantity and quality. In addition, the high levels of bridging social capital among the efficiency CAIs facilitated in improvement of the decision-making skills of women within the community level and with market providers which had spill over effects on decision-making at the intra-household on the production of food. Regarding income, the power of decision-making of women on household incomes showed a negative effect on FCS for both the efficiency of participating households and non-participants. However, the negative marginal effects were higher for the participating households than the non-participants. This finding supports another study in Kenya (Fischer & Qaim, 2012a) that found that women's incomes generated from banana marketing groups did not translate to HFS due to a lack of control over household income by women.

Table 6.5: Effect of women’s empowerment on food security among efficiency members

		Actual		Counterfactual		Average treatment effects (ATT)		
		Coeff. Mean	SE	Coeff. Mean	SE	Coeff. Mean	SE	t-value
Production	Participants	27.540	0.860	17.984	0.846	9.556	0.907	10.540***
	Non-participants	30.490	0.838	34.669	0.874	-4.178	1.128	-3.703***
Income control	Participants	27.714	0.349	43.201	1.398	-15.487	1.454	-10.649***
	Non-participants	31.599	1.754	32.922	0.743	-1.322	1.876	-0.705
Asset ownership	Participants	26.566	1.641	32.411	2.044	-5.845	2.470	-2.366**
	Non-participants	29.681	0.659	39.383	1.303	-9.702	1.424	-6.814***
Workload	Participants	27.852	2.547	31.504	1.108	-3.651	3.369	-1.083
	Non-participants	29.702	0.674	32.526	3.461	-2.824	3.473	-0.813
Public speaking	Participants	27.442	1.092	39.158	1.149	-11.716	1.886	-6.210***
	Non-participants	30.686	1.289	29.104	1.565	1.582	2.613	0.606

*** p< 0.01, ** p< 0.05, * p< 0.1

SE = standard error

Source: Authors’ field data

The social norms that strictly perceived men as the sole providers of the households delegated them with the responsibility of making decisions on income generated from agriculture. The negative effects could also be a result of household budgetary constraints that lead to the diversion of income derived from collective marketing to non-food items including education, health, agricultural inputs, home improvement and asset acquisition. The results further reveal that women's asset ownership had relatively higher negative marginal effects on HFS among the efficiency participating households compared to the non-participants. This finding can be explained by the social norms that limited women's asset ownership where the field interviews revealed that women can own assets only if it is joint ownership with their male spouses, otherwise, the assets belong to men. The previous study also revealed that participation of women in efficiency CAIs had a negative effect on women's asset ownership. An increase in women's workload among the efficiency members and non-members decreased FCS by about 3.65 and 2.82 respectively. Aligning with (Padmaja *et al.*, 2019), working for long hours can increase women's energy expenditure which can pose detrimental effects on women's health, compromising women's efficacy in domestic, production and caregiving responsibilities.

An increase in workload in efficiency CAIs was associated with highly standardised and market-oriented production that is labour-intensive. This finding could be attributed to the increased focus on market-oriented production that is labour-intensive alongside the extra workload of efficiency activities such as attending group meetings, collective marketing days, training, extension and advisory services. Lastly, comfort in public speaking had a negative effect on FCS while it positively influenced HFS. This finding does not align with the study's hypothesis and is consistent with (Quisumbing *et al.*, 2021) that women's speaking in public improved WDDS in Asia. Women's public speaking failed to translate to HFS due to the dominance of men in efficiency CAI and the underlying cultural perceptions that restrict women from speaking in public.

6.3.5 Women's empowerment effects on food security among livelihood members

Table 6.6 presents the results on the influence of empowering women on HFS through the interaction of membership in livelihood CAIs.

Table 6.6: Effect of women empowerment on HFS among livelihood members

		Actual		Counterfactual		Average treatment effects (ATT)		
		Coeff. Mean	Std Error	Coeff. Mean	Std Error	Coeff. Mean	Std Error	t-value
Production	Participants	33.517	0.677	6.833	0.384	26.684	0.610	43.734***
	Non-participants	30.252	0.322	55.310	0.574	-25.058	0.572	-43.748***
Income control	Participants	27.280	0.602	20.548	0.640	6.732	0.417	16.139***
	Non-participants	33.459	0.434	41.304	0.367	-7.845	0.302	-26.003***
Asset ownership	Participants	33.641	0.913	37.711	0.894	-4.070	0.620	-6.569***
	Non-participants	30.429	0.395	33.866	0.520	-3.437	0.265	-12.965***
Credit control	Participants	31.183	0.373	14.973	0.394	16.210	0.296	54.756***
	Non-participants	31.277	0.677	13.790	0.628	17.487	0.727	24.067***
Workload	Participants	30.630	1.176	11.808	0.855	18.823	1.060	17.755***
	Non-participants	31.146	0.346	52.066	0.627	-20.920	0.616	-33.971***
Public speaking	Participants	31.661	0.287	-1.992	0.211	33.654	0.440	76.485***
	Non-participants	30.517	0.214	7.305	0.295	23.212	0.430	54.039***

*** p< 0.01, ** p< 0.05, * p< 0.1

Std. Error = standard error

Source: Authors' field data

Participation in collective action increased FCS through decision-making of women in production. This could be explained by the subsistence and home-based production farming practices practised by the livelihood members due to the small land sizes. Since women dominate in providing labour for food production and given that women represent the majority in the livelihood membership, their decision-making abilities in production translates to improved HFS. Additionally, the high levels of bonding social capital among the livelihood CAIs facilitates in exchange of knowledge and experiences that could influence the quantity and quality of food production. Women's control over household incomes through participation in livelihood groups had a positive influence on HFS but a negative effect on FCS among the non-members. It was found that livelihood CAIs provided income-generating opportunities through savings, credit, asset acquisition and informal insurance that smoothens household incomes and consumption. Most importantly, the dominance of women in livelihood CAIs empowered women to translate the household incomes for non-food and food items in budgetary allocation. However, the obligations of contributing to the collective action kits of savings, credit, and informal insurance alongside repayment of credit could limit the household budgetary allocation of food items. To overcome this shortcoming, women in livelihood CAIs supplemented their meagre incomes from subsistence marketable surpluses by engaging in wage employment and small entrepreneurial businesses that were conducted either collectively or individually with the support of the group.

The ownership of assets by women revealed a negative effect on HFS for both non-members and members of livelihood CAIs. This is despite women having ownership of assets purchased through the group. The negative effect implies that women's control over household assets is limited for them to translate the assets to meeting nutritional needs, especially during crises such as crop failure and food price hikes. Similarly, the household assets would be allocated to purchasing other non-food items such as education where farmers sold their livestock to meet the education needs of their children at the expense of dietary needs. As hypothesised, women's control over credit had a positive effect on HFS. This is conceivable considering that livelihood CAIs provide credit to their members either internally or through bank linkages with the group as collateral. Credit is important in smoothing incomes and consumption, especially during the crisis (Kumar *et al.*, 2018). However, some

authors reveal mixed associations between control over credit and nutritional outcomes (Aziz *et al.*, 2022) due to the inability of households to repay. Contrary to non-members, an increase in women's workload among the livelihood members increased HFS by 18.83 points.

An increase in workloads in livelihood groups was attributed to women's engagement in collective activities such as meetings and non-farm collective entrepreneurial economic engagements besides production and domestic work. Women's workload was also influenced by the small land sizes among the livelihood participating households that culminated in women's engagement in non-farm economic activities to supplement household incomes for enhanced HFS. However, women working long hours may be stressed and distracted from engaging in caregiving and domestic household responsibilities (Komatsu *et al.*, 2018). Regarding women's public speaking, it showed positive effects on HFS for livelihood members and non-members. This emphasises the importance of women's confidence in enhancing women's bargaining skills at the intra-household level on food production, food budgetary allocation and food provisioning. The dominance of women in livelihood CAIs and high levels of bonding social capital enhanced women's bargaining power at the community level culminating in spillover effects to women's improved intrahousehold bargaining power.

6.3.6 Synergies and trade-off effects of women empowerment on food security

From the results discussed above, the changes in the HFS outcomes across the women empowerment sub-domains offset each other in their interactions with differentials in collective action participation. This implies the presence of synergies or spill over and trade-off effects across the sub-domains. The trade-offs and synergies we unveil align with the results from the systematic research review (Lufuke *et al.*, 2023) and the studies (Sraboni & Quisumbing, 2018; Quisumbing *et al.*, 2020, 2021; Sariyev *et al.*, 2020; Ayamga *et al.*, 2023) that women empowerment sub-domains have different effects on HFS. This justifies the unpacking of the empowerment sub-domains to the overall aggregation of the sub-domains into a one standalone women empowerment score. Table 6.7 shows the synergies and trade-off effects across the women empowerment sub-domains following collective action participation.

Table 6.7: Trade-off and synergistic household food security effects

Sub-domain	Collective action	Efficiency	Livelihood
Production	+	+	+
Income control	+	○	+
Asset ownership	+	○	○
Workload	○	○	+
Public speaking	○	○	+

+ signify synergies;

○ signify trade-offs

Source: Authors' field data

On the aggregate sample, among the collective action members, women's empowerment in production, income and asset ownership all showed positive synergistic and spillover effects on HFS. However, workload and public speaking revealed trade-offs on HFS. On the efficiency CAIs, except production, the trade-offs were observed across the sub domains of income control, asset ownership, workload and public speaking. Concerning the livelihood CAIs, the synergies leveraged across the production and public speaking sub domains while the sub indicators of income control, asset ownership and workload revealed trade-offs. These findings are inconsistent with the hypotheses one (H1) and hypothesis one that collective action shows a positive effect on HFS; (H2) that empowerment of women is positively associated with HFS and hypothesis three (H3) wherein empowerment of women has a positive effect on HFS through the effects of collective action participation. The synergies and trade-offs suggest that the structures of power dynamics across different forms of CAIs differentially influence the women's capabilities in accruing HFS benefits. Therefore, these synergistic effects are not guaranteed, nor are the trade-offs irreversible, as both are determined by the context-specificity of the socio-economic attributes of the CAIs and the households.

Therefore, the study highlights the trade-offs and the synergies to obtain insights into the importance of nutrition-sensitive and gender-sensitive policy targeting and design. Contrary to the livelihood CAIs, the trade-offs are more eminent among the efficiency CAIs. The possible explanations could be, first, the efficiency form of collective action is dominated by males. The existing attitudes and social-cultural norms limit women's agency and could impede women's recognition, representation in accruing of decision-making capacities and resources that may translate to HFS.

Secondly, the wider geographical scale of operation of the efficiency CAIs limits women's abilities to capitalise on the high level of bridging social capital to improve their intrahousehold decision-making capacities on HFS. The decision-making capacities arise from the spill over effects of improvements in bargaining skills and leadership abilities that develop within the community and markets. The wider geographical scale limits women's participation due to disproportionate intrahousehold labour allocation that limits women within the domestic spheres denying them opportunities to attend general meetings, trainings and marketing days. In addition, the preference of men for cash crop production and their participation in market-oriented production in efficiency groups could result to the deviation of resources to cash crop farming at the expense of their diversified food production for home consumption (Linderhof *et al.*, 2019). Conversely, the livelihood CAIs, are dominated by women, who according to Njuki *et al.* (2022) are more concerned about household welfare and the status of HFS, and therefore more likely to invest and reinvest their incomes in improving the nutritional and health statuses of their families. Thirdly, unlike the livelihood CAIs, the low bonding social capital exhibited by the efficiency CAIs compromises with group cohesiveness, trust and reciprocity incentives that are important in facilitating the transformation and reversal of the existing gendered social norms both at the intrahousehold level and the community levels. The variations in HFS outcomes across the women empowerment sub-domains can be accounted for by the underlying household socio-economic determinants of HFS and women empowerment.

The study identifies multiple possible policy interventions that may enhance synergies while countervailing the trade-offs along the interlinkages of collective action, women empowerment and HFS as shown in Figure 6.4.

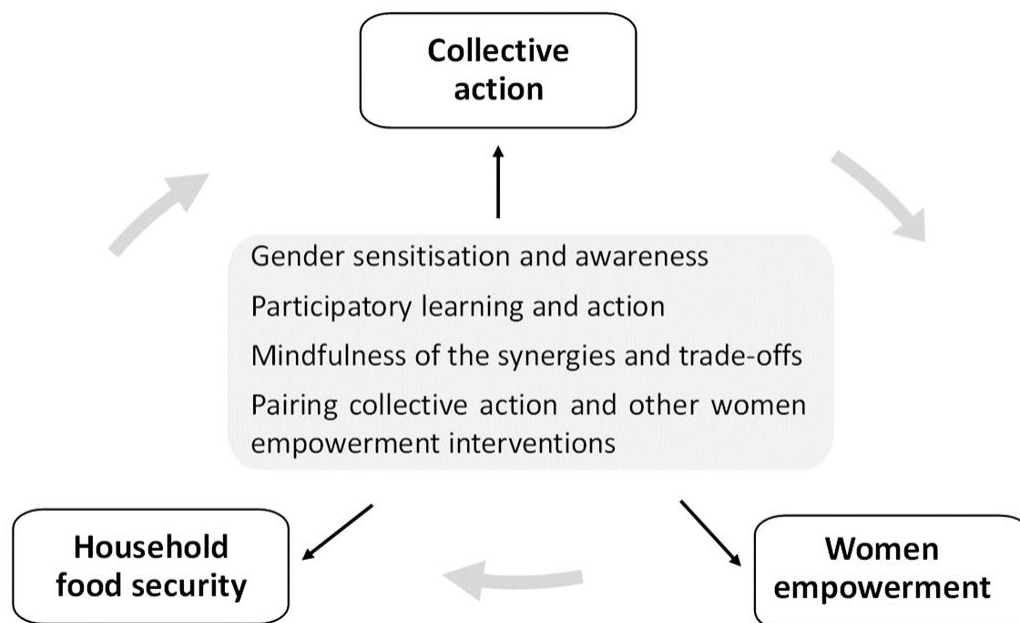


Figure 6.4: Policy interventions to address the triple challenges

Source: Authors' drawing

First, there is a need for gender sensitisation and awareness training to facilitate in transforming and reversing the gendered social norms in women's economic agency, balanced intrahousehold allocation of labour and building perceptions, norms of women's autonomy and promoting bargaining skills with spouses. Secondly, participatory learning and action need to be upheld within the collective action settings to facilitate collective planning, laying of strategies, and identification of challenges and their potential solutions. This would help in influencing the social norms by providing a safe space and level ground for both women and men. Thirdly, policies that aim to improve HFS can consider pairing collective action and women empowerment interventions for optimal HFS outcomes. Fourthly, the policymakers and the development partners can enhance the HFS of the disempowered women's households through encouraging participation in collective action. Lastly, the development partners and policymakers need to be aware and mindful of the synergies and trade-offs women face as stewards in agricultural production and HFS. This is through employing interventions that promote the women's ability to manage their time, assets and resources, and decision-making.

6.4 Conclusion

The study explored the effect of women empowerment through the interplay of collective action participation. The study compared two typologies of CAI namely efficiency and livelihood. The efficiency CAIs are dominated by men engaging in collective input sourcing and collective marketing, they manifest low levels of bonding social capital and a high level of bridging social capital. The livelihood CAIs are dominated by women, characterised by high bonding social capital and low bridging social capital. They practised pooling of savings, credit sourcing, asset acquisition and provision of informal insurance. The study employed an ESR in the empirical analyses in accounting for the confounders. The results revealed that on the aggregate sample, among the collective action members, women's empowerment in production, income and asset ownership all showed positive synergistic and spillover effects on HFS. However, workload and public speaking revealed trade-offs on HFS. On the efficiency CAIs, except production, the trade-offs were observed across the sub domains of income control, asset ownership, workload and public speaking.

Concerning the livelihood CAIs, the synergies leveraged across the production and public speaking sub-domains while the sub indicators of income control, asset ownership and workload revealed trade-offs. The synergies and trade-offs are dependent on the context-specificity of the CAIs. Therefore, the study challenges the presumption that women's empowerment automatically improves HFS. The study recommends that optimal and sustainable HFS outcomes could be leveraged by not only providing women with economic resources but also changing the gender norms and the intra-household and community structures underpinning gender inequality. In light of this, the study suggests that there is no 'one size fits all' solution in designing locally context-appropriate policies and collective action program design. The study suggests a portfolio of nutrition-sensitive and gender-sensitive policies that would help in identifying, prioritising, targeting, formulating and implementation of potential sustainable HFS solutions facing smallholder households. This portfolio of synergies has the potential to confer spill over effects, complementarities and synergies to address triple challenges of developing gender-sensitive collective action initiatives, gender equality and empowering of women objectives and household food security concerns.

Nevertheless, the study shows certain limitations. First, the analysis follows a seven-day recall, which may not mirror a precise status of HFS. Therefore, the study recommends multiple visits or the employment of panel data to provide a clear picture of the status of HFS that considers the variations with production seasons. Another limitation is that the study is underpinned on cross-sectional data that does not allow for the rigorous exploration of the socio-economic transformational mechanisms through which empowerment of women interplays with collective action in determining HFS. The study proposed several pathways (Figure 6.2) and the study suggests that future research to use longitudinal data to investigate how transformation trajectories of the CAI and gender dynamics influence HFS over time. Finally, the data of the study is highly context-specific, therefore, extensive similar studies are recommended to extend the empirical findings in broader contexts.

CHAPTER SEVEN

SYTHESIS, CONCLUSIONS AND POLICY IMPLICATIONS

This chapter provides the general synthesis, conclusion and draws policy implications from the study. Section 7.1 provide the syntheses and general discussion of the findings for chapter two to chapter seven covering the four objectives studied. Section 7.2 draws the conclusion of the study. Section 7.3 highlights the main implications of the study on policy targeting. Section 7.4 pin points the gaps for future studies.

7.1 Synthesis

Chapter two focused on the characterisation of CAIs while chapter three explored the effects of collective action on HFS. Chapter three investigated the participation patterns of men and women across the efficiency and livelihood typologies. Chapter four focussed on the effect of collective action on empowerment of women and chapter five evaluated the subsequent women empowerment effects on HFS. Chapter two characterised the heterogeneities underpinning the CAIs including savings and credit groups, producer and marketing groups, water and forest user associations, cooperatives and unions into typologies. Collective action typologies are clusters or categories of CAIs that manifest similar organizational characteristics. The findings revealed two typologies of collective action namely efficiency and livelihood. The efficiency typology focussed on ameliorating the transaction costs in markets and along the value chain through engaging in vertical coordination activities including collective extension and advisory services and farm input sourcing and collective input marketing. The livelihood typology engaged in household livelihood and resilience stock-enhancing horizontal coordination activities including sourcing of credit either internally or through bank linkages, pooling of savings through table banking, collective and reciprocal asset acquisition and provision of informal insurance.

The efficiency typology revealed low membership profile due to huge capital outlay required for investing in efficiency enhancing activities, thus favouring older, male households who have good access to information. The livelihood typology constituted of larger membership profile, dominated by younger female households who have lower access to resources such as livestock and land that are important in investing in efficiency CAIs. The low membership profile was attributed to the closed

membership entry criteria in permitting new members to the group. The closed membership safeguards market and organizational competitiveness by minimising heterogeneities in member contributions to the group. Conversely, the livelihood typology practised open membership entry criteria. This is because they constitute of members tied by either kinship or neighbourhood. The efficiency typology is well socially networked, manifest low bridging and bonding social capital while the livelihood typology was lowly socially networked and showed high bridging and bonding social capital.

The organizational attributes differentially conditioned participation patterns of men and women across the efficiency and livelihood typology. For instance, the results showed substantial gender gaps in participation in the two forms of collective action typologies. However, the efficiency typology showed larger differences compared to livelihood CAIs because the typology requires huge capital to pursue efficiency-enhancing activities. The gender gaps are also attributed to differences among MHHs and FHHs in farm size, livestock, off-farm income, bank account, education and farming experience, control of assets and decision-making in production. The participation statuses in efficiency and livelihood CAIs among the FHHs would have been higher than they are now if the coefficients on their observed attributes had been the same as the coefficients on the characteristics of MHHs. The gender gaps in resource endowments limit women's participation the subsequent empowerment outcomes. The context-specificity of the two typologies revealed synergies and trade-off effects on women empowerment outcomes.

Analogously, the efficiency CAIs showed the trade-off effects across the domains of production decisions, autonomy in production, asset ownership, asset control, credit control, workload and leisure while the synergies were observed across the sub-domains of income control, public speaking and membership in groups. Concerning livelihood CAIs, the synergies were accrued across the sub-domains of production decisions, autonomy in production, asset control, credit control, income control, workload and leisure. However, the trade-off effects were manifested in asset ownership, public speaking and membership in groups. The trade-offs in efficiency typology were larger than efficiency typology. This could be ascribed to the dominance of men leading to women's exclusion in their agency, representation and recognition and acquisition of resources and decision-making capacities. Similarly,

the low bonding social capital in manifested in efficiency typology would debilitate the group's cohesiveness and reciprocity that can subsequently impede the transformation of the existing gendered social norms. Due to time constraints, the efficiency of CAIs' operation on a large-scale limits women's opportunity for improving their agency that can accrue as a result of attending meetings, market days and training

The synergies imply that the systemic and structural power dynamics across the efficiency and livelihood typologies differentially influenced HFS outcomes. On the aggregate sample, among the collective action members, women's empowerment in production, income and asset ownership all showed positive synergistic and spillover effects on HFS. However, workload and public speaking revealed trade-offs on HFS. On the efficiency CAIs, except production, the trade-offs were observed across the sub domains of income control, asset ownership, workload and public speaking. Concerning the livelihood CAIs, the synergies leveraged across the production and public speaking sub domains while the sub indicators of income control, asset ownership and workload revealed trade-offs. Contrary to the livelihood CAIs, the trade-offs are more eminent among the efficiency CAIs. The possible explanations could be, first, the efficiency form of collective action is dominated by males. The existing social-cultural attitudes and norms limit women's agency and could impede women's accruing of decision-making capacities, women's representation, recognition and resources that may translate to HFS.

Secondly, the wider geographical scale of operation of the efficiency CAIs limits women's abilities to capitalise on the high bridging social capital to improve their intrahousehold decision-making capacities on HFS. The decision-making capacities arise from the spill over effects of improvements in bargaining skills and leadership abilities that develop within the community and markets. The wider geographical scale limits women's participation due to disproportionate intrahousehold labour allocation that limits women within the domestic spheres denying them opportunities to attend general meetings, trainings and marketing days. In addition, the preference of men for cash crop production and their participation in market-oriented production in efficiency groups could lead to the deviating of resources to cash crop farming at the expense of their diversified food production for home consumption (Linderhof *et al.*, 2019). Conversely, the livelihood CAIs, are dominated by women, who according

to Njuki *et al.* (2022) are more concerned about household welfare and the status of HFS, and therefore more likely to invest and reinvest their incomes in improving the nutritional and health statuses of their families. Thirdly, unlike the livelihood CAIs, the low bonding social capital exhibited by the efficiency CAIs compromises with group cohesiveness, trust and reciprocity incentives that are important in facilitating the transformation and reversal of the existing gendered social norms both at the intrahousehold level and the community levels. The variations in HFS outcomes across the women empowerment sub-domains can be accounted for by the underlying household socio-economic determinants of HFS and women empowerment.

7.2 Conclusions

The study explored the heterogeneity of CAIs and their implications on participation among men and women and subsequent women empowerment and HFS. The findings revealed two typologies of collective action namely efficiency and livelihood. The two typologies were quite different in their gender composition, nature and scope of coordination, level of social networking, level of social capital, membership entry criteria and formalization. The differential in organizational characteristics influence men's and women's participation patterns across efficiency and livelihood typologies. In light of this, the findings revealed gender gaps in participation across the two typologies. The gender gaps were larger among the efficiency typology compared to the livelihood typology. The gender gaps were attributed to the gender inequalities and differentials in intrahousehold and interhousehold resource endowments and preferences as well as agricultural roles of men and women. The findings further show that the gender inequalities in resource endowments and participation in livelihood and efficiency typology resulted to heterogeneous effect on women empowerment across the domains.

The efficiency typology empowered women through the synergistic effects on the control over income of women and membership in groups but showed trade-offs on women's production, autonomy in production, workload and leisure. On the other hand, the livelihood typology empowered women through the synergies of improving women's decision making on production, autonomy in production, asset ownership, income control, workload and leisure. Both efficiency and livelihood typology showed negative effects on women's asset ownership. The heterogeneous women

empowerment effects in turn influenced HFS benefits aggregated across the empowerment sub-domains. On the aggregate sample of both livelihood and efficiency typologies members combined, women's empowerment in production, income and asset ownership all showed positive synergistic and spill over effects on HFS. However, workload and public speaking revealed trade-offs on HFS. On the efficiency CAIs, except production, the trade-offs were observed across the sub domains of income control, asset ownership, workload and public speaking.

Concerning livelihood CAIs, the synergies leveraged across the production and public speaking sub-domains while the sub indicators of income control, asset ownership and workload revealed trade-offs. Regarding the HFS along the pathways of income and production, participation in efficiency and livelihood CAIs had a substantial effect on HFS through production by increasing access to improved inputs technologies and skills. Nonetheless, contrary to the livelihood CAIs, the efficiency CAIs had a negative HFS through the effect of income. The overall HFS across the combined pathways of income and production was low for both efficiency and livelihood CAIs due to the trade-offs exhibited through the income effects. However, the effects were lower for the efficiency CAIs than the livelihood CAIs due to the negative income effects exhibited by the former while and the synergies arising from income and production on the latter.

7.3 Policy implications

The findings of the study suggest that 'one size fits all' promotional collective action and policy program designs are inadequate. The study therefore suggested several context-specific, gender-sensitive and nutritional-sensitive policy implications. The policies would take into account of the opportunities and co-benefits vis-à-vis the challenges and trade-offs the collective action typologies pose to men and women. The policies would strengthen the synergies and opportunities while countering the challenges and trade-offs underlying collective action typologies in delivering fostering participation, women empowerment and HFS. The policies would offer potential complementarities, spill over and synergetic effects that would allow for better development of the collective action typologies while addressing the multiple SDGs of women empowerment and gender equality, food security and poverty reduction. For instance, there is need to prioritise the efficiency typology due to its

close associations of efficiency typology to efficiency-enhancing activities such as collective input sourcing and collective farm output marketing.

The efficiency typology would yield synergies and spillover effects for improving household incomes, agricultural production, food security, poverty reduction and rural development. For instance, the efficiency typology constituted of low membership profile of the households particularly young farmers and women. Aligning with the objectives of inclusivity, gender equality and empowerment of women, it is necessary to incentivise incentivize the youth and the women to stimulate their participation. This is through promoting efficiency-enhancing activities that offer female-targeted membership requirements that suit the agricultural activities performed by the women such as horticulture and small livestock farming. There is also a need to improve infrastructure notably tarmac roads to minimize the transaction costs of accessing markets in improving women's agency and resource access. It is important to foster good leadership and management in implementing accountability, transparency, governance and members' satisfaction with the CAIs, which efficiency CAIs seem to be lacking in the study area.

Financial empowerment policies are integral to strengthen the bargaining power of the efficiency typology members in markets as well as paying farmers for their produce in time. This would mitigate the liquidity constraints the farmers face due to delayed payments. The study further proposes that the mixed-gender groups that are better targeted to the needs of women may increase empowerment of women. There is further need to incentivize the non-farm livelihood-enhancing economic activities among the livelihood members to fill the household food gaps arising from low production. This is through providing group micro-credit schemes, transport services and input acquisition to ease some of the women's constraints. The policy makers and development practitioners need to carry out the gender sensitisation and awareness training to facilitate in transforming and reversing the gendered social norms in women's economic agency, balanced intrahousehold allocation of labour and building perceptions, norms of women's autonomy and promoting bargaining skills with spouses.

Participatory learning and action need to be upheld within the collective action settings to facilitate interactions among men and women within group settings. This would help in influencing the social norms by providing a safe space and level ground

for both women and men. Otherwise, participation in collective action may not yield to women's empowerment and HFS if the underlying social issues that lead to gender disparities are not addressed. Additionally, there is a need for policies that aim to improve HFS can consider pairing collective action and women empowerment interventions or/and objectives for optimal HFS outcomes. The development partners and policymakers need to be aware and mindful of the synergies and trade-offs women face as stewards of HFS. This is through employing interventions that promote the women's ability to manage their time, assets and resources, and decision-making

7.4 Areas for further study

The study demonstrates that organizational characteristics of the efficiency and livelihood collective action typologies align with socio-economic contextual factors of men and women. Therefore, the organizational characteristics determine the preferences of specific CAIs among men and women. Therefore, further research is important using choice experiments to ascertain the preferences of men and women for the livelihood and efficiency typologies' organizational characteristics and its implications on the gendered participation patterns, women empowerment and subsequent HFS outcomes. Collective action typologies are highly sensitive to, and continuously transforming in response to changing agricultural seasons, opportunities, risks and shocks. In this context, in complementing this study that relied on the cross-sectional data, the study recommends follow up studies employing panel data.

Panel data will help in capturing the dynamism and complexities underpinning the transformations of the collective action typologies in their organizational characteristics over time and its implications on the gendered participation patterns, women empowerment and HFS. In addition, there is need for more studies in complementing this seven-day recall metrics of HFS either through conducting panel data that considers the variations on the status of HFS with production seasons. Lastly, the highly contextual nature of the study's findings calls for broader spectrum studies in different socio-economic contexts to extend the empirical findings and generalizations to broader settings.

REFERENCES

- Agarwal, B. (2000). Conceptualising environmental collective action: Why gender matters. *Cambridge Journal of Economics*, 24(3), 283–310. <https://doi.org/10.1093/cje/24.3.283>
- Agricultural Sector Transformation and Growth Strategy. (2019). *Agricultural Sector Transformation and Growth Strategy 2022-2029*. 1–216.
- Akter, S., Rutsaert, P., Luis, J., Htwe, N. M., San, S. S., Raharjo, B., & Pustaka, A. (2017). Women's empowerment and gender equity in agriculture: A different perspective from Southeast Asia. *Food Policy*, 69(May), 270–279. <https://doi.org/10.1016/j.foodpol.2017.05.003>
- Alemu, S. H., Van Kempen, L., & Ruben, R. (2018). Women Empowerment Through Self-Help Groups: The Bittersweet Fruits of Collective Apple Cultivation in Highland Ethiopia. *Journal of Human Development and Capabilities*, 19(3), 308–330. <https://doi.org/10.1080/19452829.2018.1454407>
- Ampaire, Enid, M. K., Amare, T., & Robin, B. (2020). Gender differences in agri-marketing farmer organizations in Uganda and Malawi: Implications for R4D delivery mechanisms. *African Journal of Agricultural Research*, 16(6), 916–930. <https://doi.org/10.5897/ajar2019.14394>
- Andersson, E., & Gabrielsson, S. (2012). “Because of poverty, we had to come together”: Collective action for improved food security in rural Kenya and Uganda. *International Journal of Agricultural Sustainability*, 10(3), 245–262. <https://doi.org/10.1080/14735903.2012.666029>
- Arasio, R. L., Kaufmann, B., Otieno, D. J., & Wasonga, O. V. (2018). Understanding the emergence and evolution of pastoral community groups from the perspective of community members and external development actors in northern Kenya. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, 119(2), 53–66. <https://doi.org/10.17170/kobra-2018121865>
- Ayamga, J. A., Ayawine, A., & Ayentimi, D. T. (2023). Women empowerment and food - nutrition security in Sierra Leone : The Gender Model Family approach. *Agriculture & Food Security*, 2023, 1–11. <https://doi.org/10.1186/s40066-023-00445-1>
- Aziz, N., He, J., Raza, A., & Sui, H. (2022). A systematic review of review studies on women's empowerment and food security literature. *Global Food Security*, 34(June), 100647. <https://doi.org/10.1016/j.gfs.2022.100647>
- Badejo, A. F., Majekodunmi, A. O., Kingsley, P., Smith, J., & Welburn, S. C. (2017). The impact of self-help groups on pastoral women's empowerment and agency: A study in Nigeria. *Pastoralism*, 7(1). <https://doi.org/10.1186/s13570-017-0101-5>
- Barham, J., & Chitemi, C. (2009). Collective action initiatives to improve marketing performance: Lessons from farmer groups in Tanzania. *Food Policy*, 34(1), 53–59. <https://doi.org/10.1016/j.foodpol.2008.10.002>
- Bautista, C. M. (2020). *Filipino couples' reproductive choices*. 9, 30–39.
- Beber, C. L., Lakner, S., & Skevas, I. (2021). Organizational forms and technical efficiency of the dairy processing industry in Southern Brazil. *Agricultural and Food Economics*, 9(1). <https://doi.org/10.1186/s40100-021-00195-3>
- Benassi, M., Garofalo, S., Ambrosini, F., Sant'Angelo, R. P., Raggini, R., De Paoli, G., Ravani, C., Giovagnoli, S., Orsoni, M., & Piraccini, G. (2020). Using Two-Step Cluster Analysis and Latent Class Cluster Analysis <file:///C:/Users/Catherine/Desktop/download.php.pdf> Classify the Cognitive

- Heterogeneity of Cross-Diagnostic Psychiatric Inpatients. *Frontiers in Psychology*, 11(June), 1–11. <https://doi.org/10.3389/fpsyg.2020.01085>
- Bernard, T., & Taffesse, A. S. (2012). Returns to scope? Smallholders' commercialisation through multipurpose cooperatives in Ethiopia. *Journal of African Economies*, 21(3), 440–464. <https://doi.org/10.1093/jae/ejs002>
- Bijman, J. (2016). The changing nature of farmer collective action: Introduction to the book. *Cooperatives, Economic Democratization and Rural Development*, January, 1–22. <https://doi.org/10.4337/9781784719388.00007>
- Bijman, J., & Hanisch, M. (2012). *Support for Farmers Cooperatives. Developing a typology of cooperatives and producer organisations in the EU*. October 2017, 23. <https://research.wur.nl/en/publications/support-for-farmers-cooperatives-executive-summary>
- Bijman, J., & Hanisch, M. (2020). Understanding the heterogeneity among agricultural cooperatives. *Ciriec*, 13, 1–29. <http://www.ciriec.uliege.be/wp-content/uploads/2020/12/WP2020-13.pdf>
- Bijman, J., & Wijers, G. (2019). Exploring the inclusiveness of producer cooperatives. *Current Opinion in Environmental Sustainability*, 41, 74–79. <https://doi.org/10.1016/j.cosust.2019.11.005>
- Bizikova, L., Nkonya, E., Minah, M., Hanisch, M., Turaga, R. M. R., Speranza, C. I., Karthikeyan, M., Tang, L., Ghezzi-Kopel, K., Kelly, J., Celestin, A. C., & Timmers, B. (2020). A scoping review of the contributions of farmers' organizations to smallholder agriculture. *Nature Food*, 1(10), 620–630. <https://doi.org/10.1038/s43016-020-00164-x>
- Browning, M. (2014). *Efficient Intra-Household Allocations: A General Characterization and Empirical Tests*. July. <https://doi.org/10.2307/2999616>
- Chagwiza, C., Muradian, R., & Ruben, R. (2016). Cooperative membership and dairy performance among smallholders in Ethiopia. *Food Policy*, 59, 165–173. <https://doi.org/10.1016/j.foodpol.2016.01.008>
- Charrad, M., Ghazzali, N., Boiteau, V., & Niknafs, A. (2014). NbClust: An R package for determining the relevant number of clusters. *Journal of Statistical Software*, 61(6), 1–36. https://www.researchgate.net/publication/267210575_NbClust_An_R_Package_for_Determining_the_Relevant_Number_of_Clusters_in_a_Data_Set
- Cheevapattananuwong, P., Baldwin, C., Lathouras, A., & Ike, N. (2020). Social capital in community organizing for land protection and food security. *Land*, 9(3). <https://doi.org/10.3390/land9030069>
- Chiappori, P. A. (2014). *Rational Household Labor Supply*. October. <https://doi.org/10.2307/1911842>
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. <https://www.routledge.com/Statistical-Power-Analysis-for-the-Behavioral-Sciences/Cohen/p/book/9780805802832>
- Cramer, L., Förch, W., Mutie, I., & Thornton, P. K. (2016). Connecting Women, Connecting Men: How Communities and Organizations Interact to Strengthen Adaptive Capacity and Food Security in the Face of Climate Change. *Gender, Technology and Development*, 20(2), 169–199. <https://doi.org/10.1177/0971852416639771>
- Czech, S. (2016). Mancur olson's collective action theory 50 years later. A view from the institutionalist perspective. *Journal of International Studies*, 9(3), 114–123. <https://doi.org/10.14254/2071-8330.2016/9-3/9>
- Danso-Abbeam, G., Baiyegunhi, L. J. S., & Ojo, T. O. (2020). Gender differentials

- in technical efficiency of Ghanaian cocoa farms. *Heliyon*, 6(5), e04012. <https://doi.org/10.1016/j.heliyon.2020.e04012>
- Dary, S. K., & Grashuis, J. (2020). Characterization of farmer-based cooperative societies in the upper west region of Ghana. *Annals of Public and Cooperative Economics*, 92(4), 669–687. <https://doi.org/10.1111/apce.12305>
- Deb, P., & Trivedi, P. K. (2006a). Maximum simulated likelihood estimation of a negative binomial regression model with multinomial endogenous treatment. *Stata Journal*, 6(2), 246–255. <https://doi.org/10.1177/1536867x0600600206>
- Deb, P., & Trivedi, P. K. (2006b). Specification and simulated likelihood estimation of a non-normal treatment-outcome model with selection: Application to health care utilization. *Econometrics Journal*, 9(2), 307–331. <https://doi.org/10.1111/j.1368-423X.2006.00187.x>
- Dhal, S., Lane, L., & Srivastava, N. (2020). Women’s Collectives and Collective Action for Food and Energy Security: Reflections from a Community of Practice (CoP) Perspective. *Indian Journal of Gender Studies*, 27(1), 55–76. <https://doi.org/10.1177/0971521519891479>
- Diiro, G. M., Seymour, G., Kassie, M., Muricho, G., & Muriithi, W. (2018). *Women’s empowerment in agriculture and agricultural productivity: Evidence from rural maize farmer households in western Kenya*. 1–27. <https://doi.org/10.1371/journal.pone.0197995>
- Dohmwirth, C., & Hanisch, M. (2018). Women and collective action: lessons from the Indian dairy cooperative sector. *Community Development Journal*, 53(4), 1–19. <https://doi.org/10.1093/cdj/bsx014>
- Doss. (2014). If women hold up half the sky, how much of the world’s food do they produce? *Gender in Agriculture: Closing the Knowledge Gap*, 11, 69–88. https://doi.org/10.1007/978-94-017-8616-4_4
- Doss, C. (2012). *Intrahousehold bargaining and resource allocation in developing countries*.
- Doss, C. R., & Quisumbing, A. R. (2020). Understanding rural household behavior: Beyond Boserup and Becker. *Agricultural Economics (United Kingdom)*, 51(1), 47–58. <https://doi.org/10.1111/agec.12540>
- Egamberdiev, B., Bobojonov, I., Kuhn, L., & Glauben, T. (2023). Household resilience capacity and food security: evidence from Kyrgyzstan. *Food Security*, 15(4), 967–988. <https://doi.org/10.1007/s12571-023-01369-1>
- FAO. (2011). The State of Food Insecurity in the World Addressing food insecurity in protracted crises 2010 Key messages. In *Notes*. <http://www.fao.org/docrep/013/i1683e/i1683e.pdf>
- Fernando, S., Garnevska, E., Ramilan, T., & Shadbolt, N. (2021). Organisational attributes of cooperatives and farmer companies. *Journal of Co-Operative Organization and Management*, 9(1), 100132. <https://doi.org/10.1016/j.jcom.2021.100132>
- Fischer, E., & Qaim, M. (2012a). Gender, agricultural commercialization, and collective action in Kenya. *Food Security*, 4(3), 441–453. <https://doi.org/10.1007/s12571-012-0199-7>
- Fischer, E., & Qaim, M. (2012b). Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya. *World Development*, 40(6), 1255–1268. <https://doi.org/10.1016/j.worlddev.2011.11.018>
- Fischer, E., & Qaim, M. (2014). Smallholder farmers and collective action: What determines the intensity of participation? *Journal of Agricultural Economics*, 65(3), 683–702. <https://doi.org/10.1111/1477-9552.12060>

- Florensa, D., Godoy, P., Mateo, J., Solsona, F., Pedrol, T., Mesas, M., & Pinol, R. (2021). The Use of Multiple Correspondence Analysis to Explore Associations between Categories of Qualitative Variables and Cancer Incidence. *IEEE Journal of Biomedical and Health Informatics*, 25(9), 3659–3667. <https://doi.org/10.1109/JBHI.2021.3073605>
- Fongar, A., Gödecke, T., & Qaim, M. (2019). Various forms of double burden of malnutrition problems exist in rural Kenya. *BMC Public Health*, 19(1), 1–9. <https://doi.org/10.1186/s12889-019-7882-y>
- Food and Agricultural Organization. (2023). *The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum*. <https://www.fao.org/documents/card/en/c/cc3017en>
- Food and Agriculture Organization. (2021). The State of Food Security and Nutrition in the World 2021. In *The State of Food Security and Nutrition in the World 2021*. <https://doi.org/10.4060/cb4474en>
- Food and Agriculture Organization. (2022). Food security and nutrition in the world. In *The Lancet Diabetes and Endocrinology* (Vol. 10, Issue 9). [https://doi.org/10.1016/S2213-8587\(22\)00220-0](https://doi.org/10.1016/S2213-8587(22)00220-0)
- Francesconi, G. N., & Heerink, N. (2011). Ethiopian agricultural cooperatives in an era of global commodity exchange: Does organisational form matter? *Journal of African Economies*, 20(1), 153–177. <https://doi.org/10.1093/jae/ejq036>
- Francesconi, G. N., & Wouterse, F. (2019). Building the Managerial Capital of Agricultural Cooperatives in Africa. *Annals of Public and Cooperative Economics*, 90(1), 141–159. <https://doi.org/10.1111/apce.12218>
- Frediani, A. A. (2010). Sen’s capability approach as a framework to the practice of development. *Development in Practice*, 20(2), 173–187. <https://doi.org/10.1080/09614520903564181>
- Fu, L., Id, W. P., & Shi, X. (2022). *Do cooperatives exclude small-scale farming households? Evidence from Fuchuan County, Guangxi Province*. 1–14. <https://doi.org/10.1371/journal.pone.0272150>
- Galiè, A., Teufel, N., Girard, A. W., Baltenweck, I., Dominguez-Salas, P., Price, M. J., Jones, R., Lukuyu, B., Korir, L., Raskind, I. G., Smith, K., & Yount, K. M. (2019). Women’s empowerment, food security and nutrition of pastoral communities in Tanzania. *Global Food Security*, 23(September 2017), 125–134. <https://doi.org/10.1016/j.gfs.2019.04.005>
- Ganle, J. K., Afriyie, K., & Segbefia, A. Y. (2015). Microcredit: Empowerment and disempowerment of rural women in Ghana. *World Development*, 66, 335–345. <https://doi.org/10.1016/j.worlddev.2014.08.027>
- Global Gender Gap Report. (2016). Global Gender Gap Report. In *Encyclopedia of Family Studies* (Issue March). <https://doi.org/10.1002/9781119085621.wbefs350>
- Global Hunger Index. (2023). *2023 Global Hunger Index: The Power of Youth in Shaping Food Systems*. <https://www.globalhungerindex.org/pdf/en/2023.pdf>
- Gomez, & Louhichi and Sergio. (2020). The Role of Smallholder Farms in Food and Nutrition Security. In *The Role of Smallholder Farms in Food and Nutrition Security*. <https://doi.org/10.1007/978-3-030-42148-9>
- Government of Kenya. (2010). *Constitution of Kenya* (Issue 1).
- Government of Kenya. (2021). *Kenya’s draft agriculture sector Gender Policy Policy Note*.

- Grashuis, J., & Skevas, T. (2023). What is the benefit of membership in farm producer organizations? The case of coffee producers in Peru. *Annals of Public and Cooperative Economics*, 94(2), 423–443. <https://doi.org/10.1111/apce.12390>
- Greene. (2016). *Econometrics Analysis* (Vol. 4, Issue 1).
- Greene, W. H. (2012). *Econometric analysis*.
- Groot Kormelinck, A., Bijman, J., & Trienekens, J. (2019). Characterizing Producer Organizations: The case of organic versus conventional vegetables in Uruguay. *Journal of Rural Studies*, 69(March), 65–75. <https://doi.org/10.1016/j.jrurstud.2019.04.012>
- Gyau, A., Mbugua, M., & Oduol, J. (2016). Determinants of participation and intensity of participation in collective action: Evidence from smallholder avocado farmers in Kenya. *Journal on Chain and Network Science*, 16(2), 147–156. <https://doi.org/10.3920/JCNS2015.0011>
- Habiyaremye, N., Mtimet, N., Ouma, E. A., & Obare, G. A. (2023). Cooperative membership effects on farmers' choice of milk marketing channels in Rwanda. *Food Policy*, 118(July), 102499. <https://doi.org/10.1016/j.foodpol.2023.102499>
- Harris-Fry, H., Shrestha, N., Costello, A., & Saville, N. M. (2017). Determinants of intra-household food allocation between adults in South Asia - A systematic review. *International Journal for Equity in Health*, 16(1), 1–21. <https://doi.org/10.1186/s12939-017-0603-1>
- Heckert, J., Olney, D. K., & Ruel, M. T. (2019). Social Science & Medicine Is women's empowerment a pathway to improving child nutrition outcomes in a nutrition-sensitive agriculture program?: Evidence from a randomized controlled trial in Burkina Faso. *Social Science & Medicine*, 233(April), 93–102. <https://doi.org/10.1016/j.socscimed.2019.05.016>
- High Level Panel of Experts. (2020). Food Security and Nutrition: Building a Global Narrative towards 2030. In *High Level Panel of Experts*. <http://www.fao.org/3/ca9731en/ca9731en.pdf>
- Hillenbrand, E., Obi, C., Mcdougal, C., Rossignoli, C. M., Hillenbrand, E., Obi, C., & Mcdougal, C. (2023). Scaling-out gender transformative approaches in agriculture research for development. *Gender, Technology and Development*, 0(0), 1–28. <https://doi.org/10.1080/09718524.2023.2272348>
- Hilliova, M., Hejkrlík, J., Mazancova, J., & Tseren, T. (2017). Reaching the Rural Poor Through Agricultural Cooperatives in Mongolia. *Annals of Public and Cooperative Economics*, 88(3), 449–466. <https://doi.org/10.1111/apce.12162>
- Hintz, K. S., & Pretzsch, J. (2023). Co-creation of business models for smallholder forest farmers' organizations: Lessons learned from rural Ethiopia and Tanzania. *Annals of Public and Cooperative Economics*, April, 1–29. <https://doi.org/10.1111/apce.12413>
- Hoop, T. De, Brody, C., Tripathi, S., Vojtkova, M., & W arnock, R. (2019). *Economic self-help group programmes for improving women's empowerment*. September. <https://www.3ieimpact.org/evidence-hub/publications/systematic-review-summaries/economic-self-help-group-programmes-improving>
- Ingutia, R., & Sumelius, J. (2022). Do farmer groups improve the situation of women in agriculture in rural Kenya? *International Food and Agribusiness Management Review*, 25(1), 135–156. <https://doi.org/10.22434/IFAMR2020.0142>
- Innazent, A., Jacob, D., Bindhu, J. S., Joseph, B., Anith, K. N., Ravisankar, N., Prusty, A. K., Paramesh, V., & Panwar, A. S. (2022). Farm typology of

- smallholders integrated farming systems in Southern Coastal Plains of Kerala, India. *Scientific Reports*, 12(1), 1–14. <https://doi.org/10.1038/s41598-021-04148-0>
- International Food Policy Research Institute. (n.d.). *Rethinking Food crisis responses*.
- Kaaria, S., Osorio, M., Wagner, S., & Gallina, A. (2016). Rural women's participation in producer organizations: An analysis of the barriers that women face and strategies to foster equitable and effective participation. *Journal of Gender, Agriculture and Food Security*, 1(2), 148–167.
- Kabeer, N. (1999). The Conditions and Consequences of Choice : Reflections on the Measurement of Women ' s Empowerment for Social Development. *Context*, 30(108), 435–464. <http://doi.wiley.com/10.1111/1467-7660.00125>
- Kabeer, N. (2016). Editorial: Tactics and trade-offs: Revisiting the links between gender and poverty. *IDS Bulletin*, 47(1A), 1–13. <https://doi.org/10.19088/1968-2016.117>
- Kaiser, M., Barnhart, S., & Huber-Krum, S. (2020). Measuring Social Cohesion and Social Capital within the Context of Community Food Security: A Confirmatory Factor Analysis. *Journal of Hunger and Environmental Nutrition*, 15(5), 591–612. <https://doi.org/10.1080/19320248.2019.1640161>
- Karing'u, K. N., Isaboke, H. N., & Ndirangu, S. N. (2020). Transaction costs and participation in avocado export marketing in Murang'a County, Kenya. *Journal of Agribusiness in Developing and Emerging Economies*, 11(3), 221–240. <https://doi.org/10.1108/JADEE-12-2019-0206>
- Kassie, M., Fisher, M., Muricho, G., & Diiro, G. (2020). Women's empowerment boosts the gains in dietary diversity from agricultural technology adoption in rural Kenya. *Food Policy*, 95(August), 101957. <https://doi.org/10.1016/j.foodpol.2020.101957>
- Kassie M, Ndiritu, S. W., & Stage, J. (2014). What Determines Gender Inequality in Household Food Security in Kenya? Application of Exogenous Switching Treatment Regression. *World Development*, 56, 153–171. <https://doi.org/10.1016/j.worlddev.2013.10.025>
- Kehinde, A. D., Adeyemo, R., & Ogundeji, A. A. (2021). Does social capital improve farm productivity and food security? Evidence from cocoa-based farming households in Southwestern Nigeria. *Heliyon*, 7(3), e06592. <https://doi.org/10.1016/j.heliyon.2021.e06592>
- Kehinde Olanike, M., Shittu, A. M., Adeyonu, A. G., & Ogunnaike, M. G. (2021). Women empowerment , Land Tenure and Property Rights , and household food security among smallholders in Nigeria. *Agriculture & Food Security*, 1–22. <https://doi.org/10.1186/s40066-021-00297-7>
- Kenya National Bureau of Statistics. (2021). Economic Survey Report 2021. In *Economic Survey 2021*. <https://www.knbs.or.ke/?wpdmp=economic-survey-2020>
- Kenya National Bureau of Statistics. (2022). *Economic survey*
- Kenya National Bureau of Statistics (KNBS). (2018). *Kenya Integrated Household Budget Survey 2015/2016*.
- Kenya National Bureau of Statistics (KNBS). (2022). *Economic Survey*.
- Kenya National Bureau of Statistics, K. (2023a). Demographic and Health Survey 2023. In *Demographic and Health Survey 2022*. <https://new.knbs.or.ke/reports/kdhs-2022/>
- Kenya National Bureau of Statistics, K. (2023b). *Kenya Demographic and Health*

Survey 2022.

- Kihiu, E. N., & Amuakwa-Mensah, F. (2021). Agricultural market access and dietary diversity in Kenya: Gender considerations towards improved household nutritional outcomes. *Food Policy*, *100*(September 2019), 102004. <https://doi.org/10.1016/j.foodpol.2020.102004>
- Kirimi, L., Gitau, R., & Olunga, M. (2013). Household Food Security and Commercialization Among Smallholder Farmers in Kenya. A paper prepared for the 4th International Conference of the African Association of Agricultural Economists, 22 - 25 September, 2013, Hammamet, Tunisia. *4th International Conference of the African Association of Agricultural Economists, September 2015*, 1–20. https://www.researchgate.net/publication/282077351_household_food_security_and_commercialization_among_smallholder_farmers_in_Kenya/download
- Komatsu, H., Malapit, H. J. L., & Theis, S. (2018). Does women 's time in domestic work and agriculture affect women 's and children 's dietary diversity? Evidence from Bangladesh , Nepal , Cambodia ., *79*(July), 256–270. <https://doi.org/10.1016/j.foodpol.2018.07.002>
- Koster, T., Termeer, E., Motovska, N., Kunz, M., Ayuya, O. I., & ... (2021). *Social capital and food security in Kibera*. <https://scholar.archive.org/work/efmvrk6r5dvbeigfvnuckyrmy/access/wayback/https://edepot.wur.nl/546542>
- Kumar, N., Scott, S., Menon, P., Kannan, S., Cunningham, K., Tyagi, P., Wable, G., Raghunathan, K., & Quisumbing, A. (2018). Pathways from women's group-based programs to nutrition change in South Asia: A conceptual framework and literature review. *Global Food Security*, *17*(August 2017), 172–185. <https://doi.org/10.1016/j.gfs.2017.11.002>
- Kwizerimana, S., Mugwe, J., & Nigat, B. (2023). Impact of collective marketing participation on farmers' income: Evidence from smallholder avocado farmers of Murang'a County, Kenya. *Social Sciences and Humanities Open*, *8*(1). <https://doi.org/10.1016/j.ssaho.2023.100614>
- LaFevor, M. C. (2022). Characterizing Agricultural Diversity with Policy-Relevant Farm Typologies in Mexico. *Agriculture (Switzerland)*, *12*(9). <https://doi.org/10.3390/agriculture12091315>
- Larsen, A. F., & Lilleør, H. B. (2014). Beyond the Field: The Impact of Farmer Field Schools on Food Security and Poverty Alleviation. *World Development*, *64*, 843–859. <https://doi.org/10.1016/j.worlddev.2014.07.003>
- Leder, S., Raut, M., Saikia, P., & Sugden, F. (2017). Farmer collectives and shifting gender relations in the Eastern Gangetic Plains. *Improving Water Use for Dry Season Agriculture by Marginal and Tenant Farmers in the Eastern Gangetic Plains*, 1–35.
- Linderhof, V., Janssen, V., & Achterbosch, T. (2019). Does agricultural commercialization affect food security: The case of crop-producing households in the regions of Post-Reform Vietnam? *Sustainability (Switzerland)*, *11*(5). <https://doi.org/10.3390/su11051263>
- Loko, Y. L. E., Gbemavo, C. D. S. J., Djedatin, G., Ewedje, E. E., Orobiyi, A., Toffa, J., Tchakpa, C., Sedah, P., & Sabot, F. (2022). Characterization of rice farming systems, production constraints and determinants of adoption of improved varieties by smallholder farmers of the Republic of Benin. *Scientific Reports*, *12*(1), 1–19. <https://doi.org/10.1038/s41598-022-07946-2>
- Lufuke, M., Bai, Y., Fan, S., & Tian, X. (2023). *Women 's Empowerment , Food*

Security , and Nutrition Transition in Africa.

- Lupi, V., Candelise, C., Calull, M. A., Delvaux, S., Valkering, P., Hubert, W., Sciullo, A., Ivask, N., van der Waal, E., Iturriza, I. J., Paci, D., Della Valle, N., Koukoufikis, G., & Dunlop, T. (2021). A characterization of european collective action initiatives and their role as enablers of citizens' participation in the energy transition. *Energies*, *14*(24). <https://doi.org/10.3390/en14248452>
- Lutomia, C. K., Obare, G. A., Kariuki, I. M., & Muricho, G. S. (2019). Determinants of gender differences in household food security perceptions in the Western and Eastern regions of Kenya. *Cogent Food and Agriculture*, *5*(1). <https://doi.org/10.1080/23311932.2019.1694755>
- Ma, W., & Abdulai, A. (2017). The economic impacts of agricultural cooperatives on smallholder farmers in rural China. *Agribusiness*, *33*(4), 537–551. <https://doi.org/10.1002/agr.21522>
- Ma, W., Marini, M. A., & Rahut, D. B. (2023). Farmers' organizations and sustainable development: An introduction. *Annals of Public and Cooperative Economics*, *72003089*. <https://doi.org/10.1111/apce.12449>
- Magambo, G., Oluoch-kosura, W., & Moraa, C. (2022). Does the adoption of soil carbon enhancing practices translate to increased farm yields ? A case of maize yield from Western Kenya Heliyon Does the adoption of soil carbon enhancing practices translate to increased farm yields ? A case of maize yield from. *Heliyon*, *May*, e09500. <https://doi.org/10.1016/j.heliyon.2022.e09500>
- Maindi, C. N., & Wangare, N. L. (2021). *The Exclusion Dilemma : How Women and the Poor are excluded from Collective Action and Implications for Development Policy*. *14*(5), 22–35. <https://doi.org/10.9790/2380-1405012235>
- Malapit, H. J. L., & Quisumbing, A. R. (2015). What dimensions of women's empowerment in agriculture matter for nutrition in Ghana? *Food Policy*, *52*, 54–63. <https://doi.org/10.1016/j.foodpol.2015.02.003>
- Malual, J. D., & Mazur, R. E. (2022). Social capital and food security in post-conflict rural Lira District, northern Uganda. *Disasters*, *46*(1), 80–94. <https://doi.org/10.1111/disa.12465>
- Mccarthy, N., & Kilic, T. (2015). The nexus between gender, collective action for public goods and agriculture: Evidence from Malawi. *Agricultural Economics (United Kingdom)*, *46*(3), 375–402. <https://doi.org/10.1111/agec.12170>
- McCarthy, N., & Kilic, T. (2017). Stronger Together: Intra-Household Cooperation and Household Welfare in Malawi. *Stronger Together: Intra-Household Cooperation and Household Welfare in Malawi*, *May*. <https://doi.org/10.1596/1813-9450-8043>
- McFadden, D. (1982). Ch. 05. Econometric Models of Probabilistic Choice. In *Structural Analysis of Discrete Data with Econometric Applications* (pp. 198–272).
- Min-Han Tsai and Yir-Hueih. (2022). Group Heterogeneity and the Economic Effect of Farmer Organisation Participation: Empirical Evidence from Taiwan. *Journal of Agricultural Economics Early View*. <https://doi.org/10.1111/1477-9552.12515>
- Miura, K., Kijima, Y., Sakurai, T., Foster, A., Friedman, J., Michalopoulos, S., Nakano, Y., Pakzad-Hurson, B., Rustagi, D., & Steinberg, B. (2020). *Intrahousehold Bargaining and Agricultural Technology Adoption : Experimental Evidence from Zambia Intrahousehold Bargaining and Agricultural Technology Adoption: Experimental Evidence from Zambia* □. *April*.

- MoALF. (2019). *Agricultural Sector Transformation & Growth Strategy 2019-2029. Nairobi, Kenya.*
- Mobarok, M. H., Skevas, T., & Thompson, W. (2021). Women's empowerment in agriculture and productivity change: The case of Bangladesh rice farms. *PLoS ONE*, *16*(8 August), 1–21. <https://doi.org/10.1371/journal.pone.0255589>
- Molina, J. A., Velilla, J., & Ibarra, H. (2022). Intrahousehold Bargaining Power in Spain: An Empirical Test of the Collective Model. *Journal of Family and Economic Issues*, *0123456789*. <https://doi.org/10.1007/s10834-021-09812-1>
- Mudege, N. N., Nyekanyeka, T., Kapalasa, E., Chevo, T., & Demo, P. (2015). Understanding collective action and women's empowerment in potato farmer groups in Ntcheu and Dedza in Malawi. *Journal of Rural Studies*, *42*, 91–101. <https://doi.org/10.1016/j.jrurstud.2015.09.002>
- Murang'a County. (2019). *Murang ' a County Government Annual Development Plan 2018 / 2019*. 1–179. https://muranga.go.ke/?attachment_id=3454
- Mutonyi, S. (2019). The effect of collective action on smallholder income and asset holdings in Kenya. *World Development Perspectives*, *14*(April), 100099. <https://doi.org/10.1016/j.wdp.2019.02.010>
- Mutungu, C., Manda, J., Feleke, S., Abass, A., Bekunda, M., Hoschle-Zeledon, I., & Fischer, G. (2023). Adoption and impacts of improved post-harvest technologies on food security and welfare of maize-farming households in Tanzania: a comparative assessment. *Food Security*, *15*(4), 1007–1023. <https://doi.org/10.1007/s12571-023-01365-5>
- Mwambi, M., Bijman, J., & Galie, A. (2021). The effect of membership in producer organizations on women's empowerment: Evidence from Kenya. *Women's Studies International Forum*, *87*(July), 102492. <https://doi.org/10.1016/j.wsif.2021.102492>
- Mwambi, M., Bijman, J., & Mshenga, P. (2020). Which type of producer organization is (more) inclusive? Dynamics of farmers' membership and participation in the decision-making process. *Annals of Public and Cooperative Economics*, *91*(2), 213–236. <https://doi.org/10.1111/apce.12269>
- Nakazi, F., Aseete, P., Katungi, E., & Adrogu Ugen, M. (2017). The potential and limits of farmers' groups as catalysts of women leaders. *Cogent Economics and Finance*, *5*(1), 1–16. <https://doi.org/10.1080/23322039.2017.1348326>
- Nambier, E. and. (2018). Empowering through collective action. In *Empowering through Collective Action* (Issue November). <https://doi.org/10.13140/RG.2.2.36560.97280>
- Niles, M. T., Rudnick, J., Lubell, M., Cramer, L., & Niles, M. T. (2021). *Household and Community Social Capital Links to Smallholder Food Security*. *5*(March), 1–14. <https://doi.org/10.3389/fsufs.2021.583353>
- Njuguna, K. kelvin, Isaboke, H. N., & Ndirangu, S. N. (2022). Determinants of smallholders' choice of avocado marketing outlets and profitability in Murang'a County, Kenya. *SN Business & Economics*, *2*(8). <https://doi.org/10.1007/s43546-022-00261-y>
- Njuki, J., Eissler, S., Malapit, H. J., Meinzen-Dick, R. S., Bryan, E., & Quisumbing, A. R. (2021). A review of evidence on gender equality, women's empowerment, and food systems. *SSRN Electronic Journal*, *July*. <https://doi.org/10.2139/ssrn.3886544>
- Njuki, J., Eissler, S., Malapit, H., Meinzen-dick, R., Bryan, E., & Quisumbing, A. (2022). A review of evidence on gender equality , women ' s empowerment , and food systems. *Global Food Security*, *33*(November 2021), 100622.

- <https://doi.org/10.1016/j.gfs.2022.100622>
- Nosratabadi, S., Khazami, N., Ben Abdallah, M., Lackner, Z., Band, S. S., Mosavi, A., & Mako, C. (2020). Social Capital Contributions to Food Security: A Comprehensive Literature Review. *Foods*, 9(11), 1–18. <https://doi.org/10.3390/foods9111650>
- Nyambo, D., Luhanga, E. T., & Yonah, Z. Q. (2019). A review of characterization approaches for smallholder farmers: Towards predictive farm typologies. *Scientific World Journal*, 2019. <https://doi.org/10.1155/2019/6121467>
- Ochieng, J., Afari-Sefa, V., Lukumay, P. J., & Dubois, T. (2017). Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PLoS ONE*, 12(12), 1–18. <https://doi.org/10.1371/journal.pone.0189022>
- Olson, M. (1965). *The Logic of Collective Action*.
- Oxfam. (2013). *Women ' s Collective Action Unlocking the potential of agricultural markets*. 92. <https://oxfamilibrary.openrepository.com/handle/10546/276159?show=full>
- Padmaja, R., Pramanik, S., Pingali, P., Bantilan, C., & Kavitha, K. (2019). Understanding nutritional outcomes through gendered analysis of time-use patterns in semi-arid India. *Global Food Security*, 23(April), 49–63. <https://doi.org/10.1016/j.gfs.2019.04.001>
- Pandolfelli, L., & Meinzen-dick, R. (2007). Gender and Collective Action: A Conceptual Framework for Analysis. *Gender and Collective Action: A Conceptual Framework for Analysis*, 64. <https://doi.org/10.2499/capriwp64>
- Paudel, G. P., Gartaula, H., Rahut, D. B., & Craufurd, P. (2020). Gender differentiated small-scale farm mechanization in Nepal hills: An application of exogenous switching treatment regression. *Technology in Society*, 61(April), 101250. <https://doi.org/10.1016/j.techsoc.2020.101250>
- Pfammatter, P., & Jongerden, J. (2023). Beyond farming women: queering gender, work and family farms. *Agriculture and Human Values*, March. <https://doi.org/10.1007/s10460-023-10449-z>
- Phiri, A. T., Toure, H. M. A. C., Kipkogei, O., Traore, R., Afokpe, P. M. K., & Lamore, A. A. (2022). A review of gender inclusivity in agriculture and natural resources management under the changing climate in sub-Saharan Africa. *Cogent Social Sciences*, 8(1). <https://doi.org/10.1080/23311886.2021.2024674>
- Pionetti, C. (2011). Women ' s Collective Action in Agricultural Markets. *October*.
- Poole. (2017). Smallholder Agriculture and Market Participation. In *Smallholder Agriculture and Market Participation*. <https://doi.org/10.3362/9781780449401>
- Quisumbing, A. R., & Maluccio, J. (2000). Intrahousehold allocation and gender relations: New empirical evidence from four developing countries. *FCND Brief*, May, 2. <http://www.ifpri.org/pubs/misc/dt2b8.asp%5Cnhttp://www.ifpri.org/sites/default/files/publications/fcnbr84.pdf>
- Quisumbing, A. R., Sproule, K., Martinez, E. M., & Malapit, H. (2021). Do tradeoffs among dimensions of women's empowerment and nutrition outcomes exist? Evidence from six countries in Africa and Asia. *Food Policy*, 100(November), 102001. <https://doi.org/10.1016/j.foodpol.2020.102001>
- Quisumbing, A. R., Sproule, K., Martinez, E. M., & Malapit, H. J. (2020). Women's empowerment in agriculture and nutritional outcomes: Evidence from six countries in Africa and Asia. *Food Policy*, May, 70. <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/133732>

- Ragasa, C., Aberman, N. L., & Alvarez Mingote, C. (2019). Does providing agricultural and nutrition information to both men and women improve household food security? Evidence from Malawi. *Global Food Security*, 20(April 2018), 45–59. <https://doi.org/10.1016/j.gfs.2018.12.007>
- Raghunathan, K., Kannan, S., & Quisumbing, A. R. (2019). *Can women 's self-help groups improve access to information , decision-making , and agricultural practices ? The Indian case.* May 2018, 567–580. <https://doi.org/10.1111/agec.12510>
- Rangel, J., Perea, J., De-Pablos-heredero, C., Espinosa-García, J. A., Mujica, P. T., Feijoo, M., Barba, C., & García, A. (2020). Structural and technological characterization of tropical smallholder farms of dual-purpose cattle in Mexico. *Animals*, 10(1), 1–13. <https://doi.org/10.3390/ani10010086>
- Ravichandran, T., & Farnworth, C. R. (2021). Empowering women in dairy cooperatives in Bihar and Telangana , India: a gender and caste analysis. *AgriGender - Journal of Gender, Agriculture and Food Security*, September. <https://doi.org/10.19268/JGAFS.612021.3>
- Rayamajhee, V. (2019). *Do voluntary associations reduce hunger ? An empirical exploration of the social capital- food security nexus among food impoverished households in western Nepal.* 2014. <https://link.springer.com/article/10.1007/s12571-019-00907-0>
- Republic of Kenya, Ministry of Industry, T. and C. (2017). *republic of Kenya ministry of industry , trade and co-operatives “ Promoting Co-operative Enterprises for Industrialization ” Table of Contents.* June. <https://kilimo.go.ke/wp-content/uploads/2020/07/national-co-operative-development-policy.pdf>
- Republic of Kenya, Ministry of Industry, T. and C. (2019). *Governement of Kenya ministry of industry , trade and co- operatives co-operative policy Promoting Co-operative Societies for Industrialization.* <https://repository.kippra.or.ke/handle/123456789/2990>
- Republic of Kenya, the constitution, 1 (2010).
- Republic of Kenya. (2018). Kenya Vision 2030: Third Medium Term Plan (2018-2022). *Transforming Lives : Advancing Socio-Economic Development through the “Big Four.”*
- Rocha, J. C., Schill, C., Saavedra-Díaz, L. M., Moreno, R. D. P., & Maldonado, J. H. (2021). Cooperation in the face of thresholds, risk, and uncertainty: Experimental evidence in fisher communities from Colombia. *PLoS ONE*, 15(12 December), 1–14. <https://doi.org/10.1371/journal.pone.0242363>
- Sacco Societies Regulatory Authority. (2019). *the Sacco Subsector Demographics Study Demographics Study.* 254(20).
- Selhausen, F. (2016). What Determines Women’s Participation in Collective Action? Evidence from a Western Ugandan Coffee Cooperative. *Feminist Economics*, 22(1), 130–157. <https://doi.org/10.1080/13545701.2015.1088960>
- Sen, A. (1990). Gender and co-operative conflicts. *Persistent Inequalities.*
- Serra, R., & Davidson, K. A. (2021). Selling Together: The Benefits of Cooperatives to Women Honey Producers in Ethiopia. *Journal of Agricultural Economics*, 72(1), 202–223. <https://doi.org/10.1111/1477-9552.12399>
- Shumeta, Z., & D’Haese, M. (2018). Do Coffee Farmers Benefit in Food Security from Participating in Coffee Cooperatives? Evidence from Southwest Ethiopia Coffee Cooperatives. *Food and Nutrition Bulletin*, 39(2), 266–280. <https://doi.org/10.1177/0379572118765341>

- Singh, Inderjit, Squire, Lyn, Strauss, J. (2006). *Agricultural Household Models*. 1–6. <https://www.econstor.eu/bitstream/10419/160397/1/cdp474.pdf>
- Sinharoy, S. S., Waid, J. L., Haardörfer, R., Wendt, A., Gabrysch, S., & Yount, K. M. (2018). Women’s dietary diversity in rural Bangladesh: Pathways through women’s empowerment. *Maternal and Child Nutrition*, 14(1). <https://doi.org/10.1111/mcn.12489>
- Sinyolo, S., & Mudhara, M. (2018). Collective action and rural poverty reduction: Empirical evidence from kwazulu-natal, South Africa. *Agrekon*, 57(1), 78–90. <https://doi.org/10.1080/03031853.2018.1451349>
- Squire, L., & Strauss, J. (1985). *www.econstor.eu*.
- Sraboni, E., Malapit, H. J., Quisumbing, A. R., & Ahmed, A. U. (2014). Women’s Empowerment in Agriculture : What Role for Food Security in Bangladesh ? *World Development*, 61, 11–52. <https://doi.org/10.1016/j.worlddev.2014.03.025>
- Sraboni, E., & Quisumbing, A. (2018). Women’s empowerment in agriculture and dietary quality across the life course: Evidence from Bangladesh. *Food Policy*, 81(November), 21–36. <https://doi.org/10.1016/j.foodpol.2018.09.001>
- Sseguya, H., Mazur, R. E., & Flora, C. B. (2018). Social capital dimensions in household food security interventions: implications for rural Uganda. *Agriculture and Human Values*, 35(1), 117–129. <https://doi.org/10.1007/s10460-017-9805-9>
- Struben, J., Lee, B. H., & Bingham, C. B. (2020). Collective Action Problems and Resource Allocation during Market Formation. *Strategy Science*, 5(3), 245–270. <https://doi.org/10.1287/stsc.2020.0105>
- Sulemana, E., Awearegya, J., & Granali, R. J. M. (2020). *Women’s empowerment through collective action How forest and farm producer organisations can make a difference*. <https://www.fao.org/family-farming/detail/en/c/1297430/>
- Sullivan, A., & York, A. M. (2021). Collective action for changing forests: A spatial, social-ecological approach to assessing participation in invasive plant management. *Global Environmental Change*, 71(December 2020), 102366. <https://doi.org/10.1016/j.gloenvcha.2021.102366>
- Tyagi, N., & Das, S. (2018). Assessing gender responsiveness of forest policies in India. *Forest Policy and Economics*, 92(October 2017), 160–168. <https://doi.org/10.1016/j.forpol.2018.05.004>
- Udry, E. D. and C. (2016). *Intrahousehold resource allocation in côte d’ivoire: social norms, separate accounts and consumption choices*. 4(1), 1–23.
- UN Women. (2022). Women and sustainable development goals. In *The Oxford Handbook of Women, Peace, and Security*. <https://doi.org/10.1093/oxfordhb/9780190638276.013.53>
- UNICEF. (2019). Country overview: Malnutrition burden in South Sudan. *UNICEF Global Databases Infant and Young Child Feeding*, 1–14. <https://doi.org/10.1038/s41586-019-1878-8>.Notes
- United Nations. (2009). *Convention on the elimination of all forms of discrimination against women (CEDAW)*. <https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2016/CEDAW-for-Youth-Brief.pdf>
- United Nations. (2016). United Nations Sustainable Development Goals. In *Sustainable Development*. <https://sdgs.un.org/goals>
- United Nations Women and Kenya National Bureau of Statistics. (2020). *Women’s Empowerment in Kenya* (p. 53).
- United States International Development Agency, 2022. (2020). *Final gender*

- analysis report* (Issue 47).
- United States International Development Agency, & USAID. (2020). *FINAL Gender analysis report. 47*.
- Valujeva, K., Freed, E. K., Nipers, A., Jauhiainen, J., & Schulte, R. P. O. (2023). Pathways for governance opportunities: Social network analysis to create targeted and effective policies for agricultural and environmental development. *Journal of Environmental Management*, 325(PB), 116563. <https://doi.org/10.1016/j.jenvman.2022.116563>
- Verhofstadt, E., & Maertens, M. (2013). *Cooperative membership and agricultural performance: Evidence from Rwanda. 1067-2016-86824*, 47. <http://ees.kuleuven.be/bioecon/2%0Ahttp://ageconsearch.umn.edu/record/157389>
- Waha, K., van Wijk, M. T., Fritz, S., See, L., Thornton, P. K., Wichern, J., & Herrero, M. (2018). Agricultural diversification as an important strategy for achieving food security in Africa. *Global Change Biology*, 24(8), 3390–3400. <https://doi.org/10.1111/gcb.14158>
- Wakaba, D., Ateka, J., Mbeche, R., & Oyugi, L. (2022). Determinants of Irish potato (*Solanum tuberosum*) commercialization and market participation by farmers in Nyandarua County, Kenya. *Journal of Agriculture and Food Research*, 10(September), 100382. <https://doi.org/10.1016/j.jafr.2022.100382>
- Wegi, B., Haji, J., & Mirzabaev, A. (2023). Determinants of food and nutrition security: Evidence from crop-livestock mixed farming households of central and eastern Ethiopia. *Journal of Agriculture and Food Research*, 12(March), 100556. <https://doi.org/10.1016/j.jafr.2023.100556>
- Woldu, T., Tadesse, F., & Waller, M.-K. (2018). Women ' s participation in agricultural cooperatives in Ethiopia Women ' s Participation in Agricultural Cooperatives in Ethiopia. *International Association of Agricultural Economists (IAAE) 2015 Conference. August 9-14, 2015, Milan, Italy, February*.
- World Food Programme. (2015). *Consolidated Approach to Reporting Indicators of Food Security (CARI) Guidelines, Food security analysis (VAM). November*.
- Zou, Y., & Wang, Q. (2022). Impacts of farmer cooperative membership on household income and inequality: Evidence from a household survey in China. *Agricultural and Food Economics*, 10(1). <https://doi.org/10.1186/s40100-022-00222-x>

APPENDICES

Appendix 1: Survey questionnaire

COLLECTIVE ACTION, WOMEN EMPOWERMENT AND FOOD SECURITY AMONG SMALLHOLDER FARMERS IN MURANG'A COUNTY, KENYA

INTRODUCTION AND CONSENT
<p>Hello my name is....., a member of a team of researchers from the University of Embu, undertaking a study seeking to understand how collective action can help address farmers' constraints especially women to achieve household food security. You, as one of the farmers and as the primary decision maker of the household have been identified as one of respondents. All your responses will be completely confidential and used for academic purposes only.</p>

SECTION A: PRELIMINARIES

Sr. No.	Item	Response	Sr. No.	Item	Response
A1	Name of the enumerator		A6	Ward	
A2	Start time		A7	Village	
A3	Household ID		A8	GPS longitude	
A4	Survey Date (DD/MM/YY)		A9	GPS Latitude	
A5	Sub county		A10	GPS Altitude	

SECTION B: HOUSEHOLD DEMOGRAPHICS

B1. Number of children below 12 years old in the household _____.

B2. Number of children between 13 and 17 years old in the household for at least 6 months within the last one year_____.

B3. Please inform us how many total members who belong to your household _____.

B4. Indicate the following details for all the household members above 18 years who were home at least 6 months within the last one year.

Gender 0.Male 1.Female	Age (years)	Level of education 1.No formal education 2. Primary 3.Secondary 4.Vocational 5.Tertiary	Marital status 1=Married 2=Divorced/ Separated 3=Widowed 4= Never married 5=Living together/De Facto	Main occupation 1-Farming 2-Formal Employment 3-Self-Employed 4.Casual Employment
B5	B6	B7	B8	B9
Head				
Spouse				
Adult 1				
Adult 2				
Adult 3				

SECTION C: RESOURCE AVAILABILITY
SECTION C (1) LAND OWNERSHIP AND USE

Please provide information about your land use and agriculture

Sr. No.	Item	Codes/Unit of measure	Response code
C1.01	Specify land size under agriculture	(Acres)	
C1.02	Land tenure	1=Owned with title deed 2= Owned without title deed 3= Rented/sharecropped 4= Owned by parent/relative	
C1.03	For how long has the household head engaged in farming	(Years)	
C1.04	What are the five key challenges that you face in farming? <i>(State and rank the order of importance).</i>	1=High input costs 2= Low output prices 3 =Poor markets 4=Bad weather and climate 5= Pests and diseases 6=Exploitative intermediaries	

SECTION C (2) CROP PRODUCTION AND MARKETING

Please provide information of the four main crops you produced last year (January 2021-December 2021)

Crop type	Plot size (hectares)	Quantity harvested		Quantity consumed or donated		Quantity sold		Price received per unit (KES)	Place sold	Buyer type	Quantity spoiled after harvest		Reason for spoilage
		Qty	Unit	Qty	Unit	Qty	Unit				Qty	Unit	
C2.01	C2.02	C2.03		C2.04		C2.05		C2.06	C2.07	C2.08	C2.09		C2.10
1.		1		3									
2.													
3.													
4.													
Codes for crop type (C2.01)													
1.Apples 5. Beans 9=Cassava 13=Green grams 17= Maize/green 21= Oranges 25=Tea 2.Avocadoes 6. Brocoli 10. Coffee 14=Green peas 18= Maize/dry 22=Passion fruits 26=Tomatoes 3.Arrow roots 7.Cabbage 11. Capsicum 15=Indigeneous Veges 19= Njahi/dolicos 23= Spinach 27=Yams 4. Bananas 8.Carrots 12.French beans 16= Mangoes 20=Napier 24=Sukumawiki 28=Other, specify													
Codes for Quantities (C2.03; C2.04; C2.05; C2.09)				Buyer type codes (C2.08): (Multiple responses allowed)				Place sold codes (C2.07):			Reasons for spoilage codes (C2.10) (Multiple answers allowed)		
1=90 KG Bag 2=50KG Bag 3=KGs 4= Numbers 5= Crates 6= Track 7=Bales (Napier) 8=Bunches (Bananas) 9= Debe 10. Other (Specify)				1= Broker 2= Processor 3= Exporter 4=Small trader 5=Consumer/neighbour 6=Institutions-schools, hotels 7=Cooperative 8=Other (specify)				1= Farm gate 2=Village market 3=District market 4=Factory 5=Collection centre 6=Other (specify)			1= Decay 2= Diseases and pests 3=Injuries from extreme temperatures 4=Scratches on the skin 5=Discolorations 6=Poor packaging 7=Splitting during harvesting 8=Delay in getting to the market 9=Other (specify)		

SECTION C (3) CROP INPUTS

Please provide details for the inputs used in the last one year for the four main crops produced

Input type	Quantity used	Unit	Unit cost (KES)	Total cost (KES) (if the farmer does not remember the unit cost)
C3.01	C3.02	C3.03	C3.04	C3.05
1. Seeds	4	kg		6000
2. 1 st Fertilizer				
3. 2 nd fertilizer				
4. Manure				
5. Pesticides				
6. Land hiring				
7. Machinery				
Unit codes (C3.02):				
1=90 KG bag 4= Numbers 7= Wheelbarrows 10= Acres				
2=50 KG bag 5= Litres 8= Grams 11=Other, specify				
3=KGS 6=Militres 9= Track				

SECTION C (4) LABOUR INFORMATION

Please provide details for the hired labour used in the last one year for the four main crops produced

Activity	Quantity used (Man days)	Unit cost(KES)	Total cost(KES)
C4.01	C4.02	C4.03	C4.04
Ploughing			
Planting			
Weeding			
Harvesting			
Other (specify)			

SECTION C (5) LIVESTOCK PRODUCTION

C5.01. Did you have any livestock in the course of last year, 2021? If no, skip to section D; (1= Yes; 2=No)

If Yes, please complete the table on livestock owned in the year 2021.

Type	Number currently owned	Number of animals born	Number of animals lost	Number of animals purchased	Purchase price (per animal)	Number of animals sold	Sale price (per animal)
E1.01	E1.02	E1.03	E1.04	E1.05	E1.06	E1.07	E1.08
1. Cow (exotic)							
2. Cow (crossbreed)							
3. Bull							
4. Calves							
5. Goat (local)							
6. Goat(dairy)							
7. Sheep							
8. Pigs							
9. Chicken (Improved)							
10. Chicken (local)							
11. Other, specify							

SECTION C (6) ASSET OWNERSHIP

Please tell us of any assets owned by your household

Sr. No.	Asset	1=Yes; 0=No	Value/KES	Sr. No.	Asset	1=Yes; 0=No	Value/KES
C6.01	Gas/electric cooker			C6.09	Animal traction plough		
C6.02	Refrigerator			C6.10	Maize Sheller		
C6.03	Radio			C6.11	Motorcycle		
C6.04	Television			C6.12	Vehicle		
C6.05	Mobile phone			C6.13	Water tanks		
C6.06	Houses (residential)			C6.14	Irrigation equipment		
C6.07	Solar panels			C6.15	Other, specify		
C6.08	Generator						

SECTION C (7): HOUSING (OBSERVATION)

Please observe the floor, roof and exterior walls of the main house and fill the following (**NOTE:** Ask only for ownership)

Home ownership		Floor material		Wall material		Roofing material	
C7.01		C7.02		C7.03		C7.04	
Codes	Response	Codes	Response	Codes	Response	Codes	Response
1=Owned 2=Borrowed 3=Rented 4=Other, specify		1= Earth 2=Cement 3=Tiles 4=Other, specify		1=Earth/mud 2=Cement/bricks 3=Wood/ iron sheets 4=Other, specify		1=Grass 2=Iron sheets 3=Tiles 4=Other, specify	

SECTION C (8): INCOME FROM OTHER SOURCES

Indicate the income range earned from other sources besides agriculture and the sources earned by the farmer per month

Income range (KES)(<i>tick only one</i>)	What were the main sources of the income? (<i>multiple answers allowed</i>)
C8.01	C8.02
<ol style="list-style-type: none"> 1. 0 to 10,000 2. 10, 000 to 30,000 3. 30, 001 to 50, 000 4. 50,001 to 70, 0000 5. 70,001 to 90,000 6. 90,001 to 110, 000 7. Above 110, 000 	<ol style="list-style-type: none"> 1. Trade (of agricultural produce) 2. Business (non- agricultural/self-employment/rental income) 3. Formal salaried employment (civil servant/in public sector) 4. Rental income (land, buildings) 5. Pensions, social welfare grants, and insurance payments 6. Providing labour in other farms 7. Remittance from relatives

SECTION C (9): FOOD AND NON-FOOD EXPENDITURE

How much did you spend on the following per week (KES)

Sr. No.	Monthly expenditure	Amount (KES)
C9.01	Food expenses (salt, sugar, beverages etc)	
C9.02	Non-food expenses (clothes, airtime, transport, etc)	
C9.03	School fees per term	
C9.04	Other, specify	

SECTION D: ACCESS TO SERVICES

Sr. No.	Service	Codes/Unit of measure	Response
D1	What is the distance from your homestead by walking to veterinary service?	Kilometres	
D2	What is the distance from your homestead by walking to the nearest tarmac road?	Kilometres	
D3	What is the distance from your homestead by walking to the nearest (input/output market) market for farm produce?	Kilometres	
D4	Do you have piped water in your homestead?	1=Yes; 0= No	
D5	What is the distance to the nearest health centre by walking?	Kilometres	
D6	Do you have electricity supply in your homestead	1=Yes; 0=No	
D7	Do you have solar panel in your homestead	1=Yes; 0=No	
D8	What is the distance from your homestead by walking to extension advisory/service?	Kilometres	

D9	Number of extension contact within one year	Number	
D10	Have you ever utilized the online platforms to receive agricultural information?	1=Yes; 0=No	
D11	What are the sources of agricultural market information you make use of? <i>(multiple responses allowed Rank in order)</i>	1= Extension officers 2= Radio 3= TV program 4=Group members 5=Contact farmers/neighbours 6= Lead farmers 7= Online platforms (texts, agricultural apps, Whatsapp, Facebook)	

SECTION (E) COLLECTIVE ACTION

SECTION E (1) GROUP TYPOLOGIES

Type of group	Is there such a Group in your village? 0=No 1= Yes 2=I don't know	Are you a member or does any household member belong to this group? <i>(if not group member proceed to section F)</i>	How is the group registered as 1= Agricultural (crop/livestock marketing) 2= Self-help group 3= Finance/credit/savings group 4= Cooperative society 5= Water user association 6= Business group (e.g. transport, trade) 7= Not registered	Among the groups you belong to, which are the two most important ones based on the benefits you receive? <i>(Rank them – prioritise)</i>
	E1.01	E1.02	E1.03	E1.04
Agricultural (crop/livestock marketing)				
Self-help group				
Finance/credit/savings group				
Cooperative society				
Community based organization				
Water user association				
Business group (e.g., transport, trade)				

SECTION E (1): GROUP MEMBERSHIP

SECTION E (1): GROUP MEMBERSHIP CONTINUED

Fill the following information about the first most important group the farmer participates

Sr. No.	Item	Codes/Unit of measure	Response code
E1.05	Whose name is registered in the most beneficial group from your household?	1=Spouse(female/wife) 2= Household head (Male) 3= Both husband and spouse 4= Other (Specify)	
E1.06	Which year was the group formed?	Year	
E1.07	Which year did you join the group?	Year	
E1.08	What was the main purpose of forming the group?	1=Credit sourcing 2=Farm input sourcing 3= Farm output marketing 4= Extension and advisory services 5= Social support and activities e.g. weddings, burial 6= Table banking and savings 7= Asset acquisition and accumulation 8=Religious activities 9= Rotational provision of labour 10=Value addition 11=Other (specify)	

<p>E1.09</p>	<p>What activities is your group involved in currently? (multiple responses allowed)</p>	<p>1=Credit sourcing 2=Farm input sourcing 3= Farm output marketing 4= Extension and advisory services 5= Social support and activities e.g. weddings 6= Table banking and savings 7= Asset acquisition and accumulation 8=Religious activities 9= Rotational provision of labour 10=Value addition 11=Other (specify)</p>	
<p>E1.09</p>	<p>What is the main benefit of joining the group? <i>(multiple responses allowed Rank - prioritise)</i></p>	<p>1=Improves my household's current livelihood/income/returns 2=Improves access to services such as credit, extension 3=Better farm output prices and price assurance 4=Bypassing intermediaries 5=Improves access to improved/clean/certified farm inputs 6= Enabling access to soil testing services 7=Enhances commercialisation of farm products. 8=Important in times of emergency or in future 9= Spiritual, social status, self-esteem 10= Benefits the community 11= Enjoyment/recreation</p>	

SECTION E (2) GROUP SIZE, MEMBERSHIP COMPOSITION AND ADMISSION CRITERIA

Please provide the information about the group members of the most important group you belong

Sr. No.	Item	Codes/Unit of measure	Response
E2.01	Total number of total group members	Number	
E2.02	Number of active group members	Number	
E2.03	Do you allow new members to join the group?	1=We don't admit new members 2=Admit new members with conditions 3=Anyone is free to join	
E2.04	What is the gender of the group members?	1= Females only 2= Males only 3= Mixed males and females	
E2.05	How many females are there in group?	Number	
E2.06	Number of group officials in group?	Number	
E2.07	Number of officials who are females in group?	Number	
E2.08	Gender of the group chairperson in group?	0=Male 1=Female	

SECTION E (2): HOMOGENEITY OF GROUP MEMBERS

Thinking about the members of the most important group you belong, are most of them of the same

Sr. No.	Item	Codes	Response	Sr. No.	Item	Codes	Response
E2.08	Age	0=No;1=Yes		E2.11	Education level	0=No;1=Yes	
E2.09	Gender	0=No;1=Yes		E2.12	Income level	0=No;1=Yes	
E2.10	Occupation	0=No;1=Yes		E2.13	Village/Neighbourhood	0=No;1=Yes	

SECTION E (3) GROUP LEADERSHIP AND GOVERNANCE

I am going to ask questions about your group leadership and governance

Sr. No.	Item	Codes	Response
E3.01	How are decisions made in the group?	1= Decisions made from outside 2= The leader decides and informs other group members 3= The leader consults and then decides 4= The group members discuss and decide together	
E3.02	What is the extent of members' participation in decision making in group?	1=Very active 2=Active 3= Minimal 4= No participation	
E3.03	Who majorly elects the group leaders? <i>(Multiple responses allowed)</i>	1= Group leaders 2= Group members 3= From outside 4= Other, specify	
E3.04	Which criteria do you use to elect group members? <i>(Multiple responses allowed)</i>	1= Rotational election criteria 2= Gender equitable criteria 3= Secret Ballot 4= Group members' agreement	
E3.05	Does your group impose fines to members who do not comply to the group rules?	0=No 1=Yes	
E3.06	How is it likely that the members who do not comply will be fined?	1=Very likely 2=Somewhat likely 3=Very unlikely	
E3.07	Does this group work or interact with other groups with similar goals outside the village or neighbourhood?	0=No 1=Yes	

SECTION E (4) GROUP TRUST, RECIPROCITY AND COHESION

In general, in the most important group, to what extent do you agree or disagree with the following statements.

Sr. No.	Item	Codes	Response code
E4.01	Most members in this group can be trusted	1= Disagree strongly 2=Neither agree nor disagree	3=Agree somewhat 4=Agree strongly
E4.02	Other groups can be trusted.	1= Disagree strongly 2=Neither agree nor disagree	3=Agree somewhat 4=Agree strongly
E4.03	The group leaders can be trusted	1= Disagree strongly 2=Neither agree nor disagree	3=Agree somewhat 4=Agree strongly
E4.04	Extension workers can be trusted.	1= Disagree strongly 2=Neither agree nor disagree	3=Agree somewhat 4=Agree strongly
E4.05	The group support and service providers e.g. NGOs can be trusted	1= Disagree strongly 2=Neither agree nor disagree	3=Agree somewhat 4=Agree strongly
E2.06	How strong is the feeling of togetherness in your group?	1=Very distant 2=Somewhat distant	3 Somewhat close 4=Very close
E2.07	How often have people in the group helped you solve a financial problem?	1=Regularly 2= Sometimes	4=Rarely 5= Not at all
E2.08	How often have people in the village helped you solve a financial problem?	1=Regularly 2= Sometimes	3= Rarely 4=Not at all

SECTION E (5): GROUP PARTICIPATION AND BENEFITS

Please fill the table on the most important group an individual belongs.

Sr. No.	Item/Codes	Response code	Item/Codes	Response code	Item/Codes	Response code
	Did the group enable you to access the following in the last one year (2021)?		If Yes, specify extent of participation and/or Benefits received			
E5.01	Number of group meetings scheduled in the year 2021?		Number of group meetings attended in the year 2021?			
E5.02	Group credit sourcing (1= Yes; 0=No)		Amount required to be received by an individual (KES)		Percentage of amount received	
E5.03	Collective sourcing of farm inputs (1= Yes; 0=No)		Value of inputs sourced (KES)		Name three main inputs sourced 1=Clean/improved/certified seeds/seedlings 2=Fertilizers 3=Pesticides 4=Farm tools/equipment 5=Other, specify	

E5.04	Training/extension (1= Yes; 0=No)		No of trainings attended		Name three main types of training or extension received 1= New/improved farming practice and technologies 2=Nutritional education 3= Marketing skills 4=Financial management training 5=Healthcare education 6=Childcare education 7= Marketing skills 8=Soil conservation and management practices 9=Crop diversification 10=Livestock production 11-Post-harvest management 12=Other, specify	
E5.05	Collective marketing of produce (1= Yes; 0=No)		Percentage of produce sold through the group		Three main products sold collectively 1=Avocadoes 2=Macadamia 3=Milk 4=French beans 5=Bananas 6=Tea 7=Coffee 8=Vegetables 9=Meat 10=Other, specify	

E5.06	Participation in social events z(1= Yes; 0=No)		No. of social events attended through group		Three main social events attended 1=Wedding 2= Dowry payment 3=Thanksgiving/Kamwretu 4= Burial 5=Graduation 6=Birthday 7=Other, specify	
E6.07	Coping from shocks (1= Yes; 0=No)		Specify the extent of group help 1= Greatly supported by the group 2= Supported to cope to some extent 3= Neutrally supported 4= Supported to a small extent 5 = Not supported at all by the group		Three main coping strategies received through the group 1=Credit sourcing 2=Group savings 3= Coping skills/education 4=Barter trading with other members. 5=Member voluntary financial help (contributions) 6=Other, specify	

SECTION F: WOMEN EMPOWERMENT

SECTION F (1) WOMEN'S PARTICIPATION IN PRODUCTION AND MARKETING DECISIONS

I would like to ask you some questions about your participation in certain types of agricultural activities and on making decisions	Did you or any HH member participate in the [activity] , in the past 12 months) If NO, skip to the next activity	When decisions are made regarding the [activity] , who normally makes the decision? (Use F1.02 codes below) If the responsible is SELF ONLY, skip to F1.06 NOT applicable/no decision made=98, go to next activity	How much input did you have in making decisions about what, when and how to produce [activity] ? Use F1.03	How much input did you have in making decisions about where to whom and how much to sell to [activity] ? Use F1.04	To what extent do you feel you can make your own personal decisions regarding [activity] if you want(ed) to? circle one 1=Not at all 2=Small extent 3=Medium extent 4=To a larger extent 5=All the time	How much input did you have in decisions on the use of income generated from [activity] Codes 1= Little to no input in decisions 2=Input into some decisions 3= Input into most or all decisions 98= Not applicable / no decision made
Activity	F1.01	F1.02	F1.03	F1.04	F1.05	F1.06
1). Food crop farming and marketing	1=Yes 0=No					
2). Cash crop farming and marketing	1=Yes 0=No					

3) Large livestock raising (Cattle) or marketing of milk or their products	1=Yes 0=No					
4) Small livestock raising (goats, pigs) and marketing of milk or meat products	1=Yes 0=No					
5). Poultry farming: (Chickens, ducks) and marketing of eggs and meat products	1=Yes 0=No					
<u>Code for decision makers//F1.02</u> 1= Self/partner in the HH 2=Spouse/partner in the HH 3=Joint decision made 98=Not applicable/no decision made			<u>Input in decision making codes F1.03 and F1.04</u> 1= Little to no input in decisions 2=Input into some decisions 3= Input into most or all decisions 98= Not applicable / no decision made			

SECTION F (2) WOMEN’S DECISIONS ON HOUSEHOLD INCOME AND EXPENDITURE

<p>I would like to ask you some questions about your participation in certain types of non-farm activities and on making decisions on various aspects of household life.</p>	<p>Did you or any household member participate in the [activity], in the past 12 months)</p>	<p>When decisions are made regarding the [activity], who is it that normally makes the decision? (Use F2.02 codes below) If the responsible is SELF ONLY, skip to F2.06 NOT applicable/no decision made=98 go to next activity</p>	<p>How much input did you have in making decisions about [activity]? Use F2.04 and F2.07 codes</p>	<p>To what extent do you feel you can make your own personal decisions regarding [activity] if you want(ed) to? CIRCLE ONE 1=Not at all 2=Small extent 3=Medium extent 4=To a larger extent 5=All the time</p>	<p>How much input did you have in decisions on the use of income generated from [activity] Use F2.04 and F2.07 codes</p>
Activity	F2.01	F2.02	F2.03	F2.04	F2.05
<p>1 Non-farm economic activities in other sectors (running a small business, trade, self-employment)</p>	<p>1=Yes..... 0=No.....</p>				

2	Wage and salary employment (work that is paid for cash and/ in kind in farming and other wage work)	1=Yes..... 0=No.....				
3	Large occasional household purchases (Land, cattle, transport vehicles)					
4	Routine household purchases (food for daily consumption /school fees /clothing)					
	<u>Code for decision makers//F2.02</u> 1= Self/partner in the HH 2=Spouse/partner in the HH 3= Joint decision made 4=Other HH member 98= Not applicable /no decision made				<u>Input in decision making codes//F2.03, F2.05</u> 1= Little to no input in decisions 2=Input into some decisions 3= Input into most or all decisions 98= Not applicable / no decision made	
5.	F2.06 Do you, either by yourself or together with someone your spouse, currently have an account at any of the following places: a bank or other formal financial institution				1= Yes, solely 2=Yes, jointly 3=No, my spouse solely 4=No bank account at all	

SECTION F (3) WOMEN’S OWNERSHIP, ACCESS AND CONTROL OF ASSETS AND CREDIT (RESOURCES)

Now I’d like to ask you about a number of items that could be used to generate income.

Item	Does anyone in the household currently have any (item) ? 1=Yes 0= No NOTE: If no move to the next item	Who owns (item) Ownership 1= Solely 2=Partner/HH 3=jointly	Who would you say can decide whether to sell, give away, loan or rent [ITEM] most of the time? 1=Self 2= Spouse 3=Other HH member 4= Joint decision	Who would you say can decide whether to purchase a new [ITEM] most of the time? 1=Self 2= Spouse 3=Other HH member 4= Joint decision
F3.01	F3.02	F3.03	F3.04	F3.05
Large livestock (cattle)				
Small livestock (sheep, goats, pigs)				
Poultry and other small animals (chickens, ducks, turkeys)				
Mechanized farm equipment (tractor-plough, tiller, water pump)				
Large consumer durables (refrigerator, TV)				
Non-mechanized farm equipment (Hoes, Spade, wheelbarrow)				
Means of transportation (bicycle, motorcycle, car)				

Non-farm business equipment (solar panels, sewing machine)				
Other land not used for agricultural purposes (plots, residential commercial land)				

SECTION F (3) WOMEN'S ACCESS TO CREDIT

Has anyone in your household taken any loans or borrowed cash/in-kind in the past 12 months from these sources?	Who makes the decision to borrow most of the time?	Who makes the decision about what to do with the money borrowed most of the time? Enter up to (3) member IDs
F3.01	F3.02	F3.03
1. Formal lender (Bank/Cooperative)		
2. Informal lender (shylock/mobile money such as Tala)		
3. Group micro-finance/lending/ Informal credit/savings /merry go rounds		
4. Friends/relatives/neighbours		
<u>Codes for loans borrowed-F3.01</u> 1=Yes 0=No	<u>Code for decision makers-F3.02 AND F3.03</u> 1= Self/partner in the HH 2=Spouse/partner in the HH 3=Joint decision 4= Not applicable/no decision made	

SECTION G: WOMEN'S LEADERSHIP IN COMMUNITY

SECTION G (1) WOMEN'S ACTIVE MEMBERSHIP IN SOCIAL AND ECONOMIC GROUPS

Sr. No.	Item	Codes	Response code
G1.01	Do you belong to any formal or informal groups?	1=Yes; 0=No	
G1.02	Do you hold any leadership position in the social or economic groups	1=Yes; 0=No	
G1.03	To what extent do you participate in decision making in the group?	1=Very active 2=Active 3= Not sure 4=Minimal 5= No participation	
G1.04	To what extent you feel you can influence the decisions of the group?	1=Not at all 3=Medium extent 2=Small extent 4=Large extent	
G1.05	Do you hold any leadership position in the community	1=Yes; 0=No	
G1.06	If yes, specify the leadership position.....		

SECTION G (2) PUBLIC SPEAKING

Sr. No.	Item	Codes	Response codes
G2.01	Do you feel comfortable speaking up in public about anything that is important to you, your family or your community?	1=No, not at all comfortable 2=Yes, but with a great deal of difficulty 3=Yes, but with a little difficulty 4= Yes, fairly comfortable 5= Yes, very comfortable	

SECTION H: TIME ALLOCATION

SECTION H (1): WORKLOAD- TIME ALLOCATION AMONG PRODUCTIVE AND DOMESTIC TASKS

H1.01: Please record a log of the activities for the individual in the last complete 24 hours (starting yesterday morning at 4 am finishing 3:59 am of the current day). Mark one activity for each time period by entering the corresponding activity code in the box.

Now I'd like to ask you about how you spent your time during the past 24 hours in performing different tasks												
	Night		Morning	Day								
	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00
H0.01 Activity (write activity code) (allow for multiple responses)												
	Day		Evening	Night								
	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	1:00	2:00	3:00
H1.02 Activity (write activity code) (allow for multiple responses)												
ACTIVITY CODES FOR H1.01 and H1.02 1 =Own business work 2=Horticultural/cash crop/food farming 3= Livestock raising (cattle, sheep, goats, pigs, chicken) 4= Cooking, fetching water /wood/washing/ cleaning 5= Caring for children 6= Training or meetings related to agriculture or other livelihoods 7= No work(resting/religious activities/ hobbies, eating/sleeping)												
H1.03 If you wanted to do something (livelihood-related, training-related, self-care) is there someone who could stand do it in your absence?									Codes for H1.03 1= Self/partner in the HH 2=Spouse/partner in the HH 3=Other HH member 94=Non-HH member			

SECTION H (2): SATISFACTION WITH TIME USE

Sr. No.	Question	Codes	Response code
H2.01	Generally, how satisfied are you with your time use for domestic work?	1= I feel I have plenty time 2= I feel that I have just enough time 3= I feel that I don't have enough time at all	
H2.02	Generally, how satisfied are you with your time use for productive work?	1= I feel I have plenty time 2= I feel that I have just enough time 3= I feel that I don't have enough time at all	
H2.03	Generally, how satisfied are you with your time use for resting?	1= I feel I have plenty time 2= I feel that I have just enough time 3= I feel that I don't have enough time at all	

SECTION I (2) FOOD INSECURITY EXPERIENCE SCALE (FIES)

Sr. No.	Situation	During the last 12 months was there a time when (Situation)? 0= No 1= Yes	How often did this (Situation) happen in the past 12 months? 1=Rarely (1 -2 times) 2=Sometimes (3 -10 times) 3=Often (>10 times)
I2.01	You were worried you of any household members would not have enough food to eat because of lack of money or other resources?		
I2.02	You or any household members were not able to eat the healthy and nutritious foods because of lack of money or other resources?		
I2.03	You or any household members ate a few kinds of foods because of lack money or resources?		
I2.04	You had to skip a meal because there was no enough money or resources to get food?		
I2.05	You or any household members ate less than you thought you should because there was lack of money or other resources?		
I2.06	There was no food at all in your house because of lack of money?		
I2.07	You or any household member did not eat because there was not enough money or other resources for food?		
I2.08	You or any household members went without eating for a whole day because of lack of money or resources?		

SECTION I (3) HOUSEHOLD DIETARY DIVERSITY SCORE (HDDS)

Now I would like to ask you about the types of foods that you or anyone else in your household ate specifically in the last 24 hour. Please, tell me by accurately recalling

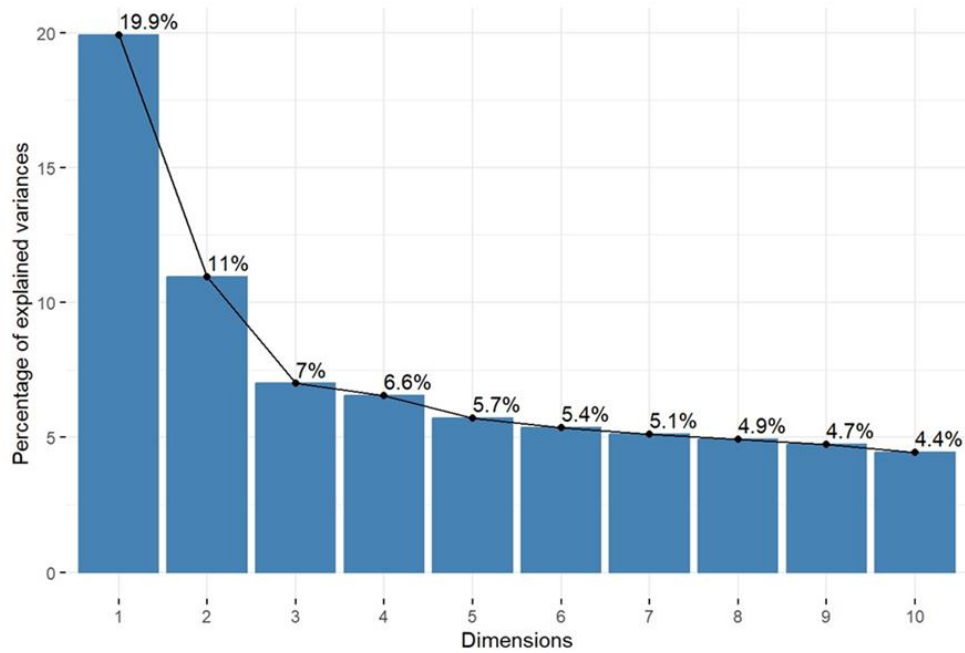
Ask the two columns separately. For 24 hr recall try to ask what was eaten at each meal time and list them on the left side of the table and sort them based on the food groups

Column 3 &4: *Read the list of foods. Place a “1” in the box if anyone in the household ate the food in question; or place a “0” in the box if no one in the household ate the food*

Sr.No.	FOOD	Description	During the last day and night	During the last day and night
			Child	Mother
I3.01	Cereals	Corn/maize, rice, barley, oats, wheat, sorghum, finger millet or any other grains or foods made from these (e.g. bread, biscuits, noodles, porridge, or other grain products)		
I3.02	Vitamin a rich vegetables and tubers	Pumpkin, carrots, squash, or yellow/orange flesh sweet potatoes or <i>other locally available vitamin-A rich vegetables (e.g. red/yellow sweet pepper)</i>		
I3.03	White tubers and roots	White potatoes, white yams, white cassava, or other foods made from roots		
I3.04	Dark green leafy vegetables	Dark green/leafy vegetables, including wild ones + <i>locally available vitamin-A rich leaves such as amaranth, Cassava leaves, Kale, Spinach, broccoli etc.</i>		
I3.05	Other vegetables	Other vegetables (e.g. tomato, onion, eggplant) , including wild vegetables		

I3.06	Vitamin a rich fruits	Ripe mangoes, cantaloupe, apricots (fresh or dried), Ripe papaya, dried peaches, passion fruits, kiwi, melon, guavas		
I3.07	Other fruits	Other fruits, including wild fruits (e.g pears, banana, apples, lemon, plums, grapes and tangerine		
I3.08	Organ meat /(iron rich)	Liver, Kidney, Heart or other organ meats or blood-based foods		
I3.09	Flesh meats	Beef, pork, lamb, goat, wild game, chicken, or other birds		
I3.10	Eggs	Chicken, duck, guinea hen or any other egg		
I3.11	Fish	Fresh or dried fish or shellfish		
I3.12	Legumes, nuts and seeds	Beans, peas, lentils, nuts, soy, lentils, seeds or foods made from these		
I3.13	Milk and milk products	Milk, cheese, yogurt or other milk products		
I3.14	Oils and fats	Oil, fats or butter added to food or used for cooking, oil seeds and foods made from oil seeds e.g. sunflower		
I3.15	Red palm products	Red palm oil, palm nut or palm nut pulp sauce		
I3.16	Sweets	Sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes		
I3.17	Spices, condiments, beverages	Spices(black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea,		
I3.18	Meal outside home	Did you or anyone in your household eat anything (meal or snack) outside of the home yesterday?		

Appendix 2: The scree plot



Source: Authors' field data

Appendix 3: MCA dimensions, their eigen values and inertia values

Dimension	Eigenvalue	Variance (%)	Cumulative variance (%)
1	0.27	19.91	19.91
2	0.15	10.95	30.87
3	0.09	7.00	37.87
4	0.09	6.56	44.42
5	0.08	5.71	50.14
6	0.07	5.37	55.50
7	0.07	5.12	60.62
8	0.07	4.94	65.56
9	0.06	4.75	70.31
10	0.06	4.44	74.75
11	0.06	4.14	78.89
12	0.05	3.75	82.64
13	0.05	3.44	86.07
14	0.04	3.08	89.15
15	0.04	2.80	91.95
16	0.03	2.57	94.51
17	0.03	2.40	96.92
18	0.02	1.72	98.64
19	0.02	1.35	100.00

Source: Authors' field data

Appendix 4: Cronbach test for the dimensions

Dimension	Raw r.	Std. r	r.corr	r.drop	Mean	sd
1	0.63	0.45	0.00	0.00	0.38	0.52
2	0.47	0.45	0.00	0.00	0.00	0.39
3	0.37	0.45	0.00	0.00	0.38	0.31
4	0.36	0.45	0.00	0.00	0.00	0.30
5	0.34	0.45	0.00	0.00	0.00	0.28

Source: Authors' field data

Appendix 5: Cronbach test for the variables

	Raw-alpha	Std. alpha	G6 (smc)	Average_r	S/N	Var_r	med.r
Variables	0.84	0.84	0.90	0.27	5.3	0.07	0.25
Membership entry	0.86	0.86	0.91	0.30	5.9	0.07	0.26
Gender composition	0.82	0.82	0.89	0.24	4.5	0.08	0.20
Amalgamation	0.82	0.82	0.88	0.25	4.6	0.07	0.23
Social networking	0.83	0.83	0.88	0.25	4.8	0.07	0.23
Input sourcing	0.81	0.81	0.98	0.23	4.3	0.07	0.21
Output marketing	0.80	0.80	0.87	0.23	4.1	0.07	0.21
Extension	0.82	0.82	0.88	0.24	4.4	0.07	0.21
Credit sourcing	0.85	0.85	0.91	0.28	5.5	0.08	0.26
Savings	0.83	0.83	0.89	0.26	4.9	0.08	0.23
Social welfare	0.83	0.83	0.92	0.27	5.0	0.07	0.23
Fine imposing	0.83	0.83	0.91	0.26	5.0	0.08	0.21
Members' trust	0.84	0.84	0.91	0.28	5.3	0.09	0.26
Other groups' trust	0.85	0.85	0.91	0.28	5.5	0.08	0.27
Method	0.86	0.86	0.91	0.30	6.1	0.08	0.29

Source: Authors' field data

Appendix 6: Correlation of the variables

	r	r.corr	r.drop
Variables	0.44	0.46	0.33
Membership entry	0.19	0.13	0.07
Gender composition	0.77	0.77	0.72
Amalgamation	0.75	0.77	0.69
Social networking	0.66	0.65	0.58
Input sourcing	0.87	0.79	0.83
Output marketing	0.96	1.02	0.95
Extension and advisory	0.80	0.82	0.75
Credit sourcing	0.34	0.25	0.22
Savings	0.59	0.55	0.51
Social welfare	0.54	0.57	0.45
Fine imposing	0.56	0.51	0.47
Members' trust	0.43	0.36	0.33
Other groups' trust	0.37	0.30	0.26
Method	0.12	0.00	0.00

Source: Authors' field data

Appendix 7: Contributions of the variables to the dimensions

	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5
Registration-no	1.11	3.54	6.01	15.9	9.11
Registration-yes	0.16	0.52	0.88	2.32	1.33
Closed entry criteria	0.00	1.88	0.05	0.08	0.22
Open entry criteria	0.05	13.92	0.38	0.64	1.63
Women only	4.39	0.86	0.11	1.01	2.36
Men only	0.06	0.02	0.01	0.33	5.37
Mixed women and men	5.62	1.01	0.15	1.03	0.15
Amalgamation-no	2.28	0.57	0.37	0.12	0.23
Amalgamation-yes	10.93	2.72	1.75	0.57	1.10
Social networking-no	2.83	0.68	0.19	0.11	1.16
Social networking-yes	8.53	2.05	0.59	0.32	3.49
Input sourcing-no	1.81	0.10	0.00	0.00	0.29
Input sourcing-yes	12.41	0.68	0.00	0.00	0.20
Output marketing-no	3.49	0.03	0.35	0.02	0.13
Output marketing-yes	15.50	0.11	1.54	0.00	0.58
Extension -no	1.47	0.02	0.03	0.05	0.59
Extension-yes	10.36	0.16	0.24	0.04	0.41
Credit sourcing -no	0.49	5.15	3.51	0.37	0.00
Credit sourcing-yes	0.73	7.75	5.28	0.12	0.00
Savings-no	3.31	5.57	6.05	0.14	5.47
Savings-yes	1.75	2.94	3.19	0.00	2.89
Social welfare-no	2.85	1.57	0.98	2.12	0.90
Social welfare-yes	2.65	1.46	0.91	1.97	0.83
Fine imposing-no	2.90	4.72	6.72	3.65	1.63
Fine imposing-yes	0.36	0.59	0.83	0.45	0.20
Members' trust- agree	1.54	11.22	13.94	0.05	0.08
Members' trust- agree	0.34	4.49	1.66	0.06	0.12
Members' trust-NAND	0.00	2.04	11.92	6.69	0.81
Members' trust-dis. st.	0.13	2.37	1.35	3.21	5.75
Other groups' trust-agree sw	1.01	3.99	17.28	1.83	0.40
Other groups' trust agree st.	0.00	12.19	0.65	0.04	0.97
Other groups' trust dis. st.	0.49	0.84	12.23	1.13	1.72
Other groups' trust NAND	0.41	4.24	0.82	1.55	3.88

Note: ag. Sw=agree somewhat; ag. st=agree strongly; dis.st=disagree strongly

NAND=neither agree nor disagree

Source: Authors' field data

Appendix 8: Nbclust optimal clusters following the validation indices

Validity index	Value-index	Number of clusters
KL	2.90	2
CH	159.45	2
Hartigan	24.76	3
CCC	14.21	10
Scott	345.95	3
Marriot	152	9
TrCovW	358.47	3
TreaceW	12.11	3
Friedman	3.54	8
Rubin	-0.15	9
Cindex	0.19	5
DB	1.16	2
Silhouette	0.42	2
Duda	2.76	2
PsudoT2	-95.00	2
Beale	-1.96	2
Ratkowsky	0.29	6
Ball	37.41	3
PtBiserial	0.58	5
Frey	2.63	3
McClain	0.23	2
Dunn	0.078	10
Hurbert	0	0
SDindex	5.39	2
Dindex	0	0
SDbw	0.2957	10

Source: Authors' data

Appendix 9: The critical values of the NbCluster package

Number of clusters	Critical value_Duda	Critical value_PseudoT2	F-value_Beale
2	0.63	84.76	1
3	0.68	70.81	1
4	0.69	46.24	0.39
5	0.62	40.35	1
6	0.60	65.11	1
7	0.64	65.66	0.04
8	0.61	32.79	1
9	0.59	41.80	1
10	0.60	44.21	1

Appendix 10: The validation clustering indices and their cluster points

Clusters	Validation indices								
	KL	CH	Hartigan	CCC	Scott	Marriot	TrCovw	TraceW	Friedman
2	2.90	159.45	76.87	0.94	551.99	12079	1213.87	165.16	3.72
3	1.56	135.23	52.11	1.01	897.94	10200	855.40	135.49	5.12
4	0.56	120.60	49.76	2.07	1124.71	9539	545.62	117.93	6.16
5	2.26	115.45	33.91	3.89	1375.11	7332	416.98	103.22	7.09
6	0.58	107.84	35.44	4.55	1541.54	6589	393.58	94.05	8.02
7	0.42	104.64	52.66	5.91	1692.87	5842	291.36	85.34	9.01
8	1.20	110.55	46.79	9.93	1978.31	3399	196.76	74.06	12.55
9	2.57	115.35	26.86	13.29	2282.42	1817	142.09	65.22	15.42
10	2.38	113.20	18.44	14.21	2367.56	1763	124.52	60.50	16.02

Source: Authors' field data

Appendix 11: The validation clustering indices for NbClust

Clusters	Validation indices								
	Rubin	Cindex	DB	Silhouette	Duda	Pseudot2	Beale	Ratkowsky	Ball
2	1.45	0.27	1.16	0.43	2.75	-95.00	-1.96	0.15	82.58
3	1.77	0.22	1.64	0.32	1.01	-0.82	-0.02	0.25	45.16
4	2.04	0.22	1.54	0.28	0.75	34.68	1.04	0.27	29.48
5	2.33	0.19	1.49	0.33	1.34	-16.59	-0.77	0.30	20.64
6	2.56	0.22	1.43	0.29	2.23	-55.64	-1.69	0.30	15.68
7	2.81	0.22	1.36	0.28	0.57	89.98	2.31	0.28	12.19
8	3.24	0.22	1.28	0.23	1.05	-2.36	-0.14	0.28	9.26
9	3.68	0.21	1.23	0.24	2.07	-31.53	-1.58	0.28	7.25
10	3.97	0.21	1.18	0.25	1.89	-31.58	-1.44	0.27	6.05

Source: Authors' field data

Appendix 12: The cluster points and their validation indices

Clusters	Validation indices							
	Ptbiserial	Frey	McClain	Dunn	Hubert	SDindex	Dindex	SDbw
2	0.57	1.43	0.23	0.06	0.01	5.39	0.60	0.75
3	0.56	2.64	0.73	0.05	0.01	5.98	0.53	0.73
4	0.47	-0.39	1.27	0.06	0.01	5.71	0.49	0.57
5	0.58	2.96	1.08	0.06	0.01	5.96	0.47	0.70
6	0.53	4.64	1.39	0.08	0.01	6.17	0.46	0.66
7	0.46	-0.16	1.96	0.07	0.01	6.01	0.43	0.44
8	0.48	0.83	1.89	0.08	0.01	7.63	0.41	0.46
9	0.45	0.84	2.24	0.08	0.02	7.09	0.39	0.34
10	0.42	0.51	2.64	0.08	0.02	6.84	0.37	0.30

Source: Authors' field data

Appendix 13: Variance inflation factor results for the multicollinearity test

Variable	VIF	1/VIF
Age	2.98	0.335
Gender	1.37	0.731
Education	2.28	0.438
Household size	1.68	0.596
Literacy ratio	2.43	0.412
Dependency ratio	1.65	0.606
Farm size	2.08	0.480
Land tenure	1.70	0.590
Livestock	2.23	0.448
Farming experience	2.14	0.467
Farm labour	2.09	0.478
Market	2.73	0.366
Tarmac road	1.74	0.575
Extension	2.64	0.378
Extension contacts	2.25	0.445
Piped water	1.43	0.701
Information	2.28	0.439
ICT	1.76	0.569
Electricity supply	1.34	0.744
Assets	2.51	0.398
Credit access	1.12	0.889
Income sources	2.10	0.478
Farm income	1.56	0.641
Income	2.15	0.467
Off-farm income	2.81	0.356
Maize produced	1.50	0.668
Beans produced	1.74	0.576
Food expenditure	1.59	0.629
GPS ware	1.67	0.598
Mean VIF	1.98	

Source: Authors' field data

Appendix 14: Hausman test results

	Livelihood			Efficiency		
	Coef.	Std.Err.	p-value	Coef.	Std.Err.	p-value
Age	-0.026	0.016	0.117	0.080	0.031	0.010
Gender	0.376	0.287	0.189	0.601	0.549	0.274
Education	0.558	0.227	0.014	0.597	0.325	0.066
Household size	-0.077	0.086	0.370	0.105	0.147	0.474
Literacy ratio	-0.052	0.099	0.596	0.097	0.154	0.531
Dependency ratio	0.167	0.123	0.175	-0.365	0.252	0.147
Farm size	0.042	0.168	0.805	0.128	0.262	0.624
Land tenure	-0.042	0.123	0.735	0.289	0.214	0.176
Livestock	0.091	0.078	0.245	0.195	0.101	0.053
Farming experience	0.015	0.013	0.268	-0.015	0.020	0.477
Farm labour	0.038	0.215	0.861	0.732	0.422	0.083
Market	0.216	0.117	0.064	0.261	0.162	0.106
Tarmac road	-0.215	0.102	0.034	-0.117	0.187	0.532
Extension	-0.083	0.113	0.460	-0.060	0.141	0.669
Extension contacts	-0.136	0.117	0.245	0.490	0.125	0.000

Piped water	-0.539	0.279	0.053	-0.734	0.508	0.149
Information	-0.136	0.117	0.245	0.374	0.171	0.029
ICT	-0.057	0.323	0.861	-0.039	0.568	0.945
Electricity supply	0.408	0.367	0.266	0.731	0.778	0.348
Assets	0.000	0.000	0.000	0.000	0.000	0.030
Credit access	1.674	0.268	0.000	0.377	0.483	0.436
Income sources	0.336	0.252	0.182	0.296	0.489	0.546
Off-farm income	-0.464	0.362	0.200	-1.015	0.715	0.156
Household income	-0.072	0.184	0.695	0.260	0.266	0.327
Food expenditure	0.000	0.000	0.590	-0.000	0.000	0.280
Constant	-1.028	1.297	0.428			
Log likelihood	-317.06					
LR chi ² (46)	197.81					
Prob > chi ²	0.000					
Pseudo R ²	0.237					

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Coef. =Coefficient; Std.Err. =Standard error

Chi2(46) = (b-B)/[(V_b-V_B)^(-1)](b-B) = 23.58; Prob > chi2 = 0.9975

Source: Authors' field data

Appendix 15: The likelihood ratio test of the instrumental variables

	Coefficient	Std. Error	P > z
Electricity	2.103	1.228	0.087
ICT	9.596	0.986	0.000
CAIs awareness	-0.016	0.298	0.957
Constant	25.634	1.396	0.000
<i>Regression diagnostics</i>			
F(3, 528)	37.17		
Prob > F	0.000		
Residual SS	55416.285		
Number of observations	532		

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Coef. =Coefficient; St.Err. =Standard error

Source: Authors' field data

Appendix 16: Determinants of food security for the pooled sample

	Food secure			Transitory food insecure			Chronic food insecure		
	AME	Std. error	P > z	AME	Std. Error	P > z	AME	Std. Error	P > z
<i>Household demographics</i>									
Age	-0.003	0.003	0.183	0.000	0.000	0.379	0.003	0.002	0.182
Gender	-0.012	0.043	0.784	0.001	0.003	0.792	0.001	0.040	0.784
Education	-0.021	0.027	0.424	0.002	0.002	0.491	0.020	0.025	0.426
Household size	0.012	0.011	0.284	-0.001	0.001	0.430	-0.011	0.010	0.283
<i>Farm and farming characteristics</i>									
Farm size	0.017	0.028	0.534	-0.001	0.002	0.586	-0.016	0.026	0.534
Land tenure	-0.105	0.018	0.000	0.008	0.007	0.257	0.097	0.015	0.000
Livestock	0.008	0.009	0.384	-0.001	0.001	0.472	-0.008	0.009	0.385
Farming experience	0.001	0.002	0.515	-0.000	0.000	0.571	-0.001	0.002	0.515
Farm labour	0.016	0.028	0.568	-0.001	0.002	0.595	-0.015	0.026	0.570
<i>Infrastructure and institutions</i>									
Market	-0.005	0.012	0.663	0.000	0.001	0.695	0.005	0.011	0.662
Tarmac road	-0.002	0.014	0.879	0.000	0.001	0.877	0.002	0.013	0.879
Extension contacts	-0.027	0.016	0.080	0.002	0.002	0.330	0.025	0.014	0.080
Piped water	-0.067	0.038	0.081	0.005	0.005	0.352	0.062	0.035	0.077
Information	0.010	0.015	0.533	-0.007	0.001	0.573	-0.009	0.014	0.534
ICT	0.225	0.044	0.000	-0.017	0.014	0.233	-0.209	0.043	0.000
<i>Household income and assets</i>									
Assets	0.000	0.000	0.712	0.000	0.000	0.721	0.000	0.000	0.713
Bank account	0.040	0.040	0.318	-0.003	0.004	0.436	-0.037	0.038	0.319
Credit access	-0.012	0.037	0.746	0.001	0.003	0.756	0.011	0.035	0.746
Income	0.007	0.028	0.805	-0.005	0.002	0.810	-0.006	0.026	0.805
Off-farm income	0.091	0.028	0.022	-0.007	0.007	0.301	-0.084	0.036	0.021
<i>Production pathway indicators</i>									
Maize produced	0.000	0.000	0.054	-8.90e-06	9.23e-06	0.335	-0.000	0.000	0.050
Beans produced	-0.000	0.000	0.038	0.000	0.000	0.299	0.000	0.000	0.039
<i>Income pathway indicators</i>									
Food expenditure	-0.000	0.000	0.002	3.42e-06	3.21e-06	0.288	0.000	0.000	0.002
<i>Regression diagnostics</i>									
Wald chi2(21)	99.96								
Prob > chi ²	0.000								
Pseudo R ²	0.157								

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1; Coef. =Coefficient; Std.Err. =Standard error; Source: Authors' field data

Appendix 17: Determinants of collective action participation

	Livelihood			Efficiency		
	Mean	Std. Error	P > z	Mean	Std. Error	P > z
<i>Household demographics</i>						
Age	-0.055	0.017	0.003	-0.007	0.047	0.889
Gender	-0.231	0.328	0.481	-2.287	1.193	0.055
Education	0.678	0.228	0.003	0.766	0.465	0.099
Household size	0.008	0.082	0.919	0.014	0.240	0.953
<i>Farm and farming characteristics</i>						
Farm size	0.440	0.250	0.078	0.847	0.431	0.049
Farming experience	0.032	0.017	0.062	0.079	0.039	0.042
Farm labour	-0.246	0.196	0.208	-0.326	0.702	0.642
Land tenure	-0.043	0.135	0.748	0.466	0.356	0.190
<i>Infrastructure and institutions</i>						
Market	0.004	0.093	0.969	0.074	0.251	0.770
Extension contacts	0.627	0.182	0.001	1.140	0.228	0.000
Information	-0.188	0.141	0.182	0.441	0.290	0.129
ICT	-1.017	0.366	0.005	0.535	1.046	0.609
Total GPS	0.068	0.101	0.499	0.371	0.312	0.235
Electricity supply	0.395	0.378	0.295	0.511	1.105	0.643
Constant	1.158	1.351	0.391	-11.786	4.303	0.006
<i>Regression diagnostics</i>						
Wald chi ² (34) vs. Wald chi ² (40)	35636.20					
Prob > chi2	0.000					
Log pseudolikelihood	-479.648					
Number of observations						

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Coef. =Coefficient; Std.Err. =Standard error

Source: Authors' field data

Appendix 18: Effect of collective action on household food security through production

	Accounting for endogeneity			Assuming exogeneity		
	Coefficient	Std. Error	P > z	Coefficient	Std. Error	P > z
<i>Food security effects</i>						
Efficiency	0.352	0.005	0.000	0.779	0.004	0.000
Livelihood	0.577	0.004	0.000	-0.032	0.003	0.000
<i>Selection term</i>						
Lnsigma	-4.860	0.132	0.000	-4.791	0.119	0.000
λ Efficiency	0.012	0.001	0.000	-0.672	0.001	0.000
λ Livelihood	-0.178	0.001	0.000	-0.025	0.002	0.000
<i>Household demographics</i>						
Age	0.005	0.000	0.000	0.001	0.000	0.000
Gender	-0.017	0.003	0.000	0.103	0.002	0.000
Household size	-0.003	0.001	0.000	0.013	0.001	0.000
Dependency ratio	0.042	0.001	0.000	0.041	0.001	0.000
Literacy ratio	-0.061	0.001	0.000	-0.064	0.001	0.000
<i>Farm and farming factors</i>						
Farm size	0.041	0.002	0.000	0.046	0.001	0.000
Land tenure	0.248	0.001	0.000	0.242	0.001	0.000
Farming experience	-0.001	0.000	0.000	-0.003	0.000	0.000
Farm labour	0.092	0.002	0.000	0.070	0.002	0.000
<i>Institutions and infrastructure</i>						
Market	0.020	0.001	0.000	0.021	0.001	0.000
<i>Production pathway indicators</i>						
Maize produced	-0.000	2.15e-06	0.000	-0.000	2.13e-06	0.000
Beans produced	0.000	8.31e-06	0.000	0.000	0.000	0.000
Constant	0.808	0.007	0.000	1.281	0.008	0.000
<i>Regression diagnostics</i>						
Wald chi ² (34) vs. Wald chi ² (40)	96721.82			109920.25		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-547.319			-548.283		
Number of observations	323			323		
Exogenous test (P > z)						

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1; Coef. =Coefficient; Std.Err. =Standard error; Source: Authors' field data

Appendix 19: Effect of collective action on household food security through income

	Accounting for endogeneity			Assuming exogeneity		
	Coefficient	Std. Error	P > z	Coefficient	Std. Error	P > z
<i>Food security effects</i>						
Efficiency	-0.114	0.005	0.000	0.557	0.008	0.000
Livelihood	0.386	0.004	0.000	-0.211	0.008	0.000
<i>Selection term</i>						
Lnsigma	-4.460	0.104	0.000	-4.192	0.136	0.000
λ Efficiency	0.408	0.001	0.000	-0.675	0.002	0.000
λ Livelihood	-0.561	0.001	0.000	0.103	0.003	0.000
<i>Household demographics</i>						
Age	0.007	0.000	0.000	-0.001	0.000	0.075
Gender	0.120	0.003	0.000	0.207	0.005	0.000
Household size	-0.008	0.001	0.000	-0.002	0.001	0.114
Dependency ratio	0.024	0.001	0.000	0.037	0.002	0.000
<i>Farm and farming factors</i>						
Farm size	0.013	0.002	0.000	-0.004	0.022	0.062
Land tenure	0.275	0.002	0.000	0.245	0.002	0.000
Farming experience	-0.001	0.000	0.000	0.000	0.000	0.475
Farm labour	0.029	0.002	0.000	-0.039	0.003	0.000
<i>Institutions and infrastructure</i>						
Market	0.015	0.001	0.000	0.001	0.001	0.189
Extension contacts	0.015	0.000	0.000	-0.014	0.001	0.000
<i>Income pathway indicators</i>						
Income	-0.067	0.002	0.000	-0.006	0.002	0.019
Food expenditure	0.000	1.27e-06	0.000	0.000	1.79e-06	0.000
Constant	0.555	0.015	0.000	1.266	0.018	0.000
<i>Regression diagnostics</i>						
Wald chi ² (34) vs. Wald chi ² (40)	65958.54			33675.09		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-765.804			-787.638		
Number of observations	447			447		
Exogenous test (P > z)						

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Coef. =Coefficient; Std.Err. =Standard error

Source: Authors' field data

Appendix 20: Effect of collective action on household food security through production and income

	Accounting for endogeneity			Assuming exogeneity		
	Coefficient	Std. Error	P > z	Coefficient	Std. Error	P > z
<i>Food security effects</i>						
Efficiency	0.244	0.011	0.000	0.119	0.262	0.649
Livelihood	0.453	0.005	0.000	0.278	0.245	0.257
<i>Selection term</i>						
lnsigma	-4.410	0.136	0.000	-0.869	0.764	0.255
λ Efficiency	0.180	0.002	0.000	0.284	0.278	0.307
λ Livelihood	-0.648	0.002	0.000	-0.424	0.297	0.153
<i>Household demographics</i>						
Age	0.011	0.000	0.000	0.008	0.005	0.119
Gender	0.046	0.005	0.000	0.032	0.088	0.712
Household size	0.006	0.001	0.000	-0.005	0.023	0.825
Dependency ratio	0.026	0.002	0.000	0.053	0.034	0.120
<i>Farm and farming factors</i>						
Farm size	0.039	0.003	0.000	0.033	0.057	0.558
Land tenure	0.257	0.002	0.000	0.264	0.034	0.000
Farming experience	-0.005	0.000	0.000	-0.005	0.004	0.233
Farm labour	0.045	0.003	0.000	0.029	0.056	0.602
<i>Institutions and infrastructure</i>						
Tarmac road	0.002	0.001	0.217	-0.016	0.028	0.575
Market	0.013	0.001	0.000	0.030	0.026	0.235
Extension contacts	0.021	0.001	0.000	0.032	0.021	0.133
<i>Production pathway indicators</i>						
Maize produced	-0.000	5.87e-06	0.000	-0.000	0.000	0.036
Beans produced	0.000	0.000	0.000	0.000	0.000	0.737
<i>Income pathway indicators</i>						
Income	-0.070	0.004	0.000	-0.052	0.034	0.329
Food expenditure	0.000	1.76e-06	0.000	0.000	0.000	0.000
Constant	0.253	0.017	0.000	0.560	0.395	0.156
<i>Regression diagnostics</i>						
Wald chi ² (34) vs. Wald chi ² (40)	35636.20			160.40		
Prob > chi2	0.000			0.000		
Log pseudolikelihood	-479.648			-508.307		
Number of observations	305			305		
Exogenous test (P > z)						

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1; Coef. =Coefficient; Std.Err. =Standard error; Source: Authors' field data

Appendix 21: Chow test for efficiency collective action initiatives

Efficiency	Coef.	St.Err.	t-value	p-value	[95% Conf	Interv al]	Sig
Market	-0.022	0.089	-0.25	0.803	-.197	0.152	
Marital status	0.168	0.532	0.32	0.752	-.874	1.210	
Extension contacts	0.129	0.057	2.28	0.022	0.018	0.240	**
Livestock	0.238	0.097	2.46	0.014	0.049	0.428	**
Income sources	-0.064	0.177	-0.36	0.718	-0.412	0.284	
Women's autonomy in production	2.359	0.976	2.42	0.016	0.446	4.273	**
Women's asset ownership	1.623	1.206	1.35	0.178	-0.074	3.987	
Household education	0.007	0.047	0.16	0.875	-0.086	0.100	
Tarmac	0.207	0.129	1.60	0.109	-0.046	0.459	
Assets	0.000	0.000	-1.20	0.232	0.000	0.000	
gGender	1.977	1.527	1.29	0.195	-1.016	4.969	
gGenderagehh	0.014	0.009	1.57	0.116	-0.003	0.030	
gGenderofffarmincome	-0.480	0.270	-1.77	0.076	-1.010	0.050	*
gGendermarket	0.035	0.102	0.34	0.731	-0.165	0.235	
gGenderqtyharvested	0.000	0.000	1.63	0.103	0.000	0.000	
gGendertotalasset	0.000	0.000	0.87	0.382	0.000	0.000	
gGenderproduction	-0.195	0.288	-0.68	0.499	-0.759	0.369	
gGenderautonomyin	-2.334	1.018	-2.29	0.022	-4.329	-0.339	**
gGenderpublicspeaki	0.018	0.200	0.09	0.927	-0.374	0.410	
gGenderownershipofi	-1.351	1.257	-1.07	0.283	-3.815	1.113	
gGenderlivestocktlu	-0.153	0.105	-1.45	.146	-0.360	0.053	
gGenderfarmsize	0.048	0.106	0.46	.649	-0.159	0.256	
gGendertarmac	-0.254	0.147	-1.73	.084	-0.541	0.034	*
gGenderextensioncos	0.032	0.065	0.49	.622	-0.096	0.160	
gGenderlandtenure	-0.209	0.213	-0.98	.326	-0.628	0.209	
gGendermaritalstat~h	0.513	0.579	0.89	.376	-0.622	1.648	
Constant	-4.547	1.419	-3.20	.001	-7.328	-1.765	***
Mean dependent var		0.119	SD dependent var			0.324	
Pseudo r-squared		0.296	Number of obs			523	
Chi-square		112.773	Prob > chi2			0.000	
Akaike crit. (AIC)		321.991	Bayesian crit. (BIC)			437.000	

*** p<.01, ** p<.05, * p<.1
chi²(15) = 39.95; Prob > chi2 = 0.000
Source: Authors' field data

Appendix 22: Chow test for livelihood co 1

Livelihood	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Market	0.179	0.056	3.22	0.001	0.070	0.288	***
Marital status	-0.203	0.168	-1.21	0.225	-0.532	0.125	
Extension contacts	0.110	0.052	2.12	0.034	0.008	0.212	**
Livestock	-0.079	0.061	-1.28	0.199	-0.199	0.041	
Income sources	0.174	0.103	1.69	0.091	-0.028	0.376	*
Autonomy in production	-0.542	0.382	-1.42	0.156	-1.292	0.207	
Ownership of assets	-0.765	0.278	-2.75	0.006	-1.309	-0.220	***
Household education	0.004	0.034	0.12	0.907	-0.062	0.070	
Tarmac	-0.268	0.076	-3.54	0.000	-0.416	-0.120	***
Assets	0.000	0.000	1.15	0.250	0.000	0.000	
gGender	3.978	125.17	0.03	0.975	-241.351	249.307	
gGenderagehh	-0.005	0.006	-0.82	0.411	-0.017	0.007	
gGenderoffarmincome	0.179	0.179	1.00	0.317	-0.171	0.529	
gGendermarket	-0.167	0.068	-2.45	0.014	-0.300	-0.033	**
gGenderqtyharvested	0.000	0.000	-1.15	0.251	0.000	0.000	
gGendertotalassetv~e	0.000	0.000	-1.22	0.222	0.000	0.000	
gGenderproductiond~i	-0.387	0.214	-1.81	0.071	-0.807	0.033	*
gGenderautonomyinp~i	1.074	0.436	2.47	0.014	0.220	1.928	**
gGenderpublicspeak~i	0.259	0.147	1.76	0.078	-0.029	0.546	*
gGENDERownershipof~i	0.552	0.438	1.26	0.208	-0.307	1.412	
gGenderlivestocktlu	0.135	0.070	1.92	0.054	-0.002	0.273	*
gGenderfarmsize	-0.077	0.087	-0.88	0.379	-0.247	0.094	
gGendertarmac	0.196	0.093	2.11	0.035	0.014	0.378	**
gGenderextensionco~s	-0.128	0.057	-2.23	0.026	-0.240	-0.016	**
gGenderlandtenure	0.171	0.160	1.07	0.286	-0.143	0.485	
gGendermaritalstat~h	-4.714	125.168	-0.04	0.970	-250.039	240.612	
Constant	0.877	0.501	1.75	0.080	-0.104	1.859	*
Mean dependent var			0.543	SD dependent var			0.499
Pseudo r-squared			0.117	Number of obs			523
Chi-square			84.443	Prob > chi2			0.000
Akaike crit. (AIC)			690.712	Bayesian crit. (BIC)			805.721

*** p<.01, ** p<.05, * p<.1
chi²(15) = 27.46; Prob > chi2 = 0.025
Source: Authors' field data

Appendix 23: Full ESTER results for collective action participation decisions

Variables	Selection			Livelihood non-membership			Livelihood membership		
	Coef.	SE	P-value	Coef.	SE	P-value	Coef.	SE	p-value
Education	0.054	0.137	0.695	0.080	0.058	0.173	0.103	0.036	0.004
Age	0.025	0.010	0.016	-0.011	0.005	0.038	-0.001	0.003	0.805
Livestock	-0.062	0.044	0.162	-0.009	0.011	0.415	0.011	0.011	0.313
Dependency ratio	0.071	0.071	0.315	0.053	0.027	0.045	0.018	0.024	0.463
Farm size	-0.133	0.115	0.249	0.058	0.048	0.226	-0.023	0.042	0.574
Labour	-0.300	0.128	0.019	-0.010	0.042	0.813	-0.086	0.044	0.053
Off-farm income	-0.250	0.183	0.172	-0.017	0.088	0.843	0.069	0.061	0.263
Farming experience	-0.022	0.009	0.017	0.005	0.003	0.119	-0.000	0.003	0.942
Quantity harvested	0.000	0.000	0.143	0.000	0.000	0.918	-0.000	0.000	0.629
Food consumption score	0.030	0.009	0.001	0.005	0.004	0.221	0.009	0.003	0.001
Production decisions	0.556	0.245	0.023	-0.196	0.143	0.169	-0.097	0.083	0.241
Ownership of assets	-2.459	0.252	0.000	-0.415	0.132	0.002	-0.267	0.137	0.052
Leisure	0.290	0.191	0.129	-0.065	0.089	0.466	0.006	0.058	0.922
Food insecurity experience scale score	-0.063	0.040	0.116	0.015	0.016	0.323	0.002	0.011	0.841
Market	0.157	0.044	0.000	0.051	0.016	0.001	0.006	0.013	0.660
Extension contacts	0.023	0.027	0.391	0.040	0.020	0.050	-0.003	0.009	0.703
Control of assets	0.229	0.202	0.256	0.023	0.094	0.804	-0.043	0.059	0.233
Autonomy in production	0.625	0.233	0.007	0.184	0.141	0.192	0.284	0.075	0.000
Public speaking	-0.631	0.175	0.000	0.131	0.077	0.088	0.067	0.056	0.233
Bank account	0.220	0.194	0.256	0.067	0.081	0.408	0.149	0.058	0.011
Tarmac	-0.173	0.060	0.004	-0.091	0.027	0.001	-0.027	0.021	0.193
Occupation	0.366	0.103	0.000	0.027	0.058	0.641	0.015	0.026	0.563
Group aware	0.190	0.061	0.002						

Electricity	-0.758	0.257	0.003						
Constant	-1.580	0.870	0.069	0.709	0.374	0.058	-0.282	0.274	0.304
/lns0	-0.800	0.057	0.000						
/lns1	-0.759	0.029	0.000						
/r0	0.457	0.265	0.085						
/r1	0.431	0.229	0.060						
sigma0	0.449	0.026							
sigma1	0.468	0.014							
rho0	0.427	0.217							
rho1	0.406	0.191							
Wald chi ² (22)	79.63								
Prob > chi ²	0.000								
Log pseudolikelihood	-418.43								

Wald test of independence of equations: $\chi^2(2) = 6.00$; Prob > $\chi^2 = 0.0498$

Source: Authors' field data

Appendix 24: Full ESTER results for efficiency participation decisions across gender

Variables	Selection			Efficiency non-members			Efficiency members		
	Coef.	SE	P-value	Coef.	SE	P-value	Coef.	SE	p-value
Education	0.037	0.134	0.785	-0.010	0.021	0.623	-0.003	0.025	0.917
Age	0.030	0.011	0.006						
Livestock	-0.070	0.046	0.132	0.027	0.009	0.002	0.005	0.009	0.569
Farm size	-0.129	0.107	0.226	0.030	0.027	0.264	0.018	0.024	0.447
Labour	-0.307	0.132	0.020	0.028	0.023	0.216	0.064	0.030	0.032
Dependency ratio	0.023	0.073	0.757						
Food insecurity experience scale score	-0.072	0.037	0.052						
Farming experience	-0.020	0.010	0.044						
Off-farm income	-0.261	0.186	0.162	-0.012	0.037	0.734	-0.132	0.037	0.000
Quantity of crops harvested	0.000	0.000	0.173						
Occupation	0.356	0.103	0.001						
Control of assets	0.134	0.216	0.534						
Group awareness	0.223	0.064	0.000						
Electricity	-0.759	0.262	0.004						
Production decisions	0.633	0.260	0.015	-0.049	0.089	0.582	-0.018	0.055	0.748
Ownership of assets	-2.423	0.251	0.000	0.144	0.089	0.104	0.275	0.115	0.017
Leisure	0.238	0.194	0.220	0.012	0.042	0.772	-0.036	0.040	0.367
Food consumption score	0.026	0.009	0.005	-0.004	0.002	0.053	-0.006	0.002	0.002
Market	0.148	0.044	0.001	0.016	0.012	0.177	0.003	0.010	0.794
Autonomy in production	0.555	0.271	0.041	0.143	0.120	0.235	-0.096	0.055	0.081
Public speaking	-0.679	0.183	0.000	-0.010	0.033	0.758	0.049	0.037	0.192
Bank account	0.266	0.196	0.175	-0.109	0.037	0.003	-0.149	0.041	0.000
Tarmac	-0.156	0.061	0.010						
Constant	-1.728	0.832	0.038	0.058	0.105	0.578	0.609	0.144	0.000
/lns0	-1.536	0.129	0.000						
/lns1	-1.139	0.067	0.000						
/r0	-0.386	0.438	0.378						
/r1	-0.483	0.202	0.017						
Sigma0	0.215	0.028							

Sigma1	0.320	0.022
rho0	-0.368	0.378
rho1	-0.449	0.161
Wald chi ² (13)	29.22	
Prob > chi ²	29.22	
Log pseudolikelihood	-187.09	

Wald test of independence of equations: $\chi^2(2) = 6.93$; Prob > $\chi^2 = 0.0313$

Source: Authors' field data

Appendix 25: Effects of collective action on women's empowerment

	Production		Autonomy in production		Income		Workload		Leisure	
	Coeff.	Standard error	Coeff.	Standard error	Coeff.	Standard error	Coefficient	Standard error	Coefficient	Standard error
Efficiency	-0.107	0.003	-0.259	0.004	0.408	0.002	0.305	0.004	-0.151	0.003
Livelihood	0.276	0.005	0.288	0.004	0.280	0.002	-0.169	0.002	0.277	0.002
λefficeincy	0.417	0.002	0.420	0.001	-0.358	0.001	-0.364	0.001	0.141	0.001
λlivelihood	-0.284	0.002	-0.297	0.002	-0.293	0.001	0.151	0.001	-0.441	0.001
lnsigma	-5.170	0.280	-4.966	0.148	-5.578	0.165	-5.241	0.217	-5.567	0.143
Sigma	0.006	0.002	0.007	0.001	0.004	0.001	0.005	0.001	0.004	0.001
Household size					-0.014	0.000	-0.006	0.000	-0.016	0.000
Age	-0.007	0.000	0.000	0.000	-0.000	0.000	-0.001	0.000	0.008	0.000
Education	0.028	0.002	-0.005	0.004	-0.108	0.001	0.016	0.001	-0.056	0.001
Dependency ratio	0.002	0.000	0.008	0.001	-0.014	0.001				
Household education	0.020	0.000	0.026	0.001	0.010	0.000	-0.008	0.000	-0.012	0.000
Labour	-0.040	0.000	0.009	0.001	-0.052	0.001	-0.045	0.002	-0.062	0.001
Livestock					0.007	0.001	-0.004	0.000	0.008	0.000
Farm size	0.057	0.002	0.038	0.001	0.013	0.001	0.005	0.001	0.008	0.001
Farming experience	0.008	0.000	-0.003	0.000	0.000	0.000	0.002	0.000	-0.002	0.000
Farm income							1.58e-07	1.50e-08	-1.29e-06	1.30e-08
Household income	0.002	0.000	0.001	0.000	1.63e-06	7.73e-09	-0.010	0.000	0.001	0.000
Income sources	-0.001	0.000	0.002	0.000	0.000	0.000	-0.002	0.000	0.001	0.000
Off-farm income	0.031	0.004	-0.041	0.003	-0.157	0.001	-0.044	0.003	0.119	0.002
Bank account	0.041	0.004	0.150	0.003	-0.033	0.001	-0.095	0.002	0.053	0.002
Tarmac	-0.002	0.001	-0.030	0.001	0.016	0.001	0.033	0.001	0.032	0.001
Market	-0.000	0.000	0.023	0.000	-0.001	0.000	-0.025	0.000	-0.015	0.000
Information	0.041	0.001	0.061	0.001	0.526	0.006	-0.068	0.001	0.056	0.000
Constant	0.398	0.007	-0.006	0.015	0.004	0.001	0.635	0.010	0.224	0.005

400 Halton sequence-based quasirandom draws per observation used

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Base category = Non-members

Appendix 26: Effects of collective action on women's empowerment continued

	Asset control		Asset ownership		Credit		Public speaking		Leadership	
	Coeff.	Standard error	Coeff.	Standard error	Coeff.	Standard error	Coeff.	Standard error	Coeff.	Standard error
Efficiency	-0.484	0.011	-0.424	0.008	-0.275	0.003	0.084	0.002	0.087	0.014
Livelihood	0.061	0.016	-0.406	0.005	0.353	0.003	-0.193	0.003	-0.162	0.007
λefficeincy	0.387	0.002	0.258	0.003	0.393	0.001	-0.002	0.000	0.027	0.004
λlivelihood	-0.193	0.006	0.336	0.002	-0.221	0.001	0.147	0.001	0.335	0.003
Insigma	-4.499	0.196	-4.506	0.150	-5.140	0.101	-5.624	0.133	-3.814	0.190
Sigma	0.011	0.002	0.011	0.002	0.006	0.001	0.004	0.000	0.022	0.004
Household size									0.005	0.002
Age	0.005	0.000	0.002	0.000	0.002	0.000	-0.002	0.000	-0.002	0.000
Education	0.830	0.006	0.059	0.004	0.029	0.001	0.0973	0.002	-0.004	0.006
Dependency ratio	-0.035	0.002	0.016	0.001	-0.001	0.001	0.041	0.001		
Household education	-0.016	0.002	-0.028	0.002	-0.012	0.000	-0.013	0.000	0.036	0.002
Labour	0.045	0.002	0.059	0.003	0.065	0.001	0.064	0.001	-0.039	0.007
Livestock							0.010	0.000	0.004	0.001
Farm size	0.043	0.004	-0.029	0.002	-0.039	0.001	-0.053	0.001	-0.030	0.003
Farming experience	-0.001	0.000	0.003	0.000	-0.001	0.001	0.001	0.000	0.001	0.000
Farm income							1.8e-06	2.66e-08		
Household income	-0.000	0.000	0.001	0.000	0.002	0.000	0.001	0.000	-0.001	0.000
Income sources	0.002	0.000	0.003	0.000	0.001	0.000	-0.001	0.000	0.000	0.000
Off-farm income	-0.004	0.010	-0.024	0.000	0.062	0.002	-0.067	0.004	0.007	0.007
Bank account	0.086	0.007	0.055	0.009	0.179	0.002	-0.041	0.001	0.070	0.007
Tarmac	0.011	0.002	-0.004	0.002	0.056	0.001	-0.071	0.001	-0.003	0.002
Market	-0.024	0.000	0.009	0.001	-0.030	0.000	0.012	0.000	0.005	0.002
Information	0.017	0.002	0.014	0.001	0.051	0.000	-0.061	0.001	0.031	0.002
Constant	0.212	0.017	0.165	0.012	0.061	0.005	0.627	0.005	0.116	0.026

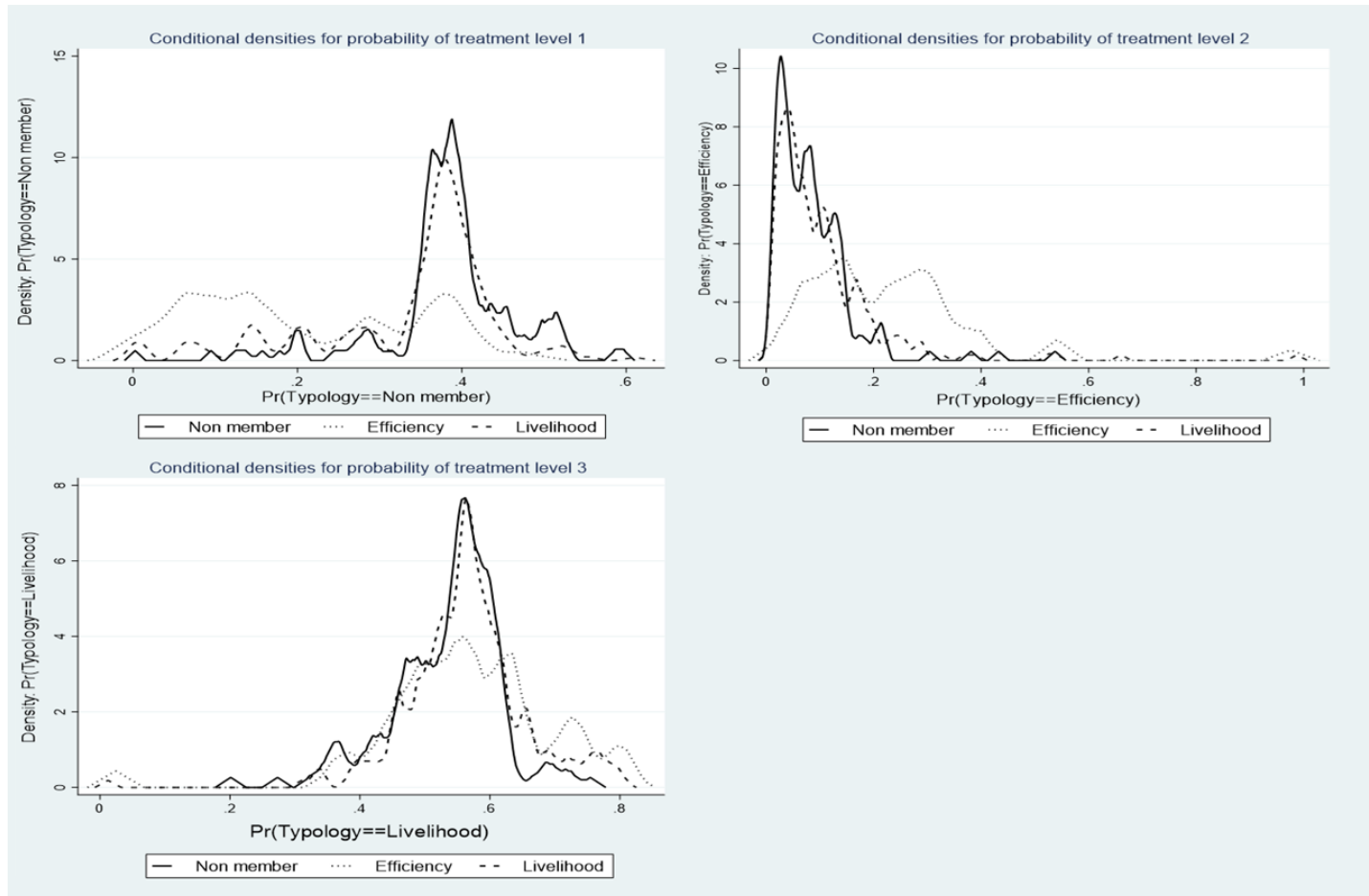
400 Halton sequence-based quasirandom draws per observation used

Significance levels *** p< 0.01, ** p< 0.05, * p< 0.1

Base category = Non-members

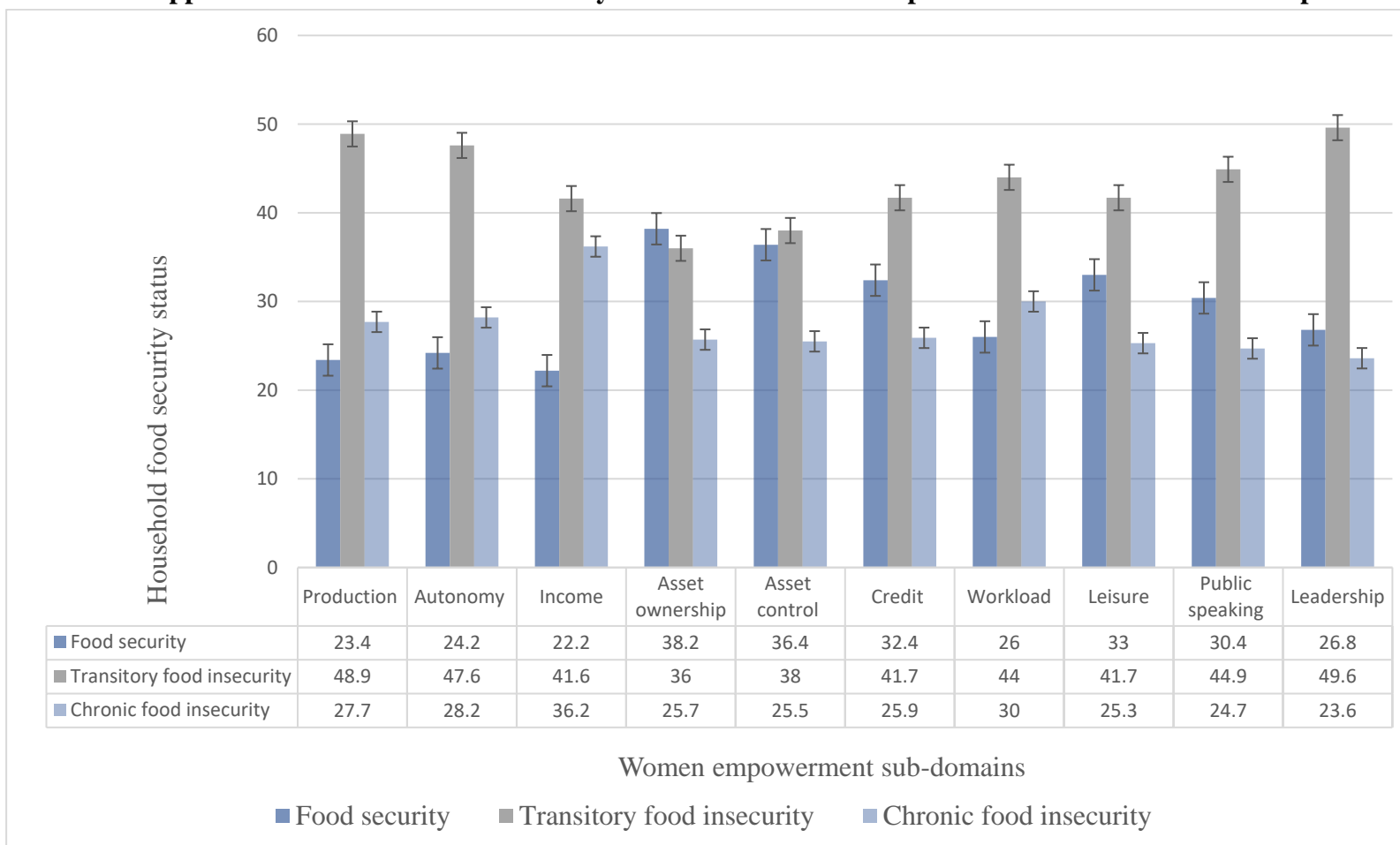
Source: Authors' field data

Appendix 27: Conditional densities for the probability of treatments



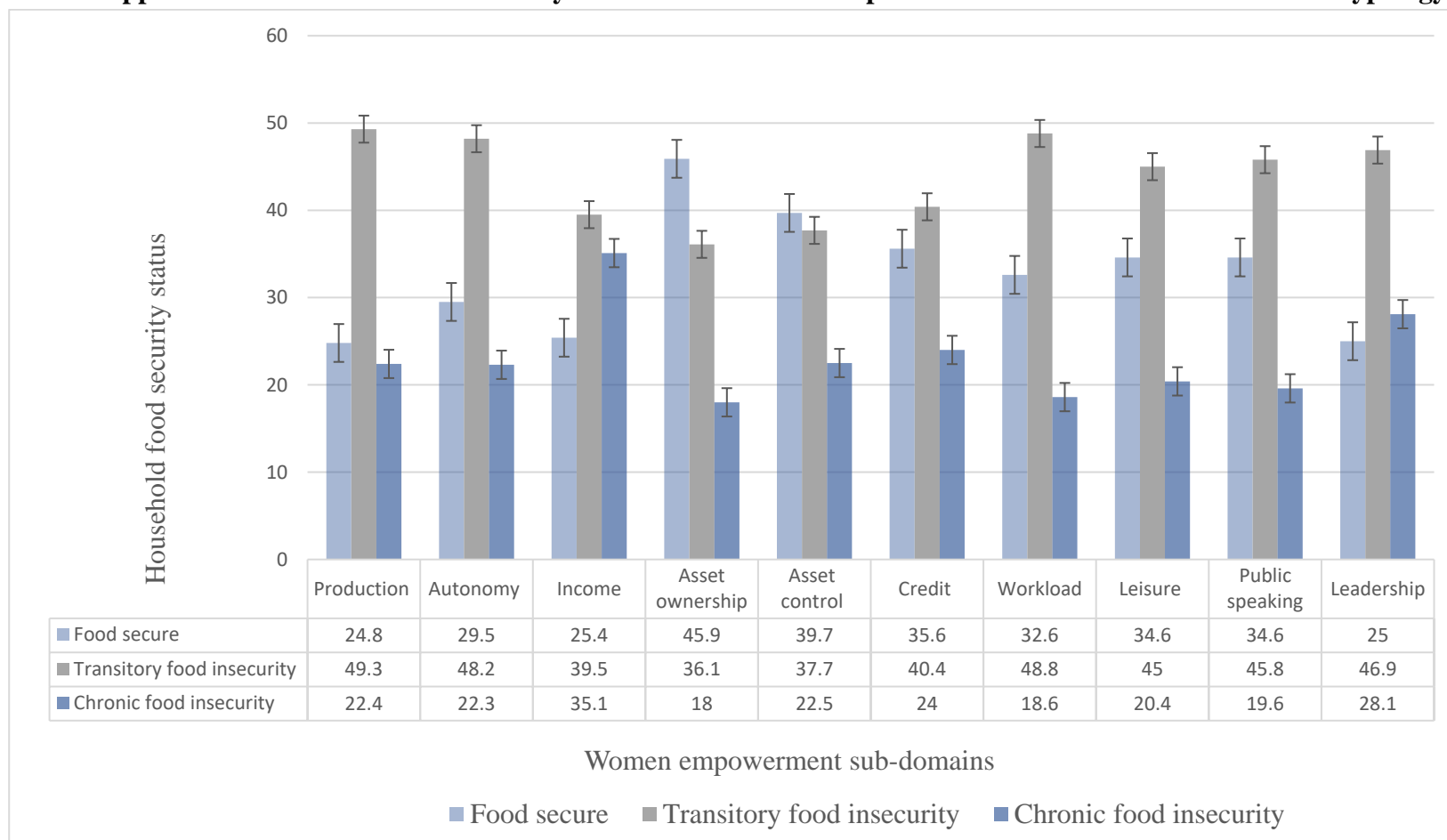
Source: Author's field data

Appendix 28: Household food security status across women empowerment sub-domains for the pooled sample



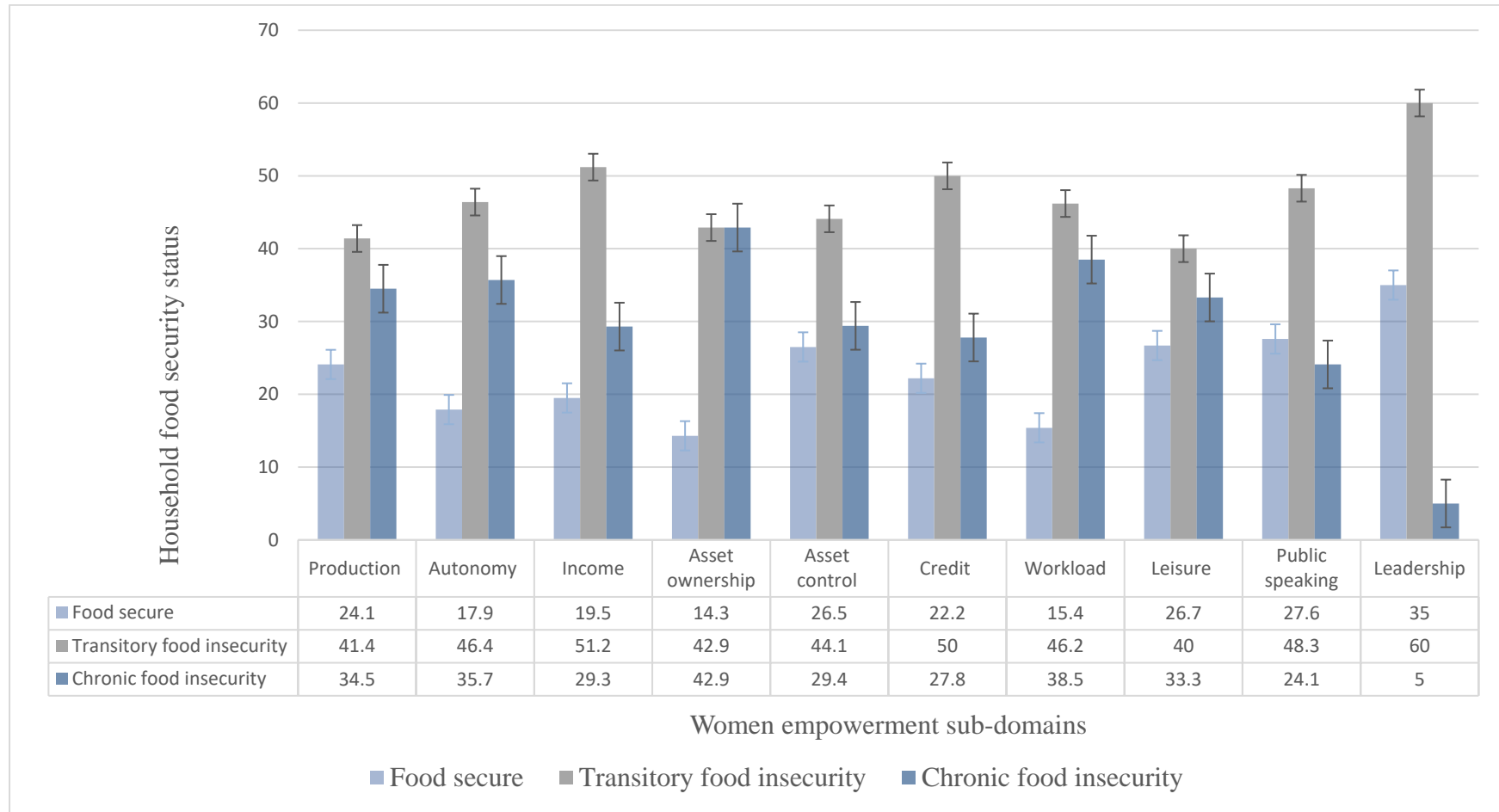
Source: Author's field data

Appendix 29: Household food security status across women empowerment sub-domains for livelihood typology



Source: Author's field data

Appendix 30: Household food security status following women empowerment sub-domains among the efficiency typology



Source: Author's field data

Appendix 31: First stage results of the multiple treatments for production and asset ownership

Variable name	Production						Asset ownership					
	Treatments for women members				Treatments for women non-members		Treatments for women members					
	Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)		Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
<i>Household demographics</i>												
Age	0.007	0.031	0.002	0.028	0.063**	0.030	0.028	0.017	-0.002	0.033	0.010	0.334
Spousal age difference	-0.019	0.056	0.028	0.050	0.012	0.054	0.038	0.034	0.056	0.064	0.046	0.062
Education of head	-0.200	0.418	0.449	0.362	0.112	0.385	0.331	0.241	0.197	0.431	-0.235	0.476
Spouse education	0.543	0.470	0.554	0.413	0.778*	0.433	0.312	0.276	0.488	0.481	-0.552	0.565
Occupation	-0.475*	0.224	-0.364*	0.201	0.002	0.214	0.069	0.132	0.107	0.261	-0.075	0.256
Household size	0.329*	0.160	0.294*	0.148	0.163	0.157	-0.0191	0.081	-0.158	0.169	-0.050	0.159
Dependency ratio	-0.288	0.223	-0.205	0.199	-0.528**	0.228						
<i>Farming characteristics</i>												
Farm size	0.022	0.231	0.005	0.204	-0.131	0.246	-0.007	0.152	-0.367	0.343	-0.003	0.228
Land tenure	0.428*	0.220	0.305	0.204	0.186	0.223	-0.087	0.127	0.119	0.262	-0.345	0.259
Labour	-0.031	0.453	-0.152	0.142	-0.101	0.461	0.045	0.264	-1.377	0.724	0.367	0.467
Farming experience	0.004	0.024	0.006	0.021	-0.023	0.022	-0.019	0.015	-0.001	0.280	-0.033	0.028
<i>Household incomes</i>												
Income sources	0.008	0.017	0.005	0.014	0.151	0.279	0.008	0.009	1.259***	0.438	0.133	0.509
Off-farm income	-0.629	0.561	-0.575	0.514	-0.862	0.600	-0.087	0.314	-0.983	0.821	0.054	0.735
<i>Infrastructure</i>												
Bank account	-0.645	0.494	-0.484	0.443	-0.817*	0.480	-0.065	0.296	-0.104	0.594	0.562	0.572
Tarmac	-0.242	0.182	-0.301*	0.164	-0.405**	0.181	-0.163	0.104	0.130	0.187	0.115	0.203
Market	0.082	0.154	0.152	0.424	0.112	0.150	0.018	0.078	0.132	0.128	-0.170	0.192
Information	0.071	0.195	0.174	0.178	0.358*	0.189	0.189*	0.112	0.633***	0.220	-0.013	0.207
Constant	-0.649	2.593	-1.770	2.330	-4.287*	2.502	-1.978	1.481	-5.647*	2.815	0.780	3.017
Log-likelihood	-353.16						-					
LR chi ² (51)	84.60						295.775					
Prob > chi ²	0.002						68.83					
Pseudo R ²	0.107						0.026					
							0.104					

*** p< 0.01, ** p< 0.05, * p< 0.1; Std. Error = standard error; Base category = Disempowered women non-members

Appendix 32: First stage results of the multiple treatments for income control and workload

Variable name	Income control						Workload					
	Treatments for women members				Treatments for women non-members		Treatments for women members					
	Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)		Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
<i>Household demographics</i>												
Age	0.065**	0.026	0.041	0.026	0.065**	0.031	0.013	0.020	0.009	0.034	0.002	0.034
Spousal age difference	-0.004	0.046	-0.025	0.046	-0.099*	0.055	0.026	0.038	-0.090	0.062	-0.112	0.071
Education of head	0.356	0.026	0.742**	0.339	0.222	0.416	0.493*	0.290	1.009**	0.423	0.194	0.514
Spouse education	0.361	0.376	0.190	0.380	-0.059	0.468	0.202	0.311	0.199	0.465	-0.159	0.563
Occupation	-0.067	0.170	-0.086	0.173	-0.374*	0.215	0.046	0.146	0.107	0.243	-0.187	0.252
Household size	0.105	0.129	0.212	0.129	0.285*	0.150	0.060	0.101	-0.310	0.194	0.025	0.168
Dependency ratio	-0.197	0.196	-0.289	0.190	-0.281	0.216	-0.137	0.151	-0.169	0.264	-0.190	0.249
<i>Farming characteristics</i>												
Farm size	0.005	0.247	0.325	0.222	0.405*	0.244	0.126	0.181	0.134	0.301	0.162	0.286
Land tenure	0.017	0.167	0.043	0.171	0.122	0.203	-0.086	0.140	0.408*	0.241	0.265	0.250
Labour	0.022	0.325	-0.304	0.349	-0.127	0.423	-0.104	0.279	-2.537***	0.813	-2.032**	0.885
Farming experience	-0.046**	0.021	-0.003	0.021	-0.026	0.025	-0.012	0.017	0.027	0.025	-0.011	0.027
<i>Household incomes</i>												
Income sources	0.006	0.247	0.003	0.015	-0.002	0.016	-0.002	0.013	0.035	0.074	-0.006	0.017
Off-farm income	0.037	0.439	-0.433	0.434	-0.018	0.514	-0.329	0.367	-1.481**	0.619	-1.270*	0.615
<i>Infrastructure</i>												
Bank account	-0.624	0.392	0.038	0.394	-0.285	0.480	-0.060	0.331	-0.376	0.547	0.128	0.558
Tarmac	-0.147	0.145	-0.282*	0.149	-0.125	0.175	0.211*	0.121	-0.020	0.202	0.120	0.210
Market	0.112	0.115	0.150	0.115	0.089	0.138	0.092	0.091	0.053	0.150	0.056	0.159
Information	0.346**	0.169	0.530***	0.167	0.457**	0.190	0.073	0.119	-0.048	0.213	-0.673**	0.279
Constant	-4.236*	2.096	-4.905*	2.121	-4.508*	2.540	-1.149	1.682	-1.392	2.926	2.634	3.100
Log-likelihood	-358.545						-270.71					
LR chi ² (51)	89.81						86.92					
Prob > chi ²	0.001						0.001					
Pseudo R ²	0.111						0.138					

*** p< 0.01, ** p< 0.05, * p< 0.1; Std. Error = standard error; Base category = Disempowered women non-members

Appendix 33: First stage results of the multiple treatments for credit control and public speaking

Variable name	Credit control						Public speaking					
	Treatments for women members				Treatments for women non-members		Treatments for women members				Treatments for women non-members	
	Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)		Empowered women non-members (1)		Empowered women members (2)		Disempowered women non-members (3)	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
<i>Household demographics</i>												
Age	0.056**	0.025	0.022	0.023	0.025	0.027	-0.009	0.022	0.035	0.022	-0.021	0.032
Education of head	-0.450	0.344	0.273	0.297	-0.561	0.380	0.319	0.305	0.596*	0.303	-0.007	0.416
Spouse education	0.995**	0.393	0.593*	0.359	0.452	0.437	0.512	0.384	0.268	0.344	0.330	0.469
Spousal age difference	-0.017	0.049	0.046	0.043	-0.008	0.051	0.048	0.034	0.017	0.042	-0.001	0.056
Occupation	0.158	0.184	0.062	0.165	0.002	0.198	0.089	0.163	0.180	0.159	0.105	0.215
Household size	0.010	0.111	-0.029	0.101	-0.037	0.124	-0.107	0.109	0.013	0.104	-0.271	0.167
Dependency ratio							0.022	0.175	-0.098	0.169	0.269	0.225
<i>Farming characteristics</i>												
Farm size	0.083	0.197	-0.135	0.180	-0.083	0.211	0.007	0.163	-0.196	0.193	-0.176	0.276
Land tenure	0.226	0.184	0.080	0.168	0.288	0.194	0.099	0.156	-0.021	0.160	0.254	0.205
Labour	0.135	0.343	-0.088	0.322	0.119	0.382	-0.209	0.367	0.273	0.344	0.340	0.413
Farming experience	-0.312	0.020	-0.019	0.018	-0.024	0.022	0.017	0.018	-0.014	0.017	0.024	0.026
<i>Household incomes</i>												
Income sources	0.232	0.255	0.004	0.010	0.008	0.014	0.003	0.015	0.000	0.015	-0.008	0.016
Off-farm income	0.001	0.494	0.178	0.387	0.487	0.472	0.046	0.0387	-0.286	0.379	0.253	0.548
<i>Infrastructure</i>												
Bank account	-0.083	0.197	0.218	0.373	0.524	0.445	-0.012	0.363	0.002	0.362	0.447	0.486
Tarmac	-0.293*	0.156	0.013	0.132	0.146	0.159	-0.108	0.128	-0.345*	0.138	-0.176	0.276
Market	0.070	0.099	-0.086	0.093	-0.176	0.131	0.0627	0.099	0.104	0.097	-0.006	0.056
Information	0.224	0.161	0.358**	0.145	0.140	0.173	0.275*	0.129	-0.121	0.138	-0.361*	0.207
Constant	-4.853**	2.082	-2.770	1.892	-1.446	2.313	-2.170	1.828	-2.890	1.823	-0.286	2.577
Log-likelihood	-391.461						-364.572					
LR chi ² (51)	74.69						73.56					
Prob > chi ²	0.008						0.021					
Pseudo R ²	0.087						0.092					

*** p< 0.01, ** p< 0.05, * p< 0.1; Std. Error = standard error; Base category = Disempowered women non-member

Appendix 34: Second stage results for the effect of women's empowerment on household food security

	Production		Asset ownership		Income control		Workload		Public speaking	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Age	-0.019***	0006	-0.012	0.112	0.143	0.069	0.014	0.014	0.018**	0.008
Education			0.082	0.207	0.183*	0.099			-0.104	0.119
Occupation							0.098	0.155		
Literacy ratio			-0.046	0.140					0.068	0.057
Household size									0.096*	0.055
Farm size	0.017	0.072	-0.062	0.054	0.144**	0.069	-0.072	0.114		
Livestock							0.085*	0.048		
Farming experience			0.012	0.010	0.011	0.008	0.009	0.020	0.0148**	0.006
Off-farm income	-0.015	0.150					-0.242	0.263		
Bank account	0.069	0.175								
ICT			-0.666*	0.363	-0.289**	0.122	0.661*	0.349	0.699***	0.194
Electricity			-0.122	0.300	0.264	0.259	-0.044	0.293	-0.250	0.258
Tarmac			0.024	0.117	-0.085	0.066	0.130	0.092	-0.049	0.065
Market	0.020	0.040	0.107**	0.054	0.077*	0.042	-0.096	0.600	0.005	0.031
Information	-0.091	0.073			0.112	0.061				
Constant	1.980	0.474	-0.886	0.833	-1.328	0.513	-2.085	0.756	-0.922	0.603
Log likelihood	-906.847		-959.028		-1028.922		-914.147		-912.234	
Wald chi ² (7)	19.36		64.06		53.16		88.63		33.85	
Prob > chi ²	0.022		0.000		0.000		0.000		0.000	

Wald test of independence of equations for production: $\chi^2(2) = 43.38$; Prob > $\chi^2 = 0.0000$

Wald test of independence of equations for income control: $\chi^2(2) = 23.11$; Prob > $\chi^2 = 0.0000$

Wald test of independence of equations. Asset ownership: $\chi^2(2) = 16.62$; Prob > $\chi^2 = 0.000$

Wald test of independence of equations for workload: $\chi^2(2) = 6.15$; Prob > $\chi^2 = 0.0461$

Wald test of independence of equations for public speaking: $\chi^2(2) = 13.98$; Prob > $\chi^2 = 0.001$

*** p < 0.01, ** p < 0.05, * p < 0.1

^aStd. Error = standard error

source: Authors' field data

Appendix 36: Qualitative data collection guide

FGD GUIDELINES

Facilitator's welcome, introduction and instructions to participants

Informing the participants about the consent and signing of the consent.

Welcome and thank you for volunteering to take part in this focus group. You have been asked to participate as your point of view is important. I realize you are busy and I appreciate your time.

Introduction: This focus group discussion is designed to assess your current thoughts and feelings about the formation, membership, functions and internal governance of your group. The focus group discussion will take no more than one and half hours.

You should try to answer and comment as accurately and truthfully as possible. I and the other focus group participants would appreciate it if you would refrain from discussing the comments of other group members outside the focus group.

If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible.

Ground rules:

- The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait until they have finished.
- There are no right or wrong answers.
- You do not have to speak in any particular order.
- When you do have something to say, please do so. There are many of you in the group and it is important that I obtain the views of each of you
- You do not have to agree with the views of other people in the group
- Does anyone have any questions? (**Answers**). OK, let's begin

Warm up: First, I'd like everyone to introduce themselves.

Collective action guide

Group participation, benefits and constraints

1. What typologies of collective action do exist in your village? How can you classify those typologies?
2. What motivates members to join particular groups and not others?
3. Do these groups constitute of men and women? Probe for gender composition and reasons for the response patterns given.
4. If any member (youth, women/men, old) wants to join the group of their preference, are they allowed?
5. Are the groups registered? What do you think are the benefits of group registration? What are the constraints of group registration?
6. Any registration fees and any other payments beforehand? Are the payments affordable?
7. Do you think members who join groups have any benefits compared to those who are not members? What are these benefits? How do these benefits vary among the group types
8. Do members need empowerment (in terms of incomes for example) to join the groups or they get empowered after joining the groups?
9. What do you think; do some group typologies perform better than others? Probe for the rationale for the reported performance.
10. Why do you think some members terminate their membership in groups? Why do you think members can be expelled from the group? Probe for constraints facing the groups. Rank them according to their severity. What do you think can be done to address these constraints?

Functionality of the groups

- 16 What activities does your group engage in? Do you receive any services to support your group activities? What are these services? Who provides the services? Do you think the services are sufficient enough? Do you pay for the services?
17. Are you part of another bigger group or cooperative? Do you interact with other groups within or outside the village? To what level do you interact?
18. What characteristics are most valued among network members (e.g., trustworthiness, reciprocity, cooperation, honesty, community respect).

Group governance systems

19. Do you have rules which govern the members' behaviour in your group? What happens to members who do not comply?
20. How are the group decisions made? How the group leaders are elected (process and qualities)? Who are the group leaders currently? What do you think of women becoming leaders in mixed gender groups?
21. In case you have an emergency, do you borrow money from each other besides the group money?
22. Do you think over the past five years the level of trust in this village has gotten worse, better, or remained the same? How well do people in your village help each other nowadays?

Women empowerment guide

Importance of assets to women

1. What assets are most likely to be owned by women and why? For women owned assets, what decisions can women make on these assets? E.g. can they make decisions on their disposal? What decisions would they have to consult their husbands?
2. When as women, you say you own an asset, what does that mean? (e.g. I came to marriage with it, inherited from my parents, bought with own earned cash, I can sell it if I wish to etc)

Importance of assets to men

3. What assets are most likely to be owned by men and why? For men owned assets, what decisions can women make on these assets? E.g. can they make decisions on their disposal? Under what circumstances can women make decisions on men owned assets? What decisions can men make on these assets? What decisions would they have to consult their spouses on?

Normative attitudes towards men and women empowerment

4. Do you think women should own assets such as land, livestock?
5. Do you think women should play in decision making within the household? (on assets? And incomes?) Do you think women should play in managing household incomes? And household expenditures? Do women play in making decisions on agricultural production?

6. What assets do you think girls and boys should inherit? And which ones they can't inherit? Why? What do you think of having joint accounts for man and woman at the household? In whose names could you wish the account to be? Can women and men have an equal access to the money in the joint account?

Impacts of the groups on men and women's asset ownership

7. Do you think group membership help in acquiring any wealth or assets? Probe how?

Changes in workload and production decisions

8. In the households who performs more tasks? Story on who their main activity, then who performs what? Cultivation, sales, income, what to buy, general household purchases and large assets such as livestock, land etc.

household food security guide

1. Do you think that many households in the community have a problem with food security? What is the extent of the problem? (probe for the major foods consumed here) Why do you think that household food security is a problem? (That is, how do you see the problem manifesting itself?) What are the contributing factors?
2. I'm wondering about what you would do in your households if there isn't enough food. Let's start by discussing the things you might do to make the food you have last longer. What are some of these things? (Probe for the following):
 - cutting amounts of food,
 - cutting size of meals,
 - skipping meals,
 - watering down ingredients
 - eating cheaper foods like potatoes
 - serving less nutritious foods because they are cheaper
 - serve children nutritious foods but eat less or less nutritious foods yourself)
3. In general, do people in this community receive food help? If so how many times a year?

4. How do you think the groups in your area could help in times of food shortages in your households?
5. How do you feel about the health/education/water services that you receive? What are the challenges that people face in accessing these services? (affordability? distance? information? Appropriateness)