

Aeroplanes without engines: Smallholder farmers' demand for, access to and utilisation of agricultural trade credit in Ghana

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Abstract

The paper investigates how agricultural trade credit (ATC) extended to smallholder cereal farmers leads to an (in)efficient agricultural marketing systems for farm produce in Ghana. With data from smallholder farmers and value chain actors, such as input dealers, aggregators and off-takers, the study employs focus group discussions to collect qualitative data for triangulation and content analysis. The findings show that ATC is the primary mechanism through which smallholder farmers in Ghana finance their production, with intermediaries such as aggregators, input dealers and processors acting as the main financiers. We further find that ATC also entrenches farmer dependency, weakens bargaining power and leaves both sides exposed to default risk from practices such as side-selling. Bridging the existing agricultural credit access gaps will require formal lenders and intermediaries to redesign ATC products around the crop calendar and group-based liability, while investing in de-risking instruments.

Key words: agricultural trade credit, smallholder farmers, agricultural inputs, aggregators, in-kind payment, marketing

1. Introduction

A common constraint to agricultural production in Ghana is a lack of access to credit, particularly for small farm households that do not have access to formal credit from commercial banks (Fan & Rue 2020; Dary 2022; Asiseh *et al.* 2025; Taherzadeh *et al.* 2026). This leaves smallholder farmers in the hands of rural and community banks, micro-finance institutions and informal financing systems such as found in the agricultural trade credit (ATC) model (Saeed 2026; Tanko & Fuseini 2026). ATC is usually a credit that is bundled with the sale or purchase of goods, making it inherent in transaction relationships involving the exchange of produce from the farmers in payments for inputs provided to the farmer by the value-chain actors mentioned earlier (Dary 2022). It is usually a short-term credit or financing in terms of which produce (goods) is usually bought and sold, with the payment deferred to a later date for the mutual benefit of both the seller and the buyer. Its application in the agricultural space is quite complicated and differs from country to country and community to community. In the agricultural space, commodity aggregators and traders usually use it as means of financing the commodity trade or aggregate. ATC usually originates from a seller of an input or buyer of a commodity to a farmer. A common example of ATC is loans to finance purchases of annual inputs such as seeds and fertilisers, or capital items such as machinery and building equipment. The originator of trade credit in agriculture may also be a firm, which buys from the farmer with the use of a procurement contract specifying conditions of the procurement in advance (Baker 1970). ATC has been an old business model for financing the production of cereals, maize and rice in Ghana, but the activities of ATC are unregulated. Anecdotal evidence suggests that traders (intermediaries) usually take undue advantage of the farmers, while the traders also claim that the farmers often do not pay for the credits that are extended to them. This deepens the limited access to credit by smallholder farmers, yet they are expected to produce for the larger society. This situation can be likened to expecting aeroplanes to fly without engines.

Agriculture trade credit in Ghana, even though popular, is still evolving (Kehinde 2022). In addition, the application of ATC has not received much attention in the research space as could be expected. As a result, the use of agricultural trade continues to be fraught with challenges (Dary & James 2019; Dary 2022). There is also no regulatory system to guide the extension and repayment of trade credit in the country. Therefore, the key research questions guiding this study are: what form does agricultural credit in Ghana take? what are the payment conditions? and how are these conditions monitored and complied with by farmers? Our objective was to explore smallholder farmers' demand for credit such as trade finance in Ghana. Specifically, the study investigates the key issues that constrain farmers from demanding formal loans and its implications for their activities. Our contribution is to generate knowledge on how to design ATC for smallholder farmers to ensure the efficient marketing of their produce and repayment of such credit when extended to them. This knowledge could guide the development of a framework for regulating ATC in Ghana and other developing countries. We further seek to provide empirical evidence of how ATC activity can be enhanced in food production and marketing by farmers. The study therefore addresses the important issue of ATC in the Ghanaian agriculture and contributes useful, qualitative insights from multiple actors in the value chain by including farmers, aggregators, input dealers, processors and financial institutions.

The rest of the paper is organised as follows. Section 2 contains the literature on agricultural trader credit in Ghana and the theoretical underpinnings of the study. The research methodology is discussed

in Section 3. Section 4 presents the findings of the study, which are discussed in Section 5. The final section highlights the conclusions and policy implications of the study.

2. Literature review

Several theories have been put forward to explain the existence of trade credit and the rationale underlying its extension and utilisation by farmers and other actors within the various agricultural value chains. The trade financing theory posits that trade credit exists because of financial market imperfections (Emery 1984; Dary 2022). The trade financing theory provides a plausible theoretical foundation for the extension of credit to sellers by buyers (Ahn 2014; Dary 2022). Wilson and Summers (2002) suggest that trade credit between traders and creditors builds relationship among the actors and helps improve the marketing of their products. They argue that firms use trade credit to drive sales.

Specific to agriculture, the general trade credit theory developed by Petersen and Rajan (1997) and extended by Burkart and Ellingsen (2004) posits that suppliers have an advantage over banks in monitoring and liquidating goods in kind. This is because it is typically less profitable for a borrower to divert inputs than to divert cash, so suppliers can lend more liberally than banks. This in-kind finance framework predicts that trade credit and bank credit can act as either complements or substitutes, explains the short maturity of trade credit, along with its greater prevalence in less-developed credit markets, and why large, unrated firms' payables behave more countercyclically than small firms. In addition, the interlinked transactions theory of Mitra (1983) suggests that rural credit could be extended as bundled with output in the input markets, and that the price at which the output is purchased is determined jointly with the terms of the credit contract.

While the literature on trade credit and its implications for firms and non-agricultural business growth is vast and expanding (see, among others, Martínez-Sola *et al.* 2014; Platonova *et al.* 2018; Xie *et al.* 2019; Li *et al.* 2020), the application of trade credit to agriculture and smallholder farmers is limited. However, a couple of studies have been done on the effect of ATC (Dary & James 2018; Dary 2022; Kehinde 2022; Bichi *et al.* 2025). These studies suggest that ATC serves as a close substitute for a bank loan. ATC allows farmers to obtain inputs and cash from buyers to finance their farming activities and pay for it through their produce, which saves them the effort of hustling to get sales and looking for buyers (Wilson & Summers 2002; Andrieu *et al.* 2018; Dary 2022; Kehinde 2022).

ATC is growing in Ghana. However, the subsistence nature of farming makes it quite challenging, as the volumes of produce produced by the farmers are in small quantities. As a result, creditors are not motivated to extend ATC to these farmers because they are not able to provide them with the required volumes of produce needed by the creditors for their trade (Dary 2022). Also, the distance between farmers makes the monitoring of trade credit very difficult. Therefore, it will be more meaningful to sell on trade credit terms if large quantities of the farm produce are closer to each other, as proximity to the buyer and interactions could be more frequent to enable the monitoring and enforcement of trade credit contracts (Kehinde 2022). One feature of ATC in Ghana is that it takes place from business to farmer or trader to farmer, in which the farmers are given cash or inputs by the trader or business, but payment is delayed until the farming season is over; at harvest time, the farmer pays with his or her produce. Usually, a contract is agreed to for the arrangement.

To ensure trade credit is well extended to farmers, it is important that farmers enter into preharvest contracts with buyers with the view of selling to them at harvest, and to specialise in producing certain crops as against mixed cropping (Dary 2018, 2022). The reason for this is that, if a farmer specialises in the production of specific crops, there is a higher probability to produce greater volumes to satisfy

the buyer who extends the trade credit to them, as they will meet the demands of the buyers. With this specialisation, the buyer is more likely to extend to the farmers all they require for their farm activities. Thus, trade credit helps primary agricultural producers to mitigate their production credit constraints. However, there are no known terms for ATC in Ghana to guide the lenders and borrowers of trade credit.

We have identified the following themes for the analysis: demand for trade credit, forms, terms and conditions of trade credit, monitoring trade credit extended to smallholder farmers, forms of in-kind payment, and challenges of trade credit.

3. Methods

3.1 Research design

An exploratory case study design was employed to collect qualitative data from smallholder farmers. The data were mainly collected from selected farmer-based organisations (FBOs) and village savings and loans associations (VSLAs) and were largely smallholder farmers (community institutions). In addition, data were collected from agricultural value chain intermediaries (actors) and selected financial institutions from the transition zone of Ghana. An exploratory case study is deemed suitable when there is limited information or investigation concerning the phenomenon, as in this case the demand for formal credit by smallholder farmers vis-à-vis trader credit. The qualitative research method was chosen for this study because it provides a deeper exploration of how ATC and related issues confront smallholder farmers in Ghana. Furthermore, this approach generated information that was very detailed and enabled the authors to develop adequate information regarding the phenomena under investigation.

For the data collection, and besides for the aforementioned organisations and associations, we conducted focus group discussions (FGD) to collect pertinent data from three key stakeholders: community institutions, agricultural value chain intermediaries and financial institutions. The community institutions were FBOs and VSLAs. The intermediaries were aggregators, processors and input dealers, while the financial institutions were basically rural bank and micro-finance institutions. To triangulate the data from the FGDs, key informant interviews (KII) were also conducted with two technicians from each group of institutions involved in the agricultural programming in the credit space in the study area (Erbaugh *et al.* 2024).

3.2 Selection of study area and communities for the interviews

The participants for the FGDs were purposively selected from five districts: Dormaa-Ahenkro, Techiman, Kintampo, Savelugu and Karaga. The reason for selecting these districts was that they constitute the agricultural hub for cereal production in the country.

In all, 11 FGDs were held; 10 in face-to-face sessions with the community institutions (FBO leaders, VSLA leaders and intermediaries) in the five districts above. In each district, we conducted two FGD sessions for FBOs and VSLAs as one group. FGDs were jointly conducted for intermediaries comprising of processors, input dealers and aggregators/off-takers as a second group. We put the farmers and the intermediaries together in the same FGD because it enabled all the actors to be aware of what the others say and, if there is a need for other perspectives and clarification, these can be provided in real time. In the face-to-face sessions, each FGD was attended by six participants, making a total of 60 participants. In the second case, 13 participating financial institutions (PFIs) were interviewed via a Zoom setting. In organising the farmers, FBO and VSLA participants, we sought

the assistance of the district directors of the Ministry of Food and Agriculture (MoFA), who arranged the meetings and booked appointments with the farmers. MoFA also helped in providing accommodation/hall (space, table, and chairs) for the FGDs.

3.3 Data collection protocol and procedure

The development of the data collection protocol went through a series of iterative processes. First, an initial draft of the protocol was prepared and reviewed by the authors. To ensure the validity and smooth implementation of the protocol for the FGDs, a pilot testing was done at Atronie in the Sunyani Municipal area on 21 June 2023. The pilot testing focused on the flow, translation and logic of the questions in the protocol. The participants of the FGD were divided into two main groups: community institutions and intermediaries. The community institutions were two FBOs, namely the Amamammaa Rice Farmers Association and the Nyamebekyere Rice Farmers Association. The FGDs for the piloting involved five participants, representing the various community institutions and intermediaries. The FGDs were held face to face with the community institutions and intermediaries. However, the FGD with the financial institutions was held virtually. The choice of virtual approach for the financial institutions was due to the high cost of gathering the FGD members to a common point. The FGD with the financial institutions was possible because they had access to internet facilities so that they could easily be engaged via a Zoom session, compared to the farmers and the value chain actors (FBOs, VSLA and intermediary groups).

3.4 Data validation workshop

A validation workshop was held to validate the key information gathered from the FGDs. Organised on 1 September 2023, the validation workshop included experts, practitioners, farmers, processors, aggregators, input dealers and other potential beneficiaries from the project area. These included stakeholders from the district departments of MoFA, the regional departments, business advisory centres, the ARB APEX Bank, the Bank of Ghana, the Agricultural Development Bank and others. A total of 35 participants attended the validation workshop. The workshop also provided information for the improvement of the validity and reliability of the data and the results.

3.5 Coding and data analysis

In the analysis, we adopted and conducted manual coding, combining deductive codes derived from the study's theoretical framework, trade credit and financial market imperfections, credit demand and access, interlinked credit-output relationships and default/repayment dynamics. Our inductive codes are grounded in the participants' own language, following the structured template-based procedure proposed by Isangula *et al.* (2024). This involved developing preliminary themes from the interview guide and research questions, anchored in the study's participant categories (community institutions such as FBOs and VSLAs, intermediaries like input dealers, aggregators, processors and participating financial institutions). Again, we read all transcripts in full – at least twice for familiarisation, and coded transcripts directly in Microsoft Word using a structured template organised by the interview questions, with excerpts tagged via the comments/track changes functions refining the coding scheme inductively as new, recurring concerns emerged from the participants. Further, we consolidated related codes into broader themes and double-checked these across participant categories to identify convergence and divergence in how different actors described the same credit arrangements; and maintaining analytic memos throughout to track emerging interpretations and document changes to the coding scheme. The final themes we use in the analysis are demand for trade credit, forms, terms and conditions of trade credit, monitoring of trade credit extended to smallholder farmers, forms of in-kind payment, and challenges of trade credit.

4. Findings

The findings from the FGDs draw on the perspectives of three categories of stakeholders: community institutions (FBOs and VSLAs), intermediaries (input dealers, aggregators/off-takers and processors), and PFIs, (i.e. rural banks). The findings relating to ATC are presented below under five subsections: demand for ATC; forms, terms and conditions of trade credit; monitoring of ATC extended to smallholder farmers; forms of in-kind payment; and challenges of trade credit.

4.1 Demand for trade credit

Across the FGDs, the demand for *formal cash* credit among smallholder farmer groups (FBOs/VSLAs) was very low. Except for one FBO in Techiman, which had accessed a cash loan from Success Microfinance and repaid it in full, no other FBO had accessed cash credit as a group. Even the Techiman FBO chose not to reapply, arguing that the interest rate was so high that taking loans under such conditions meant they were working for the bank. Other groups reported that individual members had occasionally accessed cash loans, but that past applications submitted as a group had been turned down by banks, leading them to stop applying altogether. This pattern is consistent with the broader literature suggesting that farmers suffer productivity losses because of inadequate and unaffordable access to formal financial support (Bamidele *et al.* 2019; Gollin, 2019), and helps explain why trade credit rather than bank credit has become the dominant financing arrangement for most smallholders (Dary 2022).

Intermediaries: In contrast to the muted demand among farmer groups, intermediaries expressed strong interest in accessing credit. Processors, aggregators and input dealers (except for poultry aggregators) all reported that they provided credit or credit-like services to farmers and, while simultaneously expressing a strong desire to access credit themselves, indicated a preferred interest rate range from 5% to 15%.

- *Processors* relied mainly on personal savings, business profits and family/friends for finance, and generally avoided bank loans because of unfavourable interest rates and repayment schedules. Nearly all processors who had applied for bank loans were refused, most commonly because they lacked collateral or a guarantor.
- *Input dealers* were open to bank credit but found the terms unworkable in practice. One input dealer described applying for a GHS 300 000 loan from a bank, only to be offered GHS 100 000 due to lack of collateral and a guarantor, an amount too small to meet her business needs, which she declined. Note that, at the time of the data collection, one US dollar was equivalent to 14 Ghana cedis (GHS).
- *Aggregators/off-takers* similarly financed their operations mainly through profits and loans from family and friends. While willing to borrow from banks, they cited the slow disbursement process as a major deterrent: “I would like a loan from a bank but my challenge with this type of external loan, especially from a bank, is that it takes too long.”

Participating financial institutions (PFIs): Rural banks confirmed a preference for extending credit through farmer-based organisations or value-chain financing arrangements, although they remained open to direct lending to individual farmers depending on how the credit was structured. PFIs identified a need to partner with institutions that could provide cheaper sources of funds, enabling them to extend loans to farmers at lower interest rates, and stressed the importance of group- or value chain-based lending models as a way of building the confidence needed to expand credit supply.

4.2 Forms, terms and conditions of trade credit

Trade credit arrangements were broadly similar across the districts studied, although the specific terms varied locally. In the dominant model, a farmer receives inputs, cash or services (e.g. ploughing) directly from an input dealer, aggregator or other intermediary, and repays at harvest with a predetermined quantity of farm produce whose value is fixed at the time the input or service is advanced.

- For every three litres of weedicide taken (valued at GHS 150), the farmer repays with one bag of the commodity grown (e.g. one bag of maize or soybean).
- For every two bags of NPK fertiliser (GHS 600), the farmer repays three bags of the commodity grown (GHS 750 for maize, at the previous year's price).
- For every acre ploughed or paid for by an aggregator/tractor operator (GHS 150), the farmer repays with one bag of the commodity grown (GHS 250 for maize).
- For ploughing specifically, farmers repay one bag per acre regardless of crop. Tractor operators sometimes contract with farmer groups rather than individuals, holding the group jointly responsible for repayment; this is reported to ease access to tractor services, which are in high demand.

The above information comes from an FBO in Karaga.

In Techiman, the farmers suggested that the same principle applied but was calculated as a single monetary benchmark: every GHS 300 worth of input or service advanced was repaid with one 100 kg bag of maize at harvest.

Trade credit is typically drawn down for labour, seeds, weedicides, pesticides, tractor services and other inputs needed at the start of the major and minor farming seasons. Because the transition agroecological zone (Bono, Bono East and Ahafo regions) has a bimodal rainfall pattern, farmers there require credit twice a year (major season from March/April, minor season from July), while farmers in the Northern sector require it once, from around April. Participants noted that credit disbursed outside these windows risks being diverted to other uses, raising the likelihood of default. Farmers indicated a preference for in-kind repayment because it is due only after harvest, aligning repayment with income realisation. Where they considered formal bank credit, they specified two key conditions: (i) a moratorium tied to the maturity period of the crop, and (ii) a relatively low interest rate, with proposed rates ranging from 5% to 15%. A Savelugu FGD participant illustrated why unfavourable terms deter uptake:

Yes, there was a time when a bank came to provide loans for us. When we attempted to access the loan, the terms were unfavourable as the interest was 20%, after pleading they reduced it to 12%. Upon filling in the application form we were told the repayment schedule was monthly, hence we did not take the loan at all.

Farmers also expressed a strong preference for accessing credit as a group rather than as individuals, since group applications are seen to carry more weight with lenders. As a Techiman FGD participant explained:

We prefer taking loans as a group as this gives us more weight and credibility than as individuals. The group also serves as a guarantee to the bank, and we are more likely to get the loan than as individuals.

Timeliness of loans: The FGDs emphasised that timely disbursement, matched to the crop calendar, is critical for effective loan management and repayment. It was suggested that loan products be tailored to specific crops, rather than designed as a single generic product, since different crops carry different budgets that determine appropriate loan sizing and repayment timing.

Repayment culture: Stakeholder validation discussions suggested that difficulty in repaying credit in cash is not purely a function of the interest rate but also an attitudinal issue: farmers find it difficult to set aside cash from produce sales specifically for loan repayment. This points to a need to cultivate a stronger culture of cash-based transacting in the agricultural space, alongside continued reliance on the trade credit system. Instances of dishonesty among some farmers were also flagged as a factor undermining repayment.

4.3 Monitoring trade credit extended to smallholder farmers

Because trade credit is governed largely by oral rather than written agreements, monitoring and default management are handled informally, and on a case-by-case basis, by the intermediaries who extend it. When a farmer defaults, aggregators and other intermediaries typically engage the farmer directly to renegotiate a repayment plan, either by spreading payments over time or, where necessary, deferring the outstanding amount to be recovered as part of the following season's loan. Where a farmer cannot or will not repay, the sanction is exclusion from future credit: the intermediary simply declines to extend credit to that farmer again.

A further informal monitoring mechanism is the marketing obligation attached to trade credit: farmers who have received in-kind credit are expected to sell their produce to the financing intermediary, both to settle the specific debt and to preserve their standing for credit in subsequent seasons. This creates an implicit incentive for farmers to remain in good standing, functioning as a substitute for the collateral or guarantor requirements used in formal banking.

On the formal side, PFIs identified significant gaps in their own monitoring capacity. Rural Bank staff were reported to need technical training in agricultural financing, product development suited to specific value chains and, critically, loan monitoring and recovery support. Participants also highlighted the value of de-risking instruments such as insurance to complement credit appraisal and mitigate environmental risks (e.g. weather-related production shocks) that could otherwise undermine repayment. Value-chain and group-based financing were repeatedly identified as preferred monitoring structures, since group liability (as with the tractor-ploughing arrangements in Karaga) gives lenders greater assurance of repayment than lending to individuals.

4.4 Forms of in-kind payment

In-kind payment is the dominant repayment mode in the trade credit system used by smallholder farmers. Aggregators/off-takers extend credit to farmers in the form of cash, inputs (mainly seed and fertiliser), or paid-for services (notably tractor services for land preparation); in some cases, the aggregator hands cash to the farmer to make the purchase directly, while in others the aggregator pays the supplier or service provider on the farmer's behalf.

Repayment terms and in-kind conversion rates vary by district but follow a consistent logic: the monetary value of the input, service or cash advanced is fixed at the point of disbursement and converted into an equivalent quantity of the farmer's harvested produce.

In Techiman, every GHS 300 worth of service, input or cash advanced is repaid with one 100 kg bag of maize. In Karaga, every GHS 150 advanced is repaid with one bag of the crop the farmer cultivates.

Repayment is due at harvest, which farmers regard as the main advantage of in-kind trade credit over cash bank loans, since it removes the need to find cash before produce is sold. Cash repayment is accepted as an alternative where a farmer prefers it, provided the cash value is equivalent to the produce that would otherwise have been owed. Beyond settling the specific credit obligation, farmers are expected, although not formally obliged, to sell the remainder of their produce to the financing aggregator or intermediary. Farmers who sell elsewhere risk being denied credit in the following season, which in practice binds them to a single buyer for most or all their output.

4.5 Challenges of agricultural trade credit

Several challenges emerged across the trade credit system, affecting farmers, intermediaries and financial institutions alike:

- *Side-selling and default risk*: farmers sometimes sell their produce to buyers other than the aggregator who financed them, especially in areas with many competing buyers (e.g. maize and rice markets around Techiman), resulting in non-payment. This makes lending to farmers a risky undertaking for aggregators, even though the presence of multiple buyers does not expand farmers' access to credit only to alternative sales outlets.
- *Measurement and pricing inequities*: farmers reported being “cheated” by buyers to whom they are obligated to sell using oversized sacks and noted a lack of standardisation in market measurements. There is also no price differentiation between high- and low-quality grain, which removes any incentive for farmers to invest in quality improvement.
- *Dependency and reduced bargaining power*: because farmers are effectively locked into selling to their financing intermediary to preserve future credit access, they have limited ability to benefit from price improvements elsewhere, and aggregators are reported to withhold price information from farmers, further weakening farmers' market position.
- *Unfavourable formal credit terms*: There are high interest rates (up to 30% before negotiation) and repayment schedules misaligned with crop cycles (e.g. monthly repayment) that deter farmers and intermediaries alike from taking bank loans, reinforcing reliance on trade credit. However, intermediaries often do require credit to capacitate them to provide trade credit to farmers. Thus, access barriers to credit by intermediaries – processors, input dealers and aggregators for bank loans – pose a challenge to ATC.

5. Discussion

The findings point to an ATC system that has emerged largely to fill a gap left by the limited functioning of formal agricultural credit markets in the study areas, consistent with the financial market imperfection explanations of trade credit (Schwartz 1974; Emery 1984; Dary 2022). Where formal lenders such as rural banks impose collateral and guarantor requirements that smallholder farmers, processors, input dealers and even aggregators struggle to meet, informal ATC arrangements between farmers and value-chain intermediaries have developed as a functional substitute. This is broadly consistent with the central proposition of trade financing theory that trade credit exists precisely because formal financial intermediation is incomplete or imperfect (Schwartz 1974; Emery 1984; Dary 2022). At the same time, the finding that even intermediaries who extend credit to farmers are themselves credit-constrained complicates a simple substitution narrative: rather than trade credit compensating for a gap left by well-functioning banks serving the “upper” tiers of the value chain,

the constraint appears to run through the entire chain, from farmer to aggregator to processor and input dealer alike. This suggests that interventions aimed solely at farmer-level credit access may have limited impact unless the financing constraints facing the intermediaries who mediate most trade credit are addressed simultaneously.

The near-total absence of formal group-based bank credit among FBOs, despite farmers' stated preference for borrowing as a group, echoes a well-documented tension in rural finance – between the theoretical benefits of group lending (shared liability, lower transaction costs, implicit peer monitoring) and the practical reluctance of formal lenders to extend it without complementary risk-mitigation instruments. The rural banks' own diagnosis, namely that they need de-risking tools such as insurance, cheaper wholesale funding and stronger technical capacity in agricultural loan monitoring, indicates that the barrier to expanding group-based agricultural credit is less about farmer demand (which the findings show is present, conditional on favourable terms) and more about the supply-side capacity and risk tolerance of PFIs.

The pattern of in-kind repayment, with its harvest-time settlement and locally fixed conversion rates, functions as an informal moratorium mechanism that aligns repayment with the farmer's income cycle far more closely than most formal bank products currently do. This explains farmers' preference for trade credit over cash loans and reframes the demand for a "moratorium" in formal lending not as a request for concessional terms, but as a request that loan structures mirror the repayment logic already embedded in the informal system they trust. However, the finding that some farmers misunderstand moratoria as interest-free periods signals a financial literacy gap that could undermine the intended benefits of introducing more formal, moratorium-based agricultural loan products.

Informal monitoring and enforcement mechanisms, case-by-case renegotiation, deferral of unpaid balances to the next season and, most consequentially, the implicit obligation to sell future outputs to the financing intermediary, function as a relationship-based substitute for the collateral and legal enforcement mechanisms unavailable in formal lending. While this arrangement supports continued access to credit for farmers who might otherwise be excluded from formal finance, it also entrenches a form of buyer-financier dependency that constrains farmers' bargaining power, consistent with concerns raised in the interlinked credit-output market literature: financiers who simultaneously control both the credit and output channels are positioned to capture information (e.g. withholding price data) and value (e.g. using non-standard measures) that a fully competitive, unlinked market would not permit. The reported absence of quality-based price differentiation compounds this, removing a key incentive mechanism for the very grain-quality improvements that several processors and buyers require but that most smallholders currently cannot meet.

Side-selling, and the aggregators' understandable reluctance to extend credit as a result, illustrates a coordination failure inherent in interlinked but informal contracts: the same competitive buyer environment that should, in principle, benefit farmers through price competition also erodes the enforceability of trade credit arrangements, since farmers retain an outside option to sell elsewhere without formal consequence. This dynamic helps explain why trade credit, despite its evident value in enabling access to inputs that formal credit markets do not adequately provide (Bamidele *et al.* 2019; Gollin 2019), remains a comparatively high-risk and potentially unstable financing channel from the intermediary's perspective.

Taken together, the findings suggest that improving smallholder access to productive credit in this context will likely require a hybrid approach rather than a straightforward substitution of formal credit for ATC: strengthening PFI capacity (technical training, de-risking instruments, cheaper wholesale funds) to expand group- and value chain-based lending; designing loan products with moratoria and

repayment schedules matched to specific crop calendars; pairing credit provision with complementary investments in drying and storage infrastructure, and warehouse receipt systems to reduce distress selling. Finally, they also need to address the financial literacy and cultural/attitudinal factors shaping farmers' relationship with cash-based repayment. The additional suggestion, namely that women be prioritised in loan administration, given their reported stronger repayment performance, and that gender and disability-inclusive strategies be built into any future project design, further underscores that expanding and de-risking credit access in this basin's agricultural value chains is as much a design and institutional question as a purely financial one.

6. Conclusions

The aim of the study was to broaden the understanding of ATC and related issues that confront smallholder farmers in the agricultural zones in Ghana. It also aimed to distil the key issues that constrain farmers from demanding formal loans and their implication for the trade financing of their activities and other agricultural credit products.

The findings show that trade credit, not formal bank credit, is the primary mechanism through which smallholder farmers in the study areas finance their production, with intermediaries – aggregators, input dealers and processors – acting as the main financiers despite being credit-constrained themselves. The results further show that demand for formal credit exists at every level of the value chain but is suppressed by high interest rates, collateral and guarantor requirements, and repayment schedules that do not match agricultural income cycles. These push farmers toward informal, in-kind arrangements repaid in produce at harvest as trade credit. These arrangements are monitored and enforced largely through relationship-based mechanisms – case-by-case renegotiation, deferral, and the implicit obligation to sell to one's financier, rather than formal collateral or legal recourse, which sustains access to credit. The trade credit also entrenches farmer dependency, weakens bargaining power, and leaves both sides exposed to default risk from practices such as side-selling. The persistence of this system, despite its evident inefficiencies, underscores that trade credit functions as a rational response to gaps in the formal financial market, rather than a preference for informality as such. We conclude that to close these gaps will require formal lenders to redesign credit products around the crop calendar and group-based liability, and to invest in de-risking instruments. Also, it is necessary to develop staff capacity and to pair credit access with complementary infrastructure, such as drying, storage and warehouse receipt systems, so that trade credit and formal finance can begin to function as complements, rather than the informal system remaining the only viable option for most smallholders. By ensuring that smallholder farmers have better access to credit, the proverbial aeroplanes will have engines with which to fly.

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