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RESEARCH ARTICLE

Does Agribusiness Cluster Improve Soybean Smallholder Farmers' Participation in Contract Farming? Evidence from Benin

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ABSTRACT

This study assesses the influence of agribusiness clusters (ABC) (a network set up by a private or public institution or by farmers' organizations around one or more agricultural value chains in a given geographical area) and other socio-economic and instructional factors on the adoption of soybean contract farming. We collected qualitative and quantitative data from a random sample of 360 soybean producers from three communes in the Central and Northern parts of Benin. The analysis conducted using the probit model shows that ABC foster the adoption of contract farming by improving knowledge about the content of contracts, attitudes, and the level of trust between contracting stakeholders. ABC also enhance smallholder farmers' utilization of recommended soybean production practices, thus improving their attractiveness to buyers, who tend to offer contracts to secure the relationship. Socio-economic factors, such as farmers' involvement in off-farm activities, cooperative membership, participation in contract negotiation meetings, and soybean income's share in household income, significantly foster the adoption of contract farming. Cooperative membership positively affects the adoption of contract farming because contracting firms or buyers often use cooperatives as an entry point to facilitate contract negotiations with individual producers. Technical training in soybean production and access to villages are associated with the adoption of contract farming. Cooperative membership and extension visits are also essential in promoting farmers' participation in contract farming because contracting firms employ the services of cooperatives and extension agents to create awareness and highlight the importance of contract farming. Therefore, the promotion of ABC and peasant cooperatives, investment in building trust among contract stakeholders (through extensions and cooperatives), and improving the conditions of access to villages are essential for enhancing the adoption of agricultural contracts.

INTRODUCTION

Similar to most West African countries, agriculture is the cornerstone of Benin's economy because of its contribution to export income and the active populations employed. This sector is dominated by smallholder farmers, who plant small plots of land and have low productivity. Benin's agricultural industry is predominated by small family-type farms, with an average sown area of 1.7 ha (Soro and Ifecro, 2023). Consequently, the producers face difficulties accessing agricultural inputs, marketing their harvests, and insufficient and inadequate financing (Audrey et al., 2016). To overcome these difficulties and enable smallholder farmers to improve crop productivity, various development partners have promoted and implemented agribusiness clusters (ABC) for nearly two decades. ABC is a network of organized or

unorganized actors (producers, processors, traders, financing structures, and extension agents, etc.) in a given geographical area and is set up by a private or public institution or by farmers' organizations around one or more agricultural value chains (Awode and Sodjinou, 2023).

Benin's agricultural policy has targeted the promotion of ABCs as a tool for professionalizing family-type farms to induce real structural changes in the agricultural sector (MAEP, 2017; Anang and Asante, 2020). To optimize the production and marketing processes of one or more agricultural products the implementation of ABC aims to create synergistic effects between stakeholders (to pool resources) and demands (for inputs and share knowledge) (Cherkasova et al., 2021). The goal is to improve productivity, innovation adoption, and market access for smallholder producers (Dossouhoui, 2019).

Studies (notably, Awode and Sodjinou, 2023; Assouma et al., 2023) have shown that ABC positively influence smallholder farmers' access to productivity improvement services (inputs and advisory support, in particular). Producers who are members of ABC are more likely to have access to financial services, agricultural extensions, and inputs than are those who are not (Awode and Sodjinou, 2023). ABC constitute a viable means of improving the economic integration of smallholders and marketing of their products at more remunerative prices (Awode and Sodjinou, 2023). Farmers' participation in ABC is also motivated by their desire to avoid selling their harvests at a discount and, therefore, find security in marketing their harvests. Establishing ABC should also promote contract farming between producers and certain key players in value chains, such as processing units, producer organizations, traders, and exporters (Assouma et al., 2023).

Contract farming (a pre-harvest agreement between farmers and buyers) is an additional tool to uplift farmer members of the ABC by providing better services while linking with the market (Behera, 2019; Meemken and Bellemare, 2020). It can help smallholder producers, with limited resources, to support production costs because the produce is sold in advance with the help of a company in exchange for certain services (Ragasa et al., 2018; Olounlade et al., 2020). Contract farming and ABC promote farmers' market orientation and take a broader approach to integrate efforts that benefit smallholder farmers as well as other value chain stakeholders through a market-driven and geographically based approach (Louhichi et al., 2019). ABC and contract farming can help prevent certain risks, such as fluctuating input or output prices, in the market (Melese, 2012; Selorm et al., 2023). Through the Strategic Plan for the Development of the Agricultural Sector (MAEP, 2017), cluster and contract farming are recognized as essential tools that can help link smallholder producers to sustainable value chains, thus triggering a transition from family farming to commercial agriculture.

ABC is promoted in soybean production chains because the sector faces various risks in Benin. Factors contributing to the risk include the lack of improved varieties of soybean, environmental effects on yield stability, buyer preferences influencing market acceptance, production constraints leading to low productivity, and suboptimal nutrient supplies affecting crop yields (Oloumilade and Yabi, 2019; Ahomondji et al., 2023). Contract farming helps manage those risks by stabilizing the supply chain, ensuring access to quality seeds and improved varieties, and optimizing the input supply to improve yields. Although contract farming is recognized as beneficial for smallholder producers in developing countries, the participation rate is relatively low (less than 50% for all sectors) compared to developed countries (Rokhani et al., 2020). In Benin, only 46% of producers are under contract (Gandonou et al., 2019).

However, according to Awode and Sodjinou (2023) and Assouma et al. (2023), some producers, although in ABC, refrain from participating in contract farming whereas others prefer to market part of or their entire harvest through contracts. In such conditions, it is essential to understand the reasons for the resistance of certain producers to participate in contract farming, despite being members of the ABC. In other words, does implementing ABC improve soybean farmers' participation in contract farming? This study answers this question based on empirical evidence of how ABC influence producers' decisions to engage in agricultural contractual agreements. Socio-economic and institutional factors affecting the adoption of contract farming are also highlighted.

METHODOLOGY

Theoretical framework

Adopting an innovation or technology is generally seen as a process that begins with knowledge of the innovation or technology (Rogers, 2003). When the producer has a sufficient understanding of the innovation, he can try it and then adopt it as soon as the trial results meet his expectations. In other words, the producer will decide to adopt the innovation or technology if it provides higher utility than an alternative technology. Such a decision can be explained by the theory of expected utility maximization (Chebil et al., 2013). Thus, a soybean producer (i) will adopt contract farming (m) if the utility he obtains from it (U_{im1}) is greater than that from his previous or alternative practices (U_{im0}) (Sodjinou and Henningsen, 2012; Sodjinou, 2024). For each soybean producer, the utility difference between adopting and not adopting contract farming can be written as a function of the observed (x) and unobserved characteristics (ε).

$$y^* = U_{i1} - U_{i0} = x_i\beta + \varepsilon_i \quad (1)$$

where, variable y^*, which is not observable, is called a latent variable. In the present study, adopting a given contract farming is considered binary, with 1 when the producer adopts the contract and 0 if not. Under this condition, the relationship observed between the latent variable y^* and binary variable y can be written as follows (Verbeek, 2004):

$$y_i = \begin{cases} 1 \text{ si } y_i^* > 0 \\ 0 \text{ si } y_i^* \leq 0 \end{cases} \quad (2)$$

Equation (2) determines the probability of a producer adopting a given contract. This probability can be expressed as follows (Wooldridge, 2005):

$$p(y_i = 1|x_i) = F(x_i'\beta) \quad (3)$$

where F is a function with a value between zero and one. In the adoption studies literature, two forms of distribution for the function F are generally used: the normal distribution leading to the probit model and standard logistic distribution function leading to the logit model. In practice, logit and probit models lead to similar conclusions. The probit model was used in the present study to estimate the probability that soybean producers adopted contract farming. The model is written as follows (Verbeek, 2004):

$$F(w) = \varphi(w) = \int_{-\infty}^{w} \frac{1}{\sqrt{2\pi}} \exp\left\{-\frac{1}{2}t^2\right\} dt \quad (4)$$

Sampling and data collection

This study is based on primary data collected in 2022 from three major soybean-producing communes in Benin: Kérou, Glazoué, and Nikki. They account for nearly a quarter of the soybean production in Benin (MAEP, 2021; Issahou et al., 2023). They also offer great geographical and socio-economic diversity to soybean production areas. In each of these communes, four villages were selected randomly. In those villages, a census of soybean producers was conducted with the support of key informants. Then, 30 producers were selected using systematic random sampling. 360 soybean producers were interviewed. However, in Kérou, one survey form was invalidated due to the poor quality of information. Thus, data used in this study were from 359 soybean producers (Table 1).

Semi-structured interviews were conducted with key informants (development agents, extension agents, producer organizations, etc.). A focus group was conducted in each village. The data collected through these interviews were qualitative and related, in particular, to the practice of contract farming, existence or absence of clusters in the sampled villages, activities and stakeholders of these clusters, and farmers' perceptions of contract farming.

We used a questionnaire implemented in the KoBoToolbox for data collection at the individual producer level. The collected data were related to the socio-economic characteristics of the producers (gender, age,

level of education, access to extension services, etc.), membership in a cluster, practice of contract farming, and share of soybeans marketed through formal contract farming.

Table 1. Distribution of the sample of producers according to cluster membership

Commune	Producer of non-cluster villages	Non-member of the cluster village	Cluster member	All
Glazoué	51	48	21	120
Nikki	0	81	39	120
Kérou	58	53	8	119
Total	109	182	68	359

Data analysis

Analyses were performed according to the type of data collected. Thus, the qualitative data were subjected to content analysis. For quantitative data, descriptive analyses (mean, standard deviation, etc.) were used to describe soybean producers and the types of contracts according to producers' membership in clusters. The influence of clusters and other socio-economic and institutional factors on the adoption of contract farming was analyzed using probit models. A producer is considered an adopter of a given contract if he has practiced it continuously during the agricultural campaign preceding the surveys. For each type of contract farming considered, the empirical adoption model is given by the following:

$$y_i = \beta_0 + \beta_1 ABCV_i + \beta_2 CLUSTER_i + \beta_3 AGE_i + \beta_4 GEND_i + \beta_5 EDUC_i + \beta_6 COPP_i + \beta_7 CVUL_i + \beta_8 OFARM_i + \beta_9 FSOY_i + \beta_{10} PCAGR_i + \beta_{11} RSOY_i + \beta_{12} DISTVM_i + \beta_{13} RSTAT_i + \varepsilon_i \quad (5)$$

In equation 5, y_i represents the dependent variable, with value 1 when the contract is used and 0 otherwise, i indicates the farmer, β is a vector of unknown parameters, and ε is an error term. The independent variables are listed in Table 2 and described as follows:

ABCV: Residing in a village where ABC is available. ABC facilitates access to shared resources, agricultural information, and market opportunities in villages. This can influence the adoption of contract farming. Adong et al. (2012) showed that producers closer to a cluster were more likely to accept contract farming. The coefficient of this variable is expected to be positive, indicating that producers residing in villages with clusters are more likely to receive the collective benefits offered by clusters.

Table 2. Variables that could potentially determine the adoption of contract farming

Variable	Label	Expected sign
Independent variables		
ABCV	Reside in a village where a cluster exists (1=yes, 0=no)	+
CLUSTER	Cluster membership (1=yes, 0=no)	+
AGE	Farmer's age (in year)	+/-
GEND	Gender of the farmer (1=male, 0=female)	+
EDUC	Farmer's education level (in year)	+
COPP	Peasant cooperative membership (1=yes, 0=no)	+
CVUL	Contact with extension agents (1=yes, 0=no)	+
OFARM	Involved in an off-farm activity (1=yes, 0=no)	+/-
FSOY	Technical training in soybean production (1=yes, 0=no)	+
PCAGR	Participation in contract negotiation meetings (1=yes, 0=no)	+
RSOY	Share of soybean in household income (%)	+
DISTVM	Distance to nearest periodic market (km)	-

RSTAT	State of the road leading to the village (1= Poor in all seasons, 2= Poor in rainy seasons, 3= Good in all seasons)	+/-
Dependent variables		
PRODCF	Production-oriented contract (1=yes, 0=no)	
COMCF	Storage-oriented contract (1=yes, 0=no)	
STORCF	Commercialization-oriented contract (1=yes, 0=no)	
TRADCF	Traditional contract (1=yes, 0=no)	

CLUSTER: This variable refers to whether a producer is a member of an agricultural cluster. Participation in contract farming can be affected by the degree of clustering of farmers within a given location (Michelson, 2013). Thus, the higher the level of clustering, the more likely farmers are to engage in contract farming. As cluster membership facilitates the exchange of expertise, resources, and support among farmers, it positively influences the decision to adopt contracts (Dubbert et al., 2023). The coefficient of CLUSTER is expected to be positive.

AGE: This variable represents producer age. According to Nsimbila (2021), the age of the household head influences the adoption of contract farming by smallholder cotton farmers in Tanzania. Younger farmers may be more open to innovation and structural changes in their farm management methods, whereas older producers may be more conservative or less likely to change their established practices. The coefficient of this variable can take both signs, depending on the specific socio-economic and cultural context.

GEND: Indicates the producer's gender. Gender is an essential dimension in the analysis of agricultural dynamics, and can influence the adoption of contract farming (Owusu-Amankwah, 2019). Bullock et al. (2018) found that marketing contracts do not provide women in married households with significant opportunities for participation and benefit due to their limited involvement in decision-making and restricted access to training. In many contexts, access to resources, markets, and information can differ significantly by gender. A positive sign is expected, generally reflecting a greater propensity for men to adopt contracts, although this may vary across contexts.

EDUC: Measures the producer's education level. Farmers' education influences their ability to understand and apply advanced agricultural practices, such as contract farming. More educated producers are often better equipped to engage in complex contracts and take advantage of the opportunities offered (Bezabeh and Beyene, 2023). Otsuka et al. (2016) showed that educated farmers actively participate in contract farming. Thus, we anticipate a positive coefficient, indicating that more educated producers are more likely to adopt contract farming.

COPP: This variable indicates whether the producer is a member of a peasants' cooperative. Membership in a cooperative strengthens the members' bargaining power, allowing them to obtain higher prices for their products. According to Yo et al. (2020), membership in a peasants' cooperative influences the adoption of contracts for actors in the parboiled rice value chain. They often offer benefits, such as access to collective resources, training, and group sales, which can promote the adoption of contract farming. Thus, we assume that the coefficient of this variable is positive.

CVUL: Contact of farmers with agricultural extension institutions or agents. Contact with extension can include technical advice, training, and information on best agricultural practices, which can positively influence contract farming adoption. According to Azumah et al. (2016), one of the factors that positively influences farmers participation in contract farming is access to extension services. Akhtar et al. (2021) and Kumar et al. (2018) stated that extension services promote the adoption of contract farming, providing the necessary resources, and reducing farming risks. Accordingly, the coefficient is expected to be positive for this variable.

OFARM: s Off-farm income-generating activities. The effect of this variable on contract farming adoption is controversial in the socio-economic literature. On one hand, Azumah et al. (2016) and Nazifi and Hussain (2021) argued that farmers that engaged in off-farm activities are less likely to participate in contract

farming because they have other sources of income. On the other hand, Ruml et al. (2022) stated that the practices of off-farm activities are a kind of diversification of income sources that can influence the perception of risks and opportunities associated with contracting. This can positively affect farmers' decisions to participate in contract farming. This divergence in literature implies that the sign of the variable can be positive or negative.

FSOY: Whether the producer has received specific training in soybean production. This training helps improve technical skills and management of soybean cultivation, allowing the adoption of contract farming. Following Otsuka et al. (2016) and Kokeyo (2013), the propensity of producers who have received training in the soybean sector to participate in contract farming is higher than that of non-trained farmers. A positive sign is expected for this variable.

PCAGR: Participation in agricultural contract negotiation meetings. Farmers' participation in contract negotiations may indicate their active engagement in farm management and planning, while promoting the adoption of contracts to secure income and optimize production. According to Yo et al. (2020), participation in agricultural contract negotiation meetings can influence the probability of effective contracting. Unequal mastery of basic information, including the floor price, criteria for assessing the quality of nuts, and other market conditions, due to non-involvement in contract negotiation determines the participation of farmers (Degla and Ahodode, 2021). Thus, we hypothesize a positive sign for this variable.

RSOY: Share of soybean income in the total producer household income. This share of soybean income reflects the relative economic importance of soybeans to households. Thus, adopting contract farming to improve income is challenging for producers (Masakure and Henson, 2005). In other words, stronger economic dependence on soybeans could encourage producers to use contracts to minimize risks and maximize profits in this sector. Thus, we expect this variable to determine farmers' participation in contract farming.

DISTVM: Distance from village to periodic markets, which is significantly associated with the adoption of agricultural technologies (Feyisa, 2020). A greater distance may lead to higher transportation costs and difficulty accessing the market, which may negatively influence the adoption of contract marketing (Abdulai, 2023). A negative coefficient is expected, indicating that producers closer to the market are more likely to adopt contracts.

RSTAT: Status of the road leading to the village. One of the factors limiting emerging farmers from moving to commercial farming is poor physical infrastructure, such as inadequate roads (Khapayi and Celliers, 2016). According to Barrett et al. (2012), farmers in villages in hard-to-reach areas reported difficulty in finding contractors and incurred significant losses due to road crop damage. Better road infrastructure can reduce transportation costs, facilitate access to markets and services, and promote contract farming. In this study, the expected sign of the coefficient of this variable is expected to be positive or negative.

RESULTS AND DISCUSSION

Profile of soybean producers according to their membership in clusters

Table 3 shows the socio-economic profiles of soybean producers according to their cluster membership. The analysis in this table indicates that men represent approximately 91% of the sample versus 9% of women. The average age of the producers is 39 years, and their education level is approximately three years. Members of the clusters are relatively more educated than non-members.

Almost all producers of a cluster belong to a cooperative (96% of cases), whereas less than 50% of non-members belong to a cooperative. More than 69% of respondents who are members of the clusters are in contact with an agricultural extension agent. Less than half of the producers in the sample are involved in off-farm activities. Furthermore, the number of producers who have received training in soybean production is relatively low. Approximately 39% of the farmers benefited from that training, especially producers who are members of ABC.

Cluster members participate more in agricultural contract negotiation meetings (53% of cases) than non-members and producers from non-intervention villages. Soybeans represent approximately 6% of household income on average. The distance between the producer household and nearest periodic market is, on average, 5 km, and in most cases, the roads are in poor condition during the rainy season.

Table 3. Some socioeconomic characteristics of the respondents

Variables	Label	Producer of non-ABC villages	Non-member of ABC village	ABC member	All
AGE	Farmer's age (in year)	37,78 (12,46)	39,27 (11,41)	39,43 (11,36)	38,85 (11,72)
GEND	Gender of the farmer (%)				
	Male	79,82	96,15	92,65	90,53
	Female	20,18	3,85	7,35	9,47
EUDC	Farmer's education level (in year)	2,71 (4,25)	3,38 (4,84)	3,43 (5,32)	3,18 (4,77)
COPP	Cooperative membership (% of yes)	47,71	39,01	95,59	52,37
CVUL	Contact with extension agents (% of yes)	26,61	36,26	69,12	39,55
OFARM	Involved in an off-farm activity (% of yes)	35,78	47,80	38,24	42,34
FSOY	Technical training in soybean production (% of yes)	31,19	26,92	82,35	38,72
PCAGR	Participation in contract negotiation meetings (% of yes)	33,94	26,92	52,94	33,98
RSOY	Share of soybean in household income (%)	4,61 (1,95)	5,69 (1,95)	6,38 (1,37)	5,49 (1,95)
DISTVM	Distance to nearest periodic market (km)	9,28 (10,40)	3,74 (7,34)	3,36 (4,70)	5,35 (8,41)
RSTAT	State of the road leading to the village (%)				
	Poor condition in all seasons	0,00	0,55	0,00	0,28
	Poor condition in rainy seasons	97,25	80,22	66,18	82,73
	Good condition in all seasons	2,75	19,23	33,82	16,99

Forms of contracts farming adopted by producers and share of soybean sold under contract

Four types of contracts were identified in this study, namely production-oriented contracts (POC), market-oriented contracts (MOC), storage-oriented contracts (SOC), and traditional pre-financing (TPF) contracts called "Agbatèrè." The POC is a formal agreement established between a producer or peasant organization and trader or, to a certain extent, with a microfinance institution (MFI). It is signed by the cooperative or individually at the beginning of the agricultural campaign, and allows producers access to technical and financial support. In POC, the producer subscribes to the following: (i) to adopting a specific production charter involving rigorous monitoring and compliance with good soybean production practices and (ii) to participating in technical meetings between farmers. This favors the production of high-quality soybeans. The variety and quantity of soybeans to be delivered to buyers are often indicated in contracts. According

to Issahou et al. (2023), POC benefits stakeholders by allowing producers access to the resources necessary for production, a guaranteed market, and suitable quality products for a buyer.

The MOC is a marketing agreement (or crop sales agreement) between a producer or producer organization and a buyer (cooperative, MFIs, non-governmental organizations, etc.). This contract is written (67% of cases) or verbal (40% of cases) depending on the degree of loyalty, trust, or agreement between the two contracting parties. The MOC is signed before the start of the harvest and allows producers to cover the costs of harvesting, threshing, and winnowing soybeans. In these agreements, producers are required to respect specific commitments related to monitoring harvest and post-harvest activities to ensure the protection of the quality of soybean grain to be delivered, and to not sell soybeans to other traders. According to Issahou et al. (2023), MOC is advantageous to both parties because it allows producers to sell soybeans at an attractive price and traders to access their desired quantities.

The SOC is an agreement that brings together a producer or producers' cooperative, an MFI, and the town hall (or umbrella producers' organization). Under this type of contract, the producer or cooperative has soybean stock, the MFI provides funds, and the town hall ensures access to stores through storekeepers. After a harvest, producers often face cash liquidity problems after harvest, and this period is also when the price of agricultural products is at its lowest. Therefore, they store soybeans in a store to avoid selling them. This stock guarantees that producers will take out a loan from an MFI to solve their current problems or conduct economic activities. In this contract, producers are subject to a charter which mentions the quantity of stored soybeans, amount of the loan, and destocking conditions. In addition, they are subject to a commitment to a common approach and have to participate in follow-up meetings and other activities within the framework of the contract (54%). The contributions of a trader or MFI regarding technical support during the cropping period are almost nonexistent. The advantage of this system is that it allows producers not to immediately sell off their harvests when prices are at their lowest in the year and gives them the possibility of accessing credit to meet specific needs while waiting for prices to rise.

The TPF is negotiated individually by producers at the beginning or during agricultural campaigns. The pre-financing partly covers the production-related work and may be in kind or in cash. When the contract is made with a trader or usurer, it provides financial assistance as capital for producers to acquire production factors such as inputs and equipment or to solve household problems. The producers repay in kind with soybeans. Repayment is made immediately after the harvest with a transfer price previously established when the contract was concluded. As the contract is verbal in most cases, it is concluded in the presence of each actor's witnesses. TPF is mostly disadvantageous for producers because, usually, after the transactions, the price of a kg of soybeans increases up to three times the price initially agreed upon in the contract with the usurer or trader.

Table 4 shows the distribution of soybean producers according to the types of contracts with which they are associated, considering their place of residence and membership in ABC. Generally, contract farming adoption appears to be associated with cluster membership (Table 4). Cluster members are not only predominantly involved in all types of contracts, but also tend to adopt modern contract farming rather than traditional ones. Producers residing in non-cluster villages are more involved in TPF (21.10%) than in modern contract farming (3.67%, 14.68% and 1.83% for POC, MOC and SOC, respectively). The trend is the same for producers who are not members of clusters, but live in the villages where these clusters are implemented. Members of ABC are more involved in POC than in TPF.

These results suggest that cluster membership promotes the adoption of contract soybean farming, reflecting better collective organization and synergistic benefits among cluster members. The traditional "Agbatèrè" contract remains the primary recourse for most producers to finance their agricultural activities.

The results are in line with the data available in the literature, in which various authors have highlighted the existence of several types of contracts among farmers, each with unique implications for supporting farmers, market stability, and risk sharing. For example, Mwambi et al. (2016) described several models, such as centralized, base-planting, multi-stakeholder, informal, and intermediate models. Each model

offered different levels of support and formality in agreements with farmers. Ruml and Parlasca (2021) identified input supply and marketing contracts, and highlighted how they improved farmers' access to credit. Vicol (2017) examined the evolution of contract farming over 25 years and found various types of contract farming, notably production, marketing, and service contracts, and their effects on agricultural practices and the control of the production process. Most of the authors noted that contract farming strengthened smallholders' economic security, access to markets, and the ability to negotiate favorable conditions for production and sale of products.

Table 4. Different forms of contracts adopted by soybean producers

Type of contract	Producer of non-ABC villages	Non-member of the ABC village	ABC member	All
Production-oriented contract (POC)	3.67	3.30	83.82	18.66
Marketing-oriented contract (MOC)	14.68	14.29	66.18	24.23
Storage-oriented contract (SOC)	1.83	13.19	47.06	15.04
Traditional contract farming (TPF)	21.10	37.36	73.53	39.28

Agribusiness cluster and contract farming adoption

The results of the probit model (Table 5) indicate that residing in ABC villages positively affects the adoption of contract farming. This influence is significant for the adoption of SOC and TPF (at 1% level) but non-significant (at 5% level) for production and MOC. The implementation of ABC increases the probability of adopting formal contract farming by 3–9 percentage points and that of traditional contract farming by 20 percentage points. Similarly, ABC participants tend to adopt contracts more than non-members. The influence of ABC participation is significant (at the 1% level) for POC and MOC. Thus, ABC participation increases the probability of adopting POC by 10 percentage points and that of adopting MOC by 17 percentage points.

That is, the implementation of ABC has a positive and significant influence on the adoption of contract farming in the intervention villages among ABC members and non-members. Similarly, ABC's implementation promotes the adoption of traditional and formal (or modern) contract farming.

The positive effect of ABC on the adoption of contract farming among ABC members is because it creates an environment for exchanges between producers on the importance and benefits of contract farming and increases their negotiation power (Hichaambwa et al., 2014). Thus, ABC improves the knowledge of the content of contracts, attitudes, and level of trust between contracting parties, which, in turn, improves farmers' willingness to participate in contract farming (Khalili et al., 2024). According to Sodjinou (2024), ABC promotes contact among soybean farmers, which facilitates discussions about contract farming (based on members' experiences) and makes them aware of its benefits. According to Akhtar et al. (2021), ABC membership enhances participation in contract farming by providing producers with access to information and bargaining power. In addition, favorable contract terms, such as pricing, payment methods, quality standards and input supply, as well as the reputation of the contracting firm, are essential (Hoang and Nguyen, 2021). This supports the findings of Ba et al. (2019), who argued that the positive effect of ABC on contract farming adoption could indicate that ABC is a platform for information sharing, which helps producers to have greater opportunities to link to buyers at lower transaction costs, and the tools to comply with buyers' requirements in terms of good crop production practices.

Our findings are also in line with those of Galvez-Nogales (2010), Tabe-Ojong and Dureti (2022), and Awode and Sodjinou (2023), who found that ABC creates synergies among stakeholders enabling smallholder producers to have greater access to agricultural services and become more competitive. This is because farmers have more confidence in the cluster and find more security there than when they work alone (Assouma et al., 2023). This corroborates the results of Batzios et al. (2021), according to whom these groupings have more reassuring negotiating and marketing powers. Joffre et al. (2019) found that ABC

membership influences producers' access to contracts through various underlying processes (frequency of interactions with public and private sector actors and perception of market risk) that ultimately promote the adoption of agricultural contracts.

The positive effect of ABC on contract farming adoption can also be attributed to the coming together and adoption of appropriate production techniques and practices, ABC members obtain good-quality products in sufficient quantities. Consequently, they become more attractive to buyers who are more likely to sign contracts with them. According to Khalili et al. (2023), timely buyer payments also increase farmers' intentions to participate in contract farming. These results agree with those of Ba et al. (2019), who argue that by adopting production practices and sharing knowledge, smallholder farmers become more attractive to buyers who tend to offer contracts to secure the relationship.

The positive effect of ABC on contract adoption by non-members may be due to a spillover effect. In other words, the adoption of contracts by ABC member producers indirectly affects the adoption decisions of non-members, perhaps through the visible effects on adopters. That is, improved production, easy access to inputs, and easy access to credit and technologies. This is consistent with the findings of Meemken and Bellemare (2020), who argued that the prevalence of contract farming may also affect non-participating farmers through various pathways, such as the improved availability of farm inputs and services, technology spillovers, or investments in local infrastructure. In short, ABC's implementation encouraged non-members of the intervention villages to negotiate contracts. However, according to Issahou et al. (2023), the satisfaction rate with formal contract farming is relatively low, particularly because individual farmers have low bargaining power and are at higher risk than peasants in associations such as ABC. This low rate of satisfaction with formal contracts among producers who are not members of clusters leads them to resort to informal contracts. This explains the positive influence of cluster implementation on the adoption of TPF.

Table 5. Factors influencing the adoption of soybean contract farming: probit regression results

Variables	Label	Production-oriented contract		Marketing-oriented contract		Storage-oriented contract		Traditional contract (Agbatèrè)	
		Coefficient	Mar. Eff.	Coefficient	Mar. Eff.	Coefficient	Mar. Eff.	Coefficient	Mar. Eff.
ABCV	Residing in a village where a cluster exists (1=yes)	0,319 (0,387)	0,032 (0,036)	0,381 (0,330)	0,052 (0,039)	1,332*** (0,386)	0,087*** (0,028)	0,565*** (0,203)	0,202*** (0,067)
CLUSTER	Cluster membership (1=yes)	4,339*** (0,625)	0,965*** (0,030)	0,795*** (0,283)	0,165** (0,081)	0,293 (0,274)	0,030 (0,035)	0,338 (0,236)	0,131 (0,093)
AGE100	Age of the farmer (in year)	-0,752 (1,220)	-0,083 (0,133)	0,558 (0,943)	0,084 (0,141)	0,686 (0,946)	0,060 (0,082)	-0,273 (0,679)	-0,103 (0,256)
GEND	Gender of the farmer (1=male)	-0,430 (0,486)	-0,062 (0,088)	0,205 (0,369)	0,027 (0,044)	-0,315 (0,404)	-0,035 (0,054)	0,140 (0,292)	0,052 (0,106)
EDUC10	Farmer's education level (in year)	0,353 (0,297)	0,039 (0,034)	-0,203 (0,233)	-0,031 (0,036)	-0,049 (0,237)	-0,004 (0,021)	0,001 (0,169)	0,000 (0,064)
COPP	Cooperative membership (1=yes)	0,059 (0,419)	0,007 (0,046)	0,935*** (0,337)	0,141*** (0,048)	0,790** (0,369)	0,071** (0,035)	0,153 (0,202)	0,058 (0,076)

CVUL	Contact with extension agents (1=yes)	0,024 (0,339)	0,003 (0,038)	0,813*** (0,249)	0,140*** (0,055)	0,671** (0,267)	0,069** (0,034)	0,406** (0,178)	0,155** (0,068)
OFARM	Involved in an off-farm activity (1=yes)	0,519* (0,289)	0,062* (0,038)	0,048 (0,246)	0,007 (0,037)	-0,274 (0,253)	-0,023 (0,021)	-0,084 (0,166)	-0,032 (0,063)
FSOY	Technical training in soybean production (1=yes)	-0,995* (0,532)	-0,098** (0,047)	1,019*** (0,270)	0,184*** (0,060)	1,114*** (0,317)	0,130*** (0,050)	0,630*** (0,200)	0,240*** (0,075)
PCAGR	Participation in contract farming negotiation meetings (1=yes)	-0,798** (0,398)	-0,075** (0,033)	0,344 (0,247)	0,056 (0,045)	-0,241 (0,262)	-0,020 (0,021)	0,369** (0,187)	0,141** (0,072)
RSOY10	Share of soybean in household income (%)	-0,591 (0,795)	-0,065 (0,089)	2,559*** (0,720)	0,385*** (0,122)	0,843 (0,701)	0,074 (0,064)	1,031** (0,444)	0,390** (0,168)
DISTVM10	Distance to nearest periodic market (km)	0,290** (0,131)	0,032** (0,015)	0,327** (0,161)	0,049** (0,024)	-0,037 (0,214)	-0,003 (0,019)	0,067 (0,104)	0,026 (0,039)
RSTAT	State of the road leading to the village (1= Poor in all seasons, 2= Poor in rainy seasons, 3= Good in all seasons)	-0,664 (0,421)	-0,073 (0,045)	-0,631* (0,346)	-0,095* (0,055)	-1,158*** (0,354)	-0,102** (0,041)	-0,070 (0,218)	-0,027 (0,082)
_cons	Constant	-0,075 (1,155)		-3,705*** (1,003)		-1,535 (1,031)		-1,831 (0,610)	

( ) : Figures in parentheses are Standard Errors

Mar. Eff. = Marginal effect

The Effect of Socio-economic Factors on the Adoption of contract farming adoption

Table 5 shows that involvement in off-farm activities significantly influence the adoption of POC (at 10% level). This indicates that producers that engaged in off-farm activities are more likely to adopt POC. These results contradict those of Akumu et al. (2020) and Nazifi and Hussaini (2021), who found that engagement in non-agricultural activities reduces farmers' participation in contract farming because they have alternative sources of income. They have a diversified risk portfolio outside the farm with multiple income streams (Poku et al., 2018). Competition arises between farmers' activities, sometimes leading to delays in certain activities (Tefera et al., 2020). Thus, the causes of the contracts can be questioned.

Regarding participation in contract negotiation meetings, the result is similar to that of off-farm activities. The coefficient is significant (at 10% level) for POC and not significant for other types of contracts. Thus,

participation in agricultural contract negotiation meetings can dissuade the adoption of production contracts because of misunderstandings during these meetings or contract clauses that could be more advantageous for soybean producers. Magrini et al. (2021) found similar results, showing that collective negotiation between agricultural cooperatives is more advantageous for farmers than bilateral negotiation.

Furthermore, the share of soybean income in household agricultural income shows significant coefficients for MOC and TPF (at 1% level). Our results are consistent with the findings of Elliott et al. (2015) who noted that the percentage of soybean income is positively and significantly linked to the adoption of marketing contracts. This suggests that households where soybeans represent a significant share of farm income are more likely to adopt marketing and pre-financing contracts because of the importance of soybeans in their household economy.

The Effect of other Institutional Factors on contract farming adoption

The results of the probit regression presented in Table 5 show that membership in a producer cooperative significantly and positively influences the adoption of MOC and SOC at 1% and 5% levels, respectively. This implies that membership in a cooperative promotes MOC and SOC adoption. Our results corroborate the findings of Ba et al. (2019), who noted that farmers are more likely to participate in contract farming when they are members of peasant organizations. This is also in line with Gbede (2021), who argued that the effective implementation of cooperative principles promotes the adoption of contract farming. Being in a cooperative provides access to advice and training from extension services and to certain services (for example, tractor rental for plowing the plots) that a single person cannot afford given the small size of the plots (Selorm et al., 2023). The positive effect of cooperative membership on contract farming adoption is because contracting firms or buyers often use cooperatives as first contacts to facilitate contract negotiations with individual producers.

Contact with an extension agent positively affects the adoption of all contract farming types. Extension' effect is significant (at 1% to 5% level) for all contract farming apart from POC. Thus, farmers who have contact with extension agents are 7–16 percentage points more likely to engage in contact farming than their counterparts who have no contact with extension services. That is, producers who have had contact with extension agents are more likely to adopt MOC and SOC as well as traditional contracts, probably through the information and supervision that agents provide to farmers. This is in line with the findings of Adabe et al. (2019), who argued that the higher the extension visits to the farmer the higher the adoption rate of contract farming. According to Nazifi and Hussaini (2021), extension visits are important in promoting farmers' participation in contract farming, probably because contracting firms employ extension agents to create awareness and highlight the importance of contract farming to farmers. The direct implication of this finding is that investing in building trust among stakeholders is an important way to promote soybean contract farming. Farmer organizations and extension agents are key players in that trust-building process.

Table 5 indicates that farmers' training in soybean production has a significant and positive effect (at 1% to 10% level) on the adoption of the four types of contract farming analyzed in this study. Thus, training in soybean farming practices increases the probability of adopting MOC, SOC, and TPF by 18, 13, and 24 percentage points, respectively. This is because training improves producers' skills and knowledge and allows them to understand the advantages of contract farming (Otsuka et al., 2016). This is in line with Otsuka et al. (2016), Tamimie (2017), and Nazifi and Hussaini (2021), who showed that training in the soybean sector positively influenced contract farming adoption and, in turn, producer performance. Notably, training negatively influenced the adoption of POC (at the 10% level). Thus, producers trained in soybean production practices are 10 percentage points less likely to adopt POC than their untrained peers.

The distance between a producer's village and nearest periodic market has a positive and significant influence (at 5% level) on the adoption of POC and MOC. Thus, the probability that a soybean producer adopts a contract increases by approximately 0.3 percentage points (for POC) and 0.5 percentage points (for MOC) when they move one kilometer away from the periodic market (Table 5). Similarly, the worse the

access road to a producer's village, the more likely they are to adopt MOC and SOC contracts. Thus, producers living in villages with poor access are approximately 10 percentage points more likely to adopt MOC and SOC than their neighbors living in more accessible villages. This is because producers living in more isolated areas (far from periodic markets, with worse roads) have greater difficulty finding buyers. Consequently, they prefer to contract their produce. This result corroborates that of Abdulai (2023), who found that distance has a positive influence on the adoption of contracts in the soybean sector in northern Ghana. Khapayi and Celliers (2016) found that road conditions were a limiting factor for producers wishing to enter into marketing contracts. Our findings are also in line with those of Behera (2019), who, in a study conducted in India, concluded that producers whose farms were farther from markets were more likely to adopt contracts, particularly given that the farther one is from a market, the higher the transaction costs. This makes it easier for farmers to enter into contracts to sell their crops.

CONCLUSION AND IMPLICATIONS

This study assesses the influence of ABC and other key factors on the adoption of soybean contract farming. The adoption of four types of contract farming has been analyzed in this study, notably three modern contract farming types (POC, MOC, and SOC) and a traditional contract farming. The results indicate that residence in a cluster village and cluster membership influence the adoption of contractual farming. This is because ABC improves knowledge of the content of contracts, attitudes, and the level of trust between contracting parties, which, in turn, improves farmers' willingness to participate in contract farming. The ABC also influences producers' access to contracts through various underlying processes (frequency of interactions with public and private sector actors and perception of market risk) that ultimately promote the adoption of agricultural contracts. The ABC fosters soybean farmers' adoption of recommended soybean production practices, which in turn improves smallholder farmers' attractiveness to buyers who tend to offer contracts to secure relationships.

Socio-economic factors, such as farmers' involvement in off-farm activities, participation in contract negotiation meetings, and the share of soybean income in household income, significantly foster the adoption of soybean contract farming. In particular, cooperative membership has a positive effect on contract farming adoption because contracting firms or buyers often use cooperatives as first contacts that can facilitate contract negotiations with individual producers.

Similarly, institutional factors (notably membership in a producer cooperative, contact with extension agents, farmers' training in soybean production, and accessibility to villages) promote the adoption of contract farming. In particular, cooperative membership and extension visits are important in promoting farmers' participation in contract farming because contracting firms employ the services of cooperatives and extension agents to create awareness and highlight the importance of contract farming to farmers.

Therefore, the promotion of ABC and peasant cooperatives, investment in building trust among contract stakeholders (through extensions and cooperatives), and improving the conditions of access to villages are essential for enhancing the adoption of agricultural contracts.

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