Journal of Agribusiness in Developing and Emerging Economies

Brewing inclusivity: foreign agribusiness and local food security – the case of Heineken in Ethiopia

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Received 21 August 2024
Revised 22 January 2025
6 June 2025
Accepted 8 June 2025

Abstract

Purpose – Inclusive agribusiness models are recognized as a vital strategy for addressing development challenges by enabling smallholder farmers to profitably engage in agricultural value chains. Hence, the purpose of this study is to explore the impact of a proclaimed inclusive agribusiness model on farmers' productivity, asset stock and dietary diversity and its indirect effects on the local community in the Arsi Zone, Ethiopia.

Design/methodology/approach – This study used a mixed research approach. Survey data from 251 households were analysed using endogenous switching regression and propensity score matching to compare participant and non-participant households in terms of productivity, asset acquisitions and dietary diversity status. To understand the indirect effects on the wider community, interviews with key informants and focus group discussions with participants and non-participants were conducted.

Findings – Contracted farmers registered increased malt barley productivity and asset stocks. However, with regard to dietary diversity, there was no significant difference between participating and non-participating farmers. Interviews revealed that this was due to spending on priorities other than food and less diverse food availability in rural markets.

Research limitations/implications – Inclusive business approaches can positively contribute to smallholder farmers' productivity and income, yet this does not automatically translate into improved household diet diversity in rural areas. For this to occur, local food availability and accessibility should be taken into consideration. In addition, evaluating the impact of an inclusive business approach on a small minority (i.e. contract farmers) risks overlooking the impact on the majority, who are not reached by these business arrangements.

Originality/value – This study contributes to the literature and debates on private sector-led development by illustrating the impact of presumably inclusive agribusiness on local food security. The unique feature is that this study also considers wider community effects.

Keywords Inclusive business models, Dietary diversity, Food security, Endogenous switching regression, Ethiopia

Paper type Research article

1. Introduction

Inclusive business models-referring to commercially, viable business that provide low-income groups with opportunities to engage productively in the economy-have increasingly been recognized as effective strategies for addressing developmental challenges such as poverty

Funding: This paper is an output of the Follow the Food program, financed by the Dutch Research Council (No: W 08.250.206).

Conflict of interest: The authors declare no conflicts of interest.

Journal of Agribusiness in Developing and Emerging Economies
Emerald Publishing Limited
e-ISSN: 2044-0847
p-ISSN: 2044-0839
DOI 10.1108/JADEE-08-2024-0263

and food insecurity (Ghosh and Rajan, 2019; Kaminski *et al*., 2020; Likoko and Kini, 2017). By providing access to markets, services, and products, inclusive business models-it is assumed-can contribute to livelihood improvements (Danse *et al*., 2020; FAO, 2015b; van Westen *et al*., 2019).

Not surprisingly, the popularity of inclusive business strategies increased in the context of neoliberal approaches to development cooperation. In the "Trade Not Aid" era, which began in the 2000s, market-driven development gained widespread support, based on the belief that private actors were more efficient than governments or donors in achieving development outcomes. It was widely accepted that companies should take the lead in steering development (Schoneveld, 2020; van Westen *et al*., 2019). This is clearly manifested in the Post-2015 Development Agenda from which the Sustainable Development Goals emerged. In this agenda, businesses, governments, and civil society organizations are considered *equally* responsible for sustainable development (Scheyvens *et al*., 2016). This is further exemplified by the formation of departments and projects dedicated to the support of inclusive business initiatives within donor and development organizations such as German Society for International Cooperation, (GIZ), United States Agency for International Development (USAID), International Finance Corporation (IFC) and the United Nations Development Program (UNDP).

Specifically farmers' integration into markets through inclusive business models has received considerable attention (Danse *et al*., 2020). These models are promoted as a means to address several challenges faced by farmers, including limited access to production inputs, credit, and market information (German *et al*., 2020; Schoneveld, 2020, 2022) Most inclusive business models aim to enhance farmers' income which, in turn, is expected to improve their food security (FAO, 2015a). Driven by this expectation, many governments and donor agencies have supported inclusive businesses in agriculture (Bitzer *et al*., 2017; Pineda-Escobar and Garzon-Cuervo, 2016). However, despite this popularity, there remains limited understanding of the actual impact of inclusive business models on the livelihoods of the farming communities they engage with (Chamberlain and Anseeuw, 2017). Scholars have raised concerns that centring businesses within sustainable development frameworks entails certain risks, as these enterprises may fail to address the structural determinants of persistent social inequalities and, in some instances, may inadvertently exacerbate such disparities (Scheyvens *et al*., 2016).

In this study, we examine the impact of an exemplary inclusive business model: a public-private partnership involving thousands of smallholder farmers in Ethiopia with the aim to contribute to local food security. Specifically, we focus on Heineken's local sourcing of malt barley. Our analysis investigates the benefits experienced by participating farmers as a result of their involvement. Previous studies on similar initiatives that link smallholder farmers to high-value markets, such as contract farming, report mixed outcomes (Dekker and Pouw, 2022; Devaux *et al*., 2018; Mariyono *et al*., 2020; Ton *et al*., 2018). For instance, in a study on smallholder avocado contract farming in Kenya Mwambi *et al*. (2016) find that mere participation did not significantly increase income. To ensure contract farming benefits producers, factors such as knowledge, access to credit, and clarity about contract terms were crucial. Kumar *et al*. (2018) do find that contract farming leads to higher income and improved market access but that both farm size and farmers' perceptions of risk play a role in their willingness to participate.

While most studies focus on high-value products, a study of Bidzakin *et al*. (2020) examines contract farming arrangements in rice cultivation in Ghana and finds that engagement improved rice farmers' technical, allocative, and economic efficiencies, with larger farmers benefiting more. In their study of market participation of paddy rice farmers in Eastern India, Dey and Singh (2023) observe positive effects on income and consumption expenditure. Among the few studies on contract farming in Ethiopia, Gebru *et al*. (2019) find a positive impact on the income and food access of malt barley contract farmers in the Lay Gaynit district of northern Ethiopia. Ganewo *et al*. (2022) find that the distance to malt barley collection centres negatively affected the likelihood of participation in malt barley contract farming.

Overall, the literature focuses predominantly on participating farmers. This paper is novel in that it examines the often-overlooked experiences of non-participating farmers by comparing them with their participating counterparts. It also scrutinizes the indirect effects of inclusive business on the broader local community. As such, it contributes to a deeper understanding of how inclusive business models influence local food security.

2. Market-led development for food security

Food insecurity has been a long-standing challenge in Ethiopia. According to the Food and Agricultural Organization 21.9% of the Ethiopian population were food insecure in 2022 (FAO, 2023). The 2023 Humanitarian Response Plan estimates that approximately 20.1 million people are in need of emergency food assistance. The difficult food security situation is mainly the result of the lingering impact of conflict in the northern regions and drought in the southern areas, exacerbated by severe macroeconomic challenges such as inflation and a rising debt burden (OCHA, 2013).

With a score of 29.8 Ethiopia ranked 80th out of 84 countries on the Global Hunger Index (GHI) in 2010, indicating an alarming level of hunger. A decade later, in 2020, the country ranked 101st out of 125 countries, with a GHI score of 26.2, still indicating a serious hunger situation (GHI, 2010, 2023). Although the country succeeded in reducing the proportion of undernourished people and improved its rating from "alarming" to "serious" between 2010 and 2023, it still faces significant challenges in achieving full food security.

To address the prevalence of food insecurity, the Government of Ethiopia has placed agriculture at the centre of its national development plans aimed at mitigating poverty and food insecurity. Although agriculture's contribution to gross domestic product (GDP) has been declining since 2008, it remains the backbone of the Ethiopian economy. In 2020, the sector employed more than 65% of Ethiopia's labour force and accounted for approximately 32.7% of the country's GDP. Guiding the governments "ambition to transform the agricultural sector is the agricultural development-led industrialization (ADLI) strategy."

The ADLI, which was adopted in the mid-1990s, aimed to lay the foundation for structural transformation by focusing on small-scale agricultural growth (OECD/PSI, 2020; Welteji, 2018). The ADLI guided consecutive national long-term plans implemented from the early 2000s to the present. These consecutive long-term plans have been implemented in the context of the Poverty Reduction Strategy process and have always aimed to attain national food self-sufficiency (MoFED, 2002, 2010, 2016).

The first poverty reduction strategy, the Sustainable Development and Poverty Reduction Program (2002–2005), placed strong emphasis on smallholder agriculture and rural development to boost national agricultural production and improve food security (MoFED, 2002). The program aimed to enhance smallholder farmers' productivity by providing improved seeds, fertilizers, and extension services. However, the inability to fully achieve these goals led to a shift in focus from smallholder family farming to commercial agriculture in the second poverty reduction program (Lavers, 2012; Teshome, 2006).

The second plan, the Plan for Accelerated and Sustained Development to End Poverty (PASDEP), covered the period from 2005/06 to 2009/10. This plan shifted the focus from small-scale subsistence farming to large-scale commercial agriculture and emphasized strong private sector involvement and large-scale investments in high-value export products such as floriculture, horticulture, and spice production (MoFED, 2006; Teshome, 2006).

PASDEP promoted agricultural specialization, diversification, and commercialization, with particular emphasis on enhancing agricultural commercialization and fostering private sector development. To support this, the Government of Ethiopia adjusted its investment policies to attract foreign direct investment.

Building on PASDEP, both the first and second Growth and Transformation Plan (GTP I and II), covering the period from 2010/11 to 2014/15 and 2015/16 to 2019/20, respectively, focused on modernizing agricultural practices and facilitating the transition of smallholder farmers from

subsistence farming to a commercial orientation. GTP I promoted mechanized farming with plans to transfer a total of 2.3 million hectares for the development of commercial farming. By the end of the plan period, 840 thousand hectares of land had been transferred to investors.

The primary motivation for promoting commercial farming was to increase the production of exportable goods and supply raw materials for domestic industries (Teshome, 2006). Similarly, the GTP II (GTP II) identified agriculture as the main driver of economic growth. GTP II emphasized the production of high-value crops, industrial inputs, and export commodities. Additionally, the plan highlighted the establishment of an export-oriented manufacturing sector aimed at transforming Ethiopia's economic structure (NPC, 2016). Enhancing the competitiveness of smallholder farmers in domestic and global value chains was also identified as a key strategy to achieve this transformation (MoFED, 2010, 2016; UNECA, 2018).

In summary, both GTP I and II focused on market-led agricultural growth and rural transformation, and encouraged inclusive business and contract farming schemes. As the Global North shifts aid budgets towards private sector development, this provided a fitting context for our focus on inclusive agribusiness business model examined in this article.

3. Engaging smallholders in Heinekens' business model

The malt barley boom in Ethiopia of the past ten years can be explained by a steady growth of the domestic beer market. In 2014, annual beer production stood at 5.6 million hectolitres, rising to around 7 million hectolitres in 2018, a figure that could reach 25 million hectolitres by 2023 (Ganewo *et al*., 2022).

Starting in 2011, foreign companies such as Diageo, Heineken, and Bavaria began investing in Ethiopia's beer market either by purchasing state-owned breweries or by building new ones. Heineken entered the Ethiopian market by acquiring the state-owned Harar and Bedele breweries in 2011. In 2015, the company constructed a new factory on the outskirts of Addis Ababa, increasing its total beer production capacity to 4.1 million hectolitres per year. Other brewers followed suit between 2013 and 2016, driving a rapidly growing demand for malt barley.

Barley is Ethiopia's fifth most important cereal crop after teff, maize, sorghum and wheat. In 2017, over 3.5 million smallholder farmers produced over 2.2 million tonnes of barley in 951, 993 hectare of land (CSA, 2017/18). Two types of barley are produced in the country: food barley and malt barley. The former is produced as a staple for home consumption and the latter as cash crop sold to breweries. Although food barley dominates Ethiopian barley production, the rate of malt barley production is increasing annually (Rashid *et al*., 2015). Still, according to ICARDA (2020) only about 25% of the total demand from breweries in Ethiopia is being covered by domestic supply, with most of the production occurring in Arsi and West Arsi zones, which together produce 70% of the malt barley marketed in the country (Holtland *et al*., 2017).

Multinational companies entering the Ethiopian beer market have adopted integrated supply chains to ensure a large and consistent supply of malt barley (Ali, 2018; Tefera *et al*., 2017). This study focuses on Heineken, one of the first foreign companies to establish contract farming schemes for the procurement of malt barley from smallholder farmers (Ali, 2018; Holtland *et al*., 2017; Tefera *et al*., 2017). By sourcing locally, the company claimed to provide a reliable supply of agricultural inputs and contribute to the improvement of suppliers' livelihoods and food security (Heineken, 2018).

The company began sourcing locally in 2013 across three zones within the Oromia regional state: Arsi, West Arsi, and Bale. This initiative was carried out through the Community Revenue Enhancement through Agricultural Technology Extension (CREATE) project. CREATE was a public-private partnership involving Heineken, the Ethiopian Agricultural Transformation Agency, Oromia Seed Enterprise, and several NGOs. The project was initially funded by the Netherlands Ministry of Foreign Affairs and Heineken for the period 2013–2017. Subsequently, the International Finance Corporation provided funding for an additional two years, from 2018 to 2019. Through this initiative, donors aimed to improve livelihoods,

reduce poverty, and promote food security (Bitzer *et al*., 2017; Heineken, 2018; Kentikelenis and Babb, 2021).

The CREATE project established a contract farming scheme in which farmers received two new barley varieties in exchange for supplying malt. The European Cooperative for Rural Development (EUCORD), a non-governmental organization, was responsible for implementing the project. Heineken began sourcing malt barley from 1,700 farmers in 2013, a number that grew to 40,000 by 2019. The company entered contractual agreements with lead or model farmers—better-off farmers who were quick to adopt new technologies—as well as with Farmer Unions and Microfinance Institutions. These groups then signed contracts with individual smallholder farmers. The contracts specified the required quantity, quality standards, and price for malt barley.

In the project's first year, Heineken supplied inputs on credit (such as seeds and herbicides) to the unions and model farmers, who then distributed them to contracted farmers. However, due to high default rates, Heineken discontinued the credit provision. From 2015 onward, farmers were required to purchase inputs directly.

According to the website of IFC, Heineken increased its local sourcing from 5,000 metric tonne (MT) in 2017/18 (baseline), to 19,000 MT or 13% of total production in 2018/19, and 15,000 MT or 10% of total production in 2019/20. This was due to increased productivity where the yield of malt barley doubled from 2.4 MT/ha to 5.2 MT/ha.

4. Method

4.1 Study area

The study was conducted in three districts of the Arsi Zone, Oromia Regional State, that is, Tiyo, Digelu Tijo, and Lemu Bilbilo. The Arsi Zone is located 185 km southeast of Addis Ababa (Figure 1). Arsi has 27 districts with highly diverse agro-climatic zones, from the highlands with abundant annual rainfall (1059.3 mm) to low-land areas with low and unreliable annual rainfall availability (633.7 mm). The total area coverage of the zone is 19825.22 km^2 and has a population of 3,632,944, according to the Ethiopian Statistical Service

Figure 1. Map of the study area. Source: Authors' own work

in 2019. Out of the 27 districts, nine are categorized as food insecure districts and about 29,147 households in these districts are under the Productive Safety Net Program, Ethiopia's largest social protection program that supports poor and chronically food insecure households.

The Arsi Zone is the leading malt barley producer in the country. Other crops grown in the region are wheat, barley, faba bean, and pea. The zone and the three districts were selected purposively because of their position as major barley producers, both in terms of area and production volume.

4.2 Source and data collection method

The data for this study was collected as part of a PhD research project. The study involved interviews and Focus Group Discussions (FGDs) with smallholder farmers, as well as officials and experts from the Arsi Zone Agriculture and Rural Development Office. In addition, the study involved insights related to the CREATE Project operated by Heineken Ethiopia. Prior to data collection, the researcher contacted the relevant contact person in the Addis Ababa and Arsi Zone as directed by Heineken Ethiopia. No proprietary or internal data were accessed. Only publicly available or anonymized field data were used.

Data was collected using a household survey comprising structured and semi-structured questions, FGDs and interviews with key informants. A total of 251 households were surveyed, of which 102 were participants and 149 were non-participants. A multistage sampling technique was used to select the final observation unit. First, the Arsi zone was purposively chosen from among the three intervention zones of the CREATE project. Second, three districts were selected from among the four project districts of the zone. Third, Six kebeles [1] were selected randomly from the 29 kebeles of the CREATE project in the three districts. Finally, households participating in the CREATE project were randomly sampled from a list of households presented by model farmers and the EUCORD office in Arsi, and non-participants were randomly sampled from lists provided by the kebeles. Moreover, nine FGDs were organized in 2018 and 2019, with five groups from participant households and four groups from the non-participants category. A total of 62 smallholder farmers participated in the discussion, and each FGD included five to eight members. These FGDs were key to understanding the intervention in practice and its impact on contracted farmers, non-contracted farmers, and the community at large. All participants were informed about the aims of the study and their rights, including the right to decline participation or withdraw at any point. Verbal informed consent was obtained from all participants. No personal identifiers were collected, and all data were anonymized and kept confidential.

The survey was designed to elicit information on malt barley productivity, crop income, land allocated for malt barley, types of assets purchased, and food security level (see Table 1). We used the Household Dietary Diversity Score (HDDS) to capture the multifaceted reality of food insecurity. The HDDS measures households' access to a variety of food items over a 24 h time period by counting the different food items consumed by household members per day (Swindale and Bilinsky, 2006). Higher HDDSs indicate higher diversity and vice versa.

4.3 Model specification

A key challenge in impact evaluation is the impossibility of observing the outcomes for the same individual both with and without the program simultaneously (Caliendo and Kopeinig, 2008). In other words, it is difficult to measure how an individual household's malt barley productivity, asset holdings, and food diversity would differ depending on their participation in the CREATE project. In a random program assignment, the impact of an intervention can be estimated by computing the difference in the means of outcome variables between those who participated in the program and those who did not (Heckman *et al*., 1998). However, in non-random program assignments, such as in the current study, this procedure cannot be applied because the participants and non-participants may significantly differ in characteristics that may have a direct impact on outcome variables. As a result, some of the observed differences

Table 1. Variable definition and measurement

Variable	Type and definition	Measurement
Treatment variable	Dummy, participation in CREATE project	1 if yes, 0 otherwise
Independent variables		
Sex	Dummy, sex of the household head	1 if male, 0 otherwise
Age	Continuous, age of the household head	In years
Land	Continuous, landholding	Hectare
Household size	Discrete, household size	Number of household members
Education	Dummy, education of household head	1 if literate, 0 illiterate
Distance to market	Continuous, distance to nearest market	In kilo metre
Outcome variables		
Productivity	Continues, yield per hectare	Quintal per hectare
Asset stock	Dummy, new asset purchase in the past four years	1 = if yes, 0 otherwise
Household dietary diversity score	Continues, food security level	0 = food insecure, 12 diverse food consumption

Source(s): Authors' own work

between participants and non-participants may partially or entirely reflect pre-existing differences rather than the effects of the program intervention alone. Under these circumstances, impact evaluation is typically conducted using non-randomized evaluation methods. Since participation in the CREATE project was not a random assignment, this study used both an Endogenous Switching Regression (ESR) model and an Endogenous Switching Probit framework for continuous and binary outcome variables, respectively, to control for both observed and unobserved characteristics that may be correlated with the outcome variables (Lokshin and Glinskaya, 2009; Lokshin and Sajaia, 2004). Propensity Score Matching was used to check the robustness of the results.

4.3.1 Endogenous switching regression method. We model participation in the CREATE project under the assumption that farmers choose between participation and non-participation, consider a farm household *i* that faces a decision on whether or not to participate on the project. This leads to two possible states: a decision to participate (S = 1) and not to participate (S = 0), and two population units: participants and non-participants. Let's denote the benefits to participating household by S_1 and the benefit stream from non-participation by S_0. Under a random utility framework, a rational farm household will choose to participate if the net benefit of participation is positive, i.e. $S_1 - S_0 > 0$. However, the net benefit ($S^* = S_1 - S_0 > 0$) is unobservable but it can be represented by a latent variable which itself is a function of observed characteristics (Z_i) and error term (U_i).

$$S_i^* = \gamma Z_i + U_i, \text{with } S_i = \begin{cases} 1 \; is \; S^* > 0 \\ 0, otherwise \end{cases} \quad (1)$$

where S_i^* is a binary decision indicator, which equals one if farmer i participates in CREATE project, and zero otherwise; γ denotes a vector of unknown parameters to be estimated; Z_i represents a vector of observable variables influencing participation; and U_i is the error term.

There are two potential outcomes conditional on households' decision of participation, which is denoted by a *selection* function, S_i: the outcome with treatment (Y_1) and the outcome without treatment (Y_0). The simplest approach to examine the impact of participation would be to include in the outcome equation a dummy variable equal to 1 if the household participated and 0 if not and then run Ordinary Least Square. This approach, however, might yield biased estimates because farmers' participation is not random assignment but involves self-selection. In this case, unobserved factors influencing the outcome variables may also be correlated with

participation (Si), which can result in selectivity bias (Lokshin and Sajaia, 2004). To overcome this, we used the ESR model as it accounts for selectivity bias from observable and unobservable factors.

In the ESR model, the decision to participate and its impact on the outcome variables are estimated in two separate stages. In the first stage, a probit model is used to identify the key variables that determine participation in the CREATE project in equation (1).

In the second stage, the determinants of outcomes variables (productivity, asset stock, and HDDS) were estimated. The outcome variables conditional on participation were represented as switching regimes as follows:

$$\text{Regime 1}: Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i} \text{ if } S_i = 1 \text{ for participating households} \tag{2}$$

$$\text{Regime 2}: Y_{0i} = \beta_0 X_{0i} + \varepsilon_{0i} \text{ if } S_i = 0 \text{ for non} - \text{participant households} \tag{3}$$

where Y_{1i} *and* Y_{0i} represents the outcome variable for the participant and non-participant groups, respectively, X_{ij} is a vector of determinant variables that affect the outcome variables. β_i is the parameter to be estimated, and ε_{1i} and ε_{0i} are independently and identically distributed error terms of the outcome variable estimation equation.

The error terms of the outcome equations from equations (2) and (3) and selection equation (1)) are assumed to follow a trivariate normal distribution with a zero mean vector and covariance of Ω, where Ω is defined as follows:

$$\text{Cov}\left(\varepsilon_{1i}, \varepsilon_{0i,U_i}\right) = \Omega = \begin{bmatrix} \delta_u^2 & \delta_{1u} & \delta_{01} \\ \delta_{1u} & \delta_1^2 & \delta_{0u} \\ \delta_{01} & \delta_{0u} & \delta_0^2 \end{bmatrix} \tag{4}$$

Where $\delta_1^2 = \text{Var}\,(\varepsilon_1)$, $\delta_0^2 = \text{Var}\,(\varepsilon_0)$, $\delta_{1u} = \text{Cov}\,(\varepsilon_{1i}, U_i)$, $\delta_{0u} = \text{Cov}\,(\varepsilon_{0i}, U_i)$, and $\delta_{01} = \text{Cov}\,(\varepsilon_{0i}, \varepsilon_{0i})$ the covariance between the error terms of the selection and outcome equations is denoted by $(\text{cov}\,(u, \varepsilon) = \delta)$. where δ_{1u} and δ_{0u} are the correlation coefficients between ε_{1i} and U_i and between ε_{0i} *and* U_i *and* respectively.

However, this two-stage approach causes the problem of heteroskedastic residuals, which cannot be used to obtain consistent standards errors without cumbersome adjustments (Lokshin and Sajaia, 2004). That is equations (2) and (3) account for observed systematic differences between participants and non-participants. In order to account for unobserved factors, the inverse mills ratios for participants (λ_{1i}) and non-participants (λ_{0i}) which are computed together with the corresponding covariance terms σ_{1u} and σ_{0u} must be included in equations (2) and (3) after estimating the selection Equation (1) as follows:

$$Y_{1i} = \beta_1 X_{1i} + \sigma 1 u \lambda_{1i} + \varepsilon_{1i} \text{ if } S_i = 1 \tag{5}$$

$$Y_{0i} = \beta_0 X_{0i} + \sigma 0 u \lambda_{0i} + \varepsilon_{0i} \text{ if } S_i = 0 \tag{6}$$

In Equations (5) and (6), the inverse mills ratios λ1i and λ0i, are used to account for selectivity bias arising from unobserved factors in a two-step procedure. In this context a more appropriate way to estimate the ESR model is using the full information maximum likelihood (FIML) method (Lokshin and Sajaia, 2004) which estimates the selection and outcome equations simultaneously and generates correlation coefficients ρ_{1u} and ρ_{0u} associated with the error terms in the selection and outcome equations. The significance of ρ_{1u} or ρ_{0u} confirm the presence of selection bias issues (Lokshin and Sajaia, 2004).

After estimating the model's parameters, the conditional expectations or expected outcomes are computed as follows.

For participant households who actually participated:

$$E\left(Y_{1i} \middle| S_i = 1, X_{1i}\right) = \beta_1 X_{1i} + \lambda 1\mathrm{i} \tag{7}$$

Non-participant households decided to participate in the CREATE project (counterfactual).

$$E\left(Y_{1i} \middle| S_i = 0, X_{1i}\right) = \beta_1 X_{1i} + \lambda 1\mathrm{i} \tag{8}$$

For participant households had they decided not to participate (counterfactual):

$$E\left(Y_{0i} \middle| S_i = 1, X_{0i}\right) = \beta_0 X_{0i} + \lambda 0\mathrm{i} \tag{9}$$

For non-participant households who actually did not participate:

$$E\left(Y_{0i} \middle| S_i = 0, X_{0i}\right) = \beta_0 X_{0i} + \lambda 0\mathrm{i} \tag{10}$$

The impact of the project on the participants (TT) is computed as the difference between the expected outcome for farm households that participated in the project (eq. (7)) and counterfactual hypothetical cases in which they did not participate (eq. (9)). The treatment effect on the untreated is computed as the difference between the outcome they would have obtained in the counterfactual scenario that they decided to participate in eq. (8) and the expected outcome for non-participating households (eq. (10)). See Table 2 for an overview of all formula.

We are also interested in estimating the impact of the CREATE project on a binary outcome variable, that is, asset stock. Consequently, we utilize the endogenous switching probit framework, which is analogous to ESR for continuous outcomes (Lokshin and Glinskaya, 2009; Lokshin and Sajaia, 2004; Miranda and Rabe-Hesketh, 2006).

4.3.2 Propensity score matching. Propensity score matching is a non-experimental impact evaluation method that uses cross-sectional data to identify comparable treatment and comparison groups (Rosenbaum and Rubin, 1983). We applied a logit model to estimate the propensity scores of participant and non-participant households based on pre-intervention observable characteristics. This approach assumes that, conditional on these characteristics, potential outcomes are independent of program participation.

Table 2. Conditional expectations, treatment, and heterogeneous effect

Sub-samples	Decision stage To participate	Not to participate	Treatment effects
Participant groups	(a) E(Y1i/S_i = 1)	(b) E(Y2i/S_i = 1)	ATT
Non-participant groups	(c) E(Y1i/S_i = 0)	(d) E(Y2i/S_i = *0*)	ATU
Heterogenous effects	BH_1	BH_2	TH

Note(s): (a) ATT: effect of CREATE (participation) on treated (participant households),
(b) ATU: effect of CREATE on untreated (non-participant households),
(c) BH_i = effect of base heterogeneity for households that participated (S = 1) and not participating (S = 0),
(d) TH = ATT – ATU is the transitional heterogeneity

Source(s): Authors' own work

To verify this assumption, we tested the equality of means for the covariates between the two groups before and after matching (see Appendix). Propensity score matching helps reduce selection bias arising from confounding variables that influence both participation and outcomes. After estimating the propensity scores, we calculated the Average Treatment Effect on the Treated to assess the impact of the CREATE project on participant households.

Following best practices in the literature Caliendo and Kopeinig (2008), Dehejia and Wahba (2002), Smith and Todd (2005), we used multiple matching algorithms specifically Kernel Matching and Radius Matching, to test the robustness of the results.

5. Results and discussion

5.1 Description of participant and non-participant households

The descriptive statistics of the survey data for the variables used to analyse the impact of participation on the outcome variables are presented in Table 3. The *t*-test and chi-square test were used to test for statistical differences between the two groups on the mean values of the continuous and categorical variables, respectively. Participant households were older; the average age of the participant household head was 47 years, whereas that of non-participants was 43 years. The first group owns an average of 2.008 ha, and the non-participating farmers own 1.52 ha. Compared to non-participant households, participant households were relatively older and had more land. This implies that older households with higher resource endowments such as land have a higher likelihood of participating in the project. Besides the use of their own land, participating households expanded their production through renting and sharecropping. On average, both participating and non-participating households rented 0.562 ha and 0.488 ha, respectively, to expand their production. This led to increased malt barley production by both groups, but more so by the participating households than the non-participating groups. The land allocated for malt barley production has increased by both groups since the project started; however, the increment by the participant households was higher than (0.43 ha) that of the non-participants (0.23 ha). Looking at the proximity to the nearby market, participant households live closer (7.86 KM) to the market than their counterparts (8.74 KM).

Table 3. Descriptive summary of sample households

Variables	Participant mean (SD)	Non-participant mean (SD)	Difference in mean	t/χ^2 value
Age of the household head (in years)	47.58 (13.95)	43.23 (13.76)	4.35	2.4472**
Sex of the household head (dummy = 1 if male, 0 otherwise)	0.912 (0.029)	0.93 (0.02)	0.014	0.6193
Household size (person)	6.774 (2.746)	6.255 (2.319)	0.477	1.6159
Education (1 = literate, 0 otherwise)	0.843 (0.36)	0.818 (0.38)	00.024	0.5010
Own land (in hectare)	2.008 (1.28)	1.52 (1.03)	00.484	3.3003***
Rented land (in hectare)	0.565 (0.081)	0.488 (0.053)	00.076	0.811
Change in land allocated for malt barley	0.423 (0.498)	0.235 (0.293)	0.187	3.747***
Price of malt barley (ETB/Qt)	1098.57 (94.04)	978.21 (6.54)	120.34	1.727*
Distance to market (in KM)	7.86(1.71)	8.74(1.872)	0.87	3.7700***

Note(s): ***, ** and * means significant at 1, 5 and 10% respectively

Source(s): Authors' own work

5.2 Endogenous switching regression results

Three outcome variables were used to evaluate the impact of the CREATE project (productivity, asset stock, and HDDS). Table 4 presents the estimates of the ESR model for the outcome variables, that is, productivity per hectare and HDDS, and the endogenous switching probit model for the binary outcome variable, that is, asset stock.

The second, fifth, and eighth columns of Table 4 show the selection equation estimates identifying the determinants of participation in productivity, asset stock, and the HDDS equation, respectively. The main factors that determine participation in the CREATE project are the age of the household head, education level, land ownership, household size, and distance to the market. Age, education, land, and labour significantly affect farmers' decisions to participate. Literate and older heads of households that are larger in size and land have a higher likelihood of participating. Moreover, households living near the market are more likely to participate. In summary, these outcomes indicate that better-off farmers have a better chance of participating in the project than resource-poor farmers. Other studies found similar results; farmers with higher resource endowment living near a market have a higher likelihood of participation in inclusive business models (Ganewo *et al*., 2022; Gebru *et al*., 2019; Wangu *et al*., 2020).

The third and fourth columns of Table 4 show the results of the ESR for productivity for the participant and non-participant groups, respectively. Similarly, the sixth and seventh columns and the ninth and tenth columns of Table 4 indicate the results of the endogenous switching probit model and the ESR for asset stock and the HDDS function for the participant and non-participant groups, respectively. The outcome variables had different patterns in terms of their significance.

The age of the household head had a significant negative effect on malt barley productivity among non-participants. Similarly, in the asset stock and HDDS equations, age negatively impacted asset acquisition and diet diversity for both participant and non-participant groups. Conversely, in the HDDS equation, land size and household size had a significant positive effect on diet diversity for non-participants. Moreover, the correlation coefficient (ρ_i) was negative and significant across all outcome equations for non-participants, indicating the presence of selectivity bias due to unobservable factors. This unobservable selectivity bias justifies the use of the ESR model.

Table 5 reports the result of the ESR model-based treatment effect for productivity function both in actual and counterfactual scenario.

Households participating in the project achieved an expected malt barley productivity of 4,989 Kg/ha. If they were to stop participating, they would lose access to improved seeds and technical support, causing their productivity to drop to just 2,164 Kg/ha. In contrast, households that did not participate in the project used second or third-generation seeds, resulting in an expected productivity of 4,500 Kg/ha. Had they chosen to participate, gaining access to first-generation seeds and technical support, their productivity could have increased to 5,499 Kg/ha, a 22% improvement. However, the negative base heterogeneity values ($BH_1 = -510$ and $BH_2 = -2{,}336$) indicate that participant households have lower productivity than non-participants, even under similar treatment conditions. This suggests the presence of underlying structural disadvantages that systematically limit participants' performance. Insights from FGDs reveal that while the project provides improved seeds and technical support, it does not offer key inputs such as fertilizer, herbicides and pesticide. As a result, participants must rely on their limited financial resources to purchase the expensive essential inputs, which leads to insufficient input application compared to their land holding. The under application of the inputs limit their overall productivity. On the other due to a smaller land holding the non-participant groups have advantage in this regard. Regardless, participants gain more from CREATE (ATT = 2,825 kg vs. average treatment effect on the untreated (ATU) = 999 kg), indicating that the project is more transformative for the participant households.

Table 4. Estimates of endogenous switching regression/probit for productivity per hectare, asset stock and HDDS

	Model estimates for productivity			Model estimates for asset stock			Model estimates for HDDS		
Variables	Participation 1/0	Participant	Non-participant	Participation 1/0	Participant	Non-participant	Participation 1/0	Participant	Non-participant
Age	0.013 (0.007)*	−0.026 (0.108)	−0.26 (0.104)**	0.010 (0.007)	−0.02 (0.01)**	−0.02 (0.008)**	0 0.012 (0 0.01)	−0.03 (0.01)**	−0.019 (0 0.011)*
Sex	−0.455 (0.326)	2.08 (4.72)	6.87 (4.96)	−0.336 (0.345)	0.78 (0.54)	0.37 (0.40)	−0.485 (0.348)	0.395 (0.548)	0 0.09 (0 0.54)
Education	0 0.479 (0.263)*	0.668 (3.65)	−1.18 (3.71)	0 0.60 (0.27)**	−0.50 (0.46)	−0.19 (0.30)	0.74 (0.274)***	−0.311 (0.446)	0.23 (0 0.39)
Land	0.125 (0.089)	1.40 (1.11)	1.43 (1.31)	0.18 (0.09)**	0.19 (0.16)	−0.066 (0.11)	0.188 (0.091)**	0.048 (0.131)	0.24 (0.145)*
Household size	0.0348 (0.0346)	−0.018 (0.45)	−0.604 (0.527)	0.066 (0.038)*	−0.006 (0.06)	0.014 (0.043)	0.071 (0.038)*	0.053 (0.054)	0.113 (0.058)**
Distance to market	−0.19 (0.033)***			−0.22 (0.05)***			−0.22 (0.05)***		
Constant	0.327 (0 0.45)	54.1 (7.7)***	43.3 (6.40)***	0.224 (0.54)	1.61 (1.04)	0.46 (0 0.52)	0.11 (0 0.54)	8.09 (0.9)***	6.29 (0.70)***
δ_i		2.4 (0.08)***	2.7 (0.074)***		−0.224 (0.60)	−1.26 (0.847)		1.3 (0.12)***	1.59 (0.171)***
ρ_i		−0.260 (0.32)	−2.11 (0 0.35)***		−0.22 (0.575)	−0.85 (0.23)***		−0.32 (0 0.29)	−0.77 (0.14)***
Observations	251	102	149	251	102	149	251	102	149

Note(s): ***, ** and * means significant at 1, 5 and 10% respectively
Source(s): Authors' own work

Table 5. Malt barley productivity (kg/ha) under the actual and counterfactual conditions

Outcome variables	Household types and treatment effects	Decision stage To participate	Not to participate	ATE's
Productivity	Participant households	4,989	2,164	2,825***
	Non-participant households	5,499	4,500	999***
	Heterogenous effects	−510	−2,336	1,826***

Note(s): *** means significant at 1%
Source(s): Authors' own work

Table 6. Treatments effects using Kernel and Radius Matching

Variables	Matching algorism	Matched samples Participant HH	Non-participant HH	ATT	Std. err.	*t*-test
Productivity per hectare	Kernel	102	145	3.468	1.751	1.98**
	Radius	99	145	3.969	1.563	2.539**

Note(s): ** means significant at 5% and HH = household
Source(s): Authors' own work

The results from the ESR-based treatment effects indicate that the CREATE project positively and significantly contributed to malt barley productivity in the study area. This result is consistent when using Kernel and Radius matching methods.

Our findings match those of other studies conducted in developing and emerging economies, which highlight that yield improvement results from better access to inputs and agricultural practices (De Boer *et al.*, 2019; Ton *et al.*, 2018; Wangu *et al.*, 2020). The focus group discussants also pointed out that the observed yield difference could be attributed to the introduction of new malt barley varieties and the technical support provided by the project. The result indicate that inclusive business models have the potential to contribute positively to productivity by addressing the lack of inputs that smallholder farmers often face.

Table 7 reports the results of the FIML endogenous switching probit model which estimated the effect of participation on asset stock. Participation in the CREATE project led to the acquisition of new assets by the participant in about 68% points compared to the counterfactual scenario of not participating.

With respect to asset composition, we find that participating households accumulated more assets than their counterparts. The matching algorithms also confirm this result (Table 8), showing that participating households hold a higher asset stock compared to non-participating households.

FGDs revealed that participants allocated their income in different ways. The majority reported saving part of their income for the next cropping season, particularly to buy seed and fertilizer. Another frequently mentioned expenditure were school expenses for their children. Beyond the essentials, the remaining money was invested in additional livestock and farm equipment, durable housing equipment, or in the construction of a new house in a nearby city. In addition, some farmers also invested in fattening sheep and goats to sell them at a better price.

Remarkably, farmers who live in peri-urban areas mostly invested in diversifying their income sources. In the words of one FGD participant:

Table 7. Endogenous switching probit model results

Outcome variable	Treatment effect			
Asset stock	ATT	ATU	ATE	MTE
	0.68***	0.21**	0.42***	0.15 (0.14)

Note(s): ATT: Average Treatment Effect on the Treated, ATU: Average Treatment Effect on the Untreated, ATE: Average Treatment Effect, and MTE: Marginal Treatment Effect,
*** and ** means significant at 1, and 5% respectively

Source(s): Authors' own work

Table 8. Treatments effects using Kernel and Radius Matching

		Matched samples				
Variables	Matching algorism	Participant HH	Non-participant HH	ATT	Std. err.	*t*-test
Asset stock	Kernel	99	145	0.097	0.069	1.41
	Radius	99	145	0.122	0.064	1.9**

Note(s): ** means significant at 5%

Source(s): Authors' own work

> Two years ago, I bought a hybrid heifer for 32,000 Birr (983 EUR) [2], now people are offering me 50,000 Birr (1,536 EUR) but I don't have any intention of selling the cow because I can benefit more by selling milk than by selling it. I am getting 450 Birr (13.8 EUR) per cow per month by selling the morning session alone, and this is good money. Now time has changed, since we live near Assela (the capital city of the Arsi Zone), people are coming to our door steps to buy milk, so my plan is not to depend on farming alone rather to expand my income by selling milk. As well. That is why I bought three more cows, now I have four in total.

In summary, participants invested their money in both productive and non-productive assets. Productive assets are mainly livestock and farm equipment that have income-generating potential, and non-productive assets are mainly furniture and home appliances that enhance their quality of life.

Table 9 presents the result of ESR model, which estimates the impact of participation on the HDDS. As the table indicates, although there is a measurable difference in ESR between the two groups, the difference is negligible. Specifically, the HDDS for participating households is 7.37. If these households were to stop participating, their dietary diversity would decrease marginally by 0.04 points, equivalent to a 0.54% reduction. Similarly, for non-participating households, the HDDS is 7.34. If they were to join the project, their dietary diversity would

Table 9. HDDS under the actual and counterfactual conditions

		Decision stage		ATE's
Outcome variables	Household types and treatment effects	To participate	Not to participate	
HDDS	Participant households	7.37	7.33	0.04**
	Non-participant households	7.28	7.34	−0.06***
	Heterogenous effects	0.09	−0.01	−0.1

Note(s): ***, ** means significant at 1 and 5% respectively

Source(s): Authors' own work

Table 10. Treatments effects using Kernel and Radius Matching

Variable	Matching algorism	Matched samples: Participant HH	Matched samples: Non-participant HH	ATT	Std. err.	*t*-test
HDDS	Kernel	102	145	0.067	0.148	0.451
	Radius	99	145	0.048	0.136	0.352

Source(s): Authors' own work

decrease slightly by 0.06 points (0.82%), representing a reduction of less than 1% in both scenarios. Moreover, the propensity score matching (PSM) result indicates that the HDDS difference between the two groups is statistically insignificant (Table 10).

These findings underscore the importance of questioning and measuring the practical significance of the statistically significant results. As argued by Kirk (2003) and supported by other recent studies on effect size, statistical significance does not necessarily equate to meaningful real-world impacts (Cumming, 2014; Dunst and Hamby, 2012; Kotrlik *et al*., 2011), To address this, we estimated the effect size (Table 11) using Cohen's d for productivity and HDDS and risk difference for asset stock, which evaluates the magnitude and practical relevance of the findings in the context of smallholder farmers' day to day life.

The result suggest that the CREATE project has not had a significant impact on improving food diversity in the project area. As indicated in Figure 2 a closer examination of the household diet reveals that cereals, legumes, roots, dairy products, oil and fats, sweets, spices, condiments, and beverages predominate the local diet with only small amounts of fruits, vegetables and animal-based foods.

This highlights the limited nutritional diversity in the diets of both participants and non-participants. This finding challenges the assumption that increased yields and income from participation in inclusive business models automatically lead to improved access to diverse foods and, consequently, enhanced food security. Several factors may explain this, including the limited availability of diverse foods in rural markets and farmers' spending on non-food items. Market failures, compounded by poor road connectivity, further restrict access to a variety of foods, especially fruits and vegetables, in local markets. This issue was also reflected in FGDs, as emphasized by one project participant.

> Even if I want to buy and consume more fruits and vegetables, I can't because I can't find the fruits and/or vegetables throughout the year in the nearby market.

Moreover, the limited availability of animal-based foods, such as meat, fish, milk, and milk products, except butter, in rural areas is another contributor to one-sided diet consumption.

Table 11. Effect size measure using Cohen's *d*

		Effect size (*d*) and RD	95% confidence interval	
Productivity	ATT	0.62	−0.51	1.75
	ATU	0.39	0.01	0.78
Asset stock	ATT	0.42	0.407	0.444
	ATU	0.107	0.085	0.128
HDDS	ATT	0.16	−0.11	0.44
	ATU	0.24	0.01	0.47

Source(s): Authors' own work

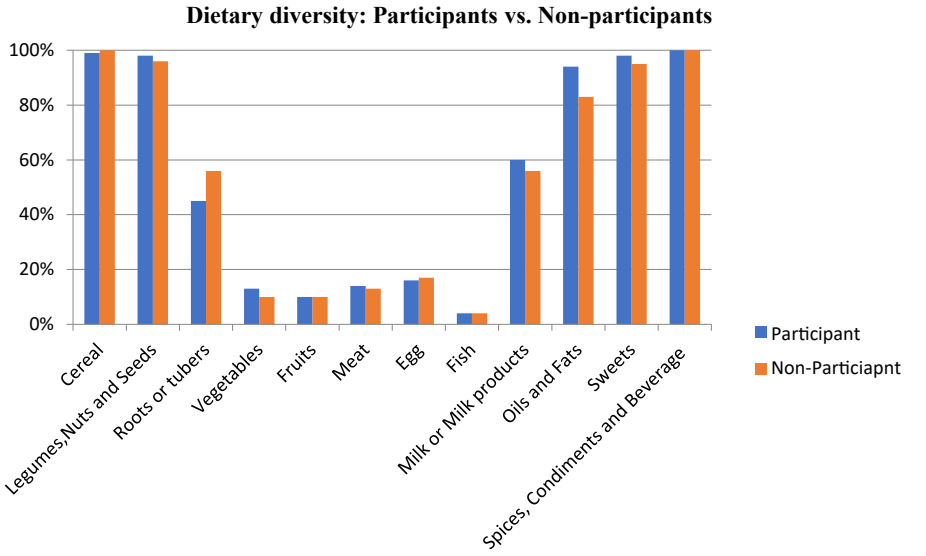

Figure 2. Diet diversity between participant and non-participant groups. Source: Authors' own work

Workicho *et al*. (2016) corroborated our findings. The researchers investigated household dietary diversity patterns using secondary data from an Ethiopian welfare monitoring survey conducted in 2011. Their findings indicated that households living in urban areas with better access to markets that supply more food varieties had higher HDDS than households living in rural areas. Other studies in Ethiopia revealed that rural areas with a better road network have better food security compared to less connected rural areas (Nagesso *et al*., 2019; Nakamura *et al*., 2019), emphasizing that the availability and accessibility of food is key to ensuring food security in rural areas.

Another factor to consider is the payment system. Heineken pays participating households once a year, immediately after the harvest. This lump-sum payment provides farmers with a significant income, enabling them to invest in consumer durables and farm improvements (Von Braun and Kennedy, 1986). In contrast, other studies from Ethiopia indicate that farmers who receive continuous income through contract farming tend to have better food security compared to those with less regular payments (Kuma *et al*., 2019; Negash and Swinnen, 2013). Regular income streams encourage spending on daily necessities like food, while lump-sum payments create opportunities to invest in more durable assets.

6. Impact on the local community

Most inclusive business models engage only a minority of farmers—usually better-off ones—and rarely work with marginalized or resource-poor farmers (Gebru *et al*., 2019; Wangu *et al*., 2020). Therefore, it would be misleading to study the impact of inclusive business solely from the perspective of contracted farmers, as this overlooks the effects on the majority of farmers. Since inclusive businesses aim to benefit the poor, this study addresses the following questions: What impact does the CREATE project have on the community at large? What changes have occurred since the project's implementation, and how have these changes affected different groups within the community?

The most notable change observed since Heineken and other multinational companies started operating in the study area was a change in land use. The amount of land allocated for food barley production, a staple crop in the study area, has been declining, whereas the land allocated for malt barley production has increased since 2014 (Table 12). For example, in 2013/2014—the year when multinational companies began operating—the total land

Table 12. Change in land allocation in Arsi zone

Year	Land allocated in hectare Malt barley	Food barley
2014/15	35,317	68,073
2015/16	42,952	59,605
2016/17	46,759	57,486
2017/18	40,506	59,724
2018/19	54,572	53,206
2019/20	62,737	43, 528

Source(s): Arsi Zone Agriculture and Natural Resource Office

allocated for food barley production in the Arsi zone was 68,073 hectares. This area declined significantly over the following years, dropping to 43,528 hectares by 2019. Conversely, land dedicated to malt barley production increased from 35,317 hectares in 2014 to 62,737 hectares in 2019. In summary, a substantial portion of land was shifted from food barley to cash crop (malt barley) production. This shift clearly impacted the availability of food barley in the local market. According to Fafchamps (1992), when market demand is high, large farmers tend to allocate a greater portion of their land to cash crop production, while smaller farmers continue to cultivate food crops. In our study area, participating households were relatively better off, owning an average of 2 hectares of land. Additionally, they expanded their production through renting and sharecropping. Our findings show that, on average, these households rented 0.53 hectares and sharecropped 0.2 hectares of land. Most of this additional land came from farmers who were unable to cultivate it themselves due to illness or a lack of necessary resources, as confirmed by FGDs.

The shift from food barley to malt barley production has significant implications for the variety of products available in the local market. As the Arsi Zone now produces more malt barley than food barley, the price of food barley in the local market has increased. For instance, in 2017, 100 kilogrammes of food barley were sold for approximately 700 Birr (22 EUR), but by 2019, the price had nearly doubled to 1,300 Birr (40 EUR). This price surge has negatively impacted economic access to food both rural and urban poor communities who depend on local markets for food crop consumption.

7. Conclusion and policy implication

The strong emphasis on private sector involvement in promoting local development in low- and middle-income countries highlights the need for empirical evaluation of its impact on smallholder farmers. This study assesses the effects of Heineken's donor-funded CREATE project on the productivity, asset accumulation, and food security of participating households, using cross-sectional survey data from three districts in the Arsi zone of Oromia Regional State. Additionally, it examines the project's indirect impact on the broader community.

The findings reveal that the project had a significant positive impact on malt barley productivity and the asset portfolios of participating farmers. Increased productivity, combined with higher market prices, resulted in greater income for contracted farmers. This rise in income facilitated the accumulation of new assets by participating households. However, the study also found that participation in the project did not lead to improved dietary diversity. One contributing factor is the reduced availability of diverse food groups, particularly fruits and vegetables, in local markets. Due to poor road connectivity, rural households in Arsi primarily rely on locally produced food. This shows structural factors such as limited market access and production constraints play a more decisive role in determining dietary patterns than project participation alone. On the other hand, the involvement of

Heineken and other multinational brewers in malt barley production led to a shift away from food barley cultivation. This shift drove up the prices of food barley, adversely affecting access to affordable food for net-buying households, particularly poorer and marginalized members of the community.

Our study underscores that while Inclusive Business Models can enhance the livelihoods of households when integrated into value chains by boosting productivity and income, the assumption that such models contribute to broader development goals, such as food and nutrition security is not necessarily valid. Firstly, higher income does not automatically lead to a more diverse diet. Secondly, while integration into these business models may improve the livelihoods of some community members, it often comes at the expense of others, particularly the less well-off. This aspect is rarely considered in the design of such interventions, emphasizing the need for a more comprehensive and integrated approach to local development and food systems.

Ethics approval

Original research was carried out according to guidelines/codes of good scientific practice (Dutch Scientific Research Organisation).

Acknowledgments

Sincere thanks goes to A.C.M. van Westen for his inspiration, feedback and comments and to Professor A. Zoomers for her peer review.

Appendix

Table A1. Comparison of covariates for participant and non-participant households before and after matching

	Before matching			After matching		
Covariates	Participant	Non-participant	*t*-value	Participant	Non-participant	*t*-value
Age of the household head	47.58	43.23	2.45**	47.58	50.51	−1.42
Sex of the household head	0 0.911	0 0.93	−0.62	0 0.911	0 0.94	−0.80
HH size	6.77	6.25	1.62	6.77	6.87	−0.27
Education	0 0.84	0 0.81	0.50	0 0.84	0 0.84	−0.00
Land	2.00	1.52	3.30***	2.00	2.17	−0.94
Distance to market	7.86	8.73	−3.77***	7.86	8.22	−1.64

Model summary	Before matching	After matching
Pseudo R^2	0.106	0.019
LR χ^2	35.86	5.43
$P > \chi^2$	0.000	0.490

Note(s): ***, ** and ** means significant at 1, 5 and 10% respectively, and LR = likelihood ratio

Source(s): Authors' own work

Notes

1. The lowest administrative unit in Ethiopia.
2. Based on 2019 exchange rate.

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