

Article

Innovative Financial Approach for Agricultural Sustainability: A Case Study of Alibaba

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Received: 23 February 2018; Accepted: 19 March 2018; Published: 20 March 2018

Abstract: Sustainability and agricultural finance are two important issues attracting attention from industry and academia. This research adopts an in-depth case study methodology to investigate the agricultural finance initiatives of Alibaba Group, and explores how the agricultural finance practices of an e-commerce platform facilitate its sustainability goal. A reference framework is proposed to prove the adoption of agricultural finance. The influence of three moderating variables, namely, IT support, financial attractiveness, and cooperation with other entities, is analyzed. We find that advanced IT support and financial attractiveness are two indispensable enablers for agricultural finance initiatives, and collaboration with other entities is necessary in adopting agricultural supply chain finance.

Keywords: agricultural finance; sustainability; supply chain finance; China; case study

1. Introduction

Recently, concern about sustainability has risen in academia and industry. Faced with increasing pressures from global competition, community pressure, government regulations, and non-governmental organizations (NGOs), enterprises have recognized the importance of considering factors like social welfare and environmental influence when making operational decisions in this era of economic globalization [1–5]. Moreover, companies are searching for competitive advantage through environmental sustainability and social responsibility [6,7]. Up to 90% of the world's 250 largest companies report on their social performance, and 67% of them commit to cut their carbon emissions in 2017 [8].

Despite increasing attention and efforts to address social and environmental issues in operations, two aspects of sustainability research have been ignored. Relatively few studies explore sustainability in the agricultural section, notwithstanding the considerable diverse research on sustainability in non-agricultural sections, like manufacturing, electronic, logistics, retailing, and energy industries [9]. As a basic industry, agriculture is essential to society, especially in developing countries where agriculture accounts for a relatively large share of total economic output [10] and is closely related to poverty alleviation [11]. In terms of financial means, only a small amount of effort has been exerted to promote sustainable development; methods applied by enterprises mainly focus on technology, products, and production [12–14]. Poor access to capital for farmers can be an obstacle to the implementation of sustainable agricultural technologies and practices in underprivileged regions [15,16].

Moreover, financial means, such as microcredit, are effective in reducing poverty by raising per capita household consumption for borrowers [17,18]. Therefore, finance is an important driving force for the sustainable development of agriculture in underdeveloped regions. However, few studies explore and analyze the relationship between corporate effort in finance and sustainability. Researchers

often study firm sustainability in the context of supply chain operations, such as transportation, warehousing, packaging, and distribution. We notice that certain e-commerce platforms in China, such as Alibaba Group (Ali), have been carrying out agricultural finance business to promote sustainable development. Ali is an influential e-commerce platform in China. Concerned with China's sustainable development and agricultural issues, Ali started to conduct agricultural finance through its affiliated company—Ant Financial Services Group (AF)—in 2014, hoping to solve rural financial problems. The latest data of rural finance released by AF show that its agricultural finance services cover all provinces and cities nationwide (Hong Kong, Macao, and Taiwan), including 231 cities and 557 counties.

Inspired by Ali's agricultural finance practices and their achievements, this study aims to investigate how agricultural finance solutions can promote agricultural sustainability. To illustrate the complex perspectives associated with implementing agricultural finance and examine the causality, we apply an explorative single case study to answer the following questions:

- RQ1. What are Ali's motivations to adopt agricultural finance and what specific agricultural finance solutions does Ali provide?
- RQ2. What are the main factors affecting the adoption of agricultural finance, and how do they affect the implementation of agricultural finance solutions?
- RQ3. How do these agricultural finance solutions perform?

2. Literature Review

2.1. Agricultural Finance

Agricultural finance focuses on the acquisition and use of financial capital by agricultural sectors [19]. The agricultural finance market is subject to highly asymmetric information, which triggers different rations from lenders that leads to credit constraints on farmers and small agricultural farms [20,21]. Asymmetric information forces lenders to exert extra effort in evaluating and monitoring the financial performance of rural borrowers, consequently increasing financial cost [19]. Lenders impose high interest rates to farmers, blocking them from affordable financing, and this lack of access contributes to financial exclusion in the agricultural financial market [22]. Researchers call for the specialization of agricultural financial lenders [19,23] to reduce the adverse influence of credit constraints on resource allocation and productivity and realize the positive effect of credit availability on productivity growth [21,24].

The problem of credit constraint is severe in the rural areas of developing countries for two reasons. On the one hand, the agricultural finance market is not a completely free market in that financial resources cannot freely flow [25]. Government regulation and policy implementation with low efficiency have considerable adverse influence on rural finance in developing countries, increasing financial risks despite motivating financial innovation [26]. On the other hand, formal financial institutions are relatively large, and they lack flexibility to offer effective agricultural finance; thus, providing loans to farmers and agricultural small and medium-sized enterprises (SMEs) is more costly for these financial institutions than for informal ones [27]. To relieve severe financial exclusion in the rural markets in developing countries, informal lenders are recommended to complement formal financial institutions to monitor individual borrowers and provide them with low collateral financial services [28,29]. Informal lenders can be moneylenders, traders and agro-processing firms. They adopt different monitoring mechanisms which would be expensive, or even impossible for banks. Besides, informal lenders can interlink the terms of the transactions in the credit market with those of transactions in the product markets [30]. For instance, a trader-lender may offer lower prices on fertilizers and pesticides to farmers who borrow from him because the use of these inputs reduces the probability of default. Moreover, informal lenders offer attractive loan contract terms with respect to collateral requirement compared to the formal institutions [29].

To cope with the shortage of collateral from the poor and the difficulty in finding credit records, microfinance employs technological innovations, such as peer insurance and peer assessment of lender creditworthiness and accompanying liability for breach of contract [31]. Microloans are flexible in supporting the seasonal production of farmers at the micro level [23], whereas microcredit can reduce rural poverty at the macro level [17,18,31]. Utilizing the financial technology innovation of microfinance is a new means to broaden credit access in rural sections, increasing inclusiveness of agricultural finance.

The stream of research on agricultural finance has grown in recent years, especially in developing countries. Although agricultural finance has been studied for decades, the focus is mostly on the factors related only to its implementation and importance to economic development or social welfare. Few studies cover the technical, economic, and social aspects of agricultural finance. Thus, agricultural finance should be investigated under a complex lens.

2.2. Sustainability and Agricultural Sustainability

In 1987, the report of the World Commission on Environment and Development *Our Common Future*, known as Brundtland Report, was published. The report clearly defines the concept of sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, calling for the active participation of all sectors of society in promoting sustainable development [32]. The goal of sustainable development is to realize the harmonious operation of three subsystems, namely, economy, society, and ecology [33], which is later captured in the triple bottom line (TBL) perspective [34]. Many researchers contribute to the interpretation and measurement of sustainability. The five principles of sustainable development are comprehensiveness, connectivity, equity, prudence, and security [35]. A three-circle metric is developed to show the different sub-subjects of sustainability, and multiple performance indicators of sustainability are introduced [36].

However, the three aspects of sustainability do not receive equal research attention from the limited literature on how to integrate environmental and social impacts in practice [37,38]. Although an increasing number of organizations take sustainability as a crucial part of their business strategy [1,37,39], the analysis of sustainable operations focuses mainly on individual dimension sustainability, whereas complex sustainability perspective is insufficient [38,40].

In the specific case of agriculture, researchers explore technologies and practices to reduce adverse effects on the environment [41] and mechanisms to incentivize sustainable agricultural practice [15]. In practice, means to increase agricultural sustainability focus on environmentally friendly agricultural technology and production [12,41]. Although these technologies are effective in reducing waste emission and resource consumption, they may not be adopted by farmers in underprivileged regions because of their poor access to capital markets [15,16]. On the contrary, inclusive credit access positively influences technological efficiency in poor countries [42]. In addition, extant literature shows that financial means is effective in reducing poverty, thereby improving the social aspect of sustainability in rural regions [17,18].

Studies on agricultural sustainability emerge, but few address the relationship between finance and agricultural sustainability. Meyer [43] addresses sustainability and rural financial service simultaneously, and shows that introducing microfinance to rural areas to meet the financial demand of rural population can contribute to sustainable credit supply. However, the sustainability of microfinance is limited in terms of the inclusiveness and efficiency of financial service, omitting the environmental effect. Hence, the influence of agricultural finance on sustainability is an interesting research direction.

3. Research Methodology

A case study is a useful research method for preliminary investigation [44]. Considering the focus of case study and its irreplaceable features, case-based research questions of “why” and “how”

are required [44,45]. Given the exploratory nature of this method, in-depth case study is adopted to investigate the agricultural finance practice of a company and its relationship with sustainability goals. Specifically, this study discusses the current agricultural finance business of AF, which is affiliated with Ali from a sustainability perspective. This study probes into “why” Ali applies and “how” Ali implements agricultural financial service. As we seek to provide a newfangled story and a detailed exploration of a particular case, Ali, this study thus follows the advice of Dyer and Wilkins [46], that a single case study is more suitable in providing a rich description of context and deep insight into social dynamics and generating a new theory, than multiple case studies.

3.1. Research Framework

A case study initially considers the research questions and framework [47], so we design a research framework (see Figure 1) to answer our research questions. The adoption of a certain agricultural financial solution is the dependent variable, and the objective to adopt different agricultural finance solutions is the independent variable. We first analyze the causal relationship, and then investigate the influence of four moderating variables on the causal relationship between the motivation and practice of different solutions. The outcomes of agricultural finance solutions are also evaluated from a sustainability perspective.

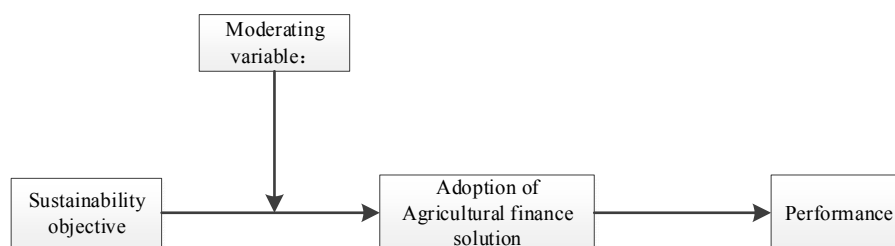


Figure 1. Research framework.

3.2. Case Selection and Data Collection

3.2.1. Case Selection

Ali is the largest business platform enterprise in China that was released as an online marketplace in December 1999 by Jack Ma and 17 other founders. Taobao was founded as a consumer e-commerce platform in May 2003. In 2004, Alibaba started to provide third-party payment (TPP) service—Alipay—as a separate business, allowing money to be wired from bank accounts to Alibaba. In April 2008, Taobao established Taobao Mall (Tmall.com) as its B2C portal, complementing its consumer-to-consumer portal (Taobao). After 10 years of development, Ali established Alibaba Cloud Computing in September 2009. Ali announced a plan to earmark 0.3% of its annual revenues to fund environmental protection initiatives in May 2010. Two years later, Ali decided to take its publicly traded Alibaba.com private, delisting from the Hong Kong stock exchange. In 2014, Ali was valued at 25 billion dollars in its Initial Public Offerings in United States, becoming the largest IPO in the history of listed companies. As the largest e-commerce retail platform in China, Ali’s total transaction amount was 3.77 trillion dollars in 2017, surpassing the gross domestic product (GDP) of Sweden. In July 2017, Ali became the first Asian company to break value mark of 400 billion USD with 507 million active buyers. All these facts make Ali the world’s largest mobile economy entity, and second only to the world’s top 20 economy entities.

Alipay was rebranded as AF on 16 October 2014. Now, AF is valued at roughly 70 billion dollars or more. In April 2016, AF had around 450 million annual active users, with Credit Suisse estimating that 58% of China’s online payment transactions went through AF. The latest data of rural finance released by AF report that by the end of February 2017, the number of AF users in payment, insurance, and credit service reached 167 million, 142 million, and 38.24 million, respectively.

In China, many e-business platforms have emerged in recent years, and leading business platforms have started agricultural finance business. Among these platforms, Ali is especially worth studying for several reasons that contribute to its representativeness [48]. First, Ali's corporate culture and vision is consistent with the research background of this article because Ali is committed to promoting the sustainable development of society. Ali has started to make an effort to protect the environment since 2010 and has set agricultural business as one of its strategies for the next decade. Since 2014, its agricultural finance business has been implemented by a professional department in its affiliated company—AF—to offer a wide range of financial services. On 19 January 2017, AF and the United Nations Environment Programme (UNEP) initiated the Green Digital Finance Alliance at the World Economic Forum in Davos, which is the first international alliance set up by UNEP in cooperation with a Chinese enterprise. Second, the strong economic capability of Ali guarantees that AF can provide inclusive agricultural finance, which requires great front capital investment. Besides, Alibaba operates comprehensive e-commerce businesses, including customer-to-customer retailing platform (Taobao), business-to-customer (B2C) retailing platform (T-Mall), online rural marketplace (Rural Taobao), and third-party payment (TPP) service (Alipay), thereby providing AF with a strong business setting for agricultural financial business. As one of the largest e-commerce platforms in the world, Ali's market capitalization exceeded 470 billion USD in 2017, surpassing that of Amazon. Third, AF is an IT company with a strong technical team, enabling the provision of innovative online financial solutions. On 11 November 2017, T-Mall created a one-day trading record of 168.2 billion yuan, and the maximum number of payments reached 256,000 times/second. Behind this record is AF's powerful data processing capability.

3.2.2. Data Collection

A complete case analysis includes data collection, coding, memos, and the script [45]. Following Corbin and Strauss [45] and Yin [48], this case study starts with data collection. Supportive information on critical application models in the agricultural finance business of AF is collected from multiple sources with guidance from Corbin and Strauss [45]. In-depth interviews are conducted with top managers who exert critical influence on the development of agricultural business in AF. Guided by a semi-structured protocol, face-to-face interviews last approximately 120 min. Guidelines included questions aiming to investigate the context and development of AF's agricultural finance and the problems in operations. Company internal information, such as annual reports, is collected. Information about the agricultural business of AF is also searched in social media, such as Weibo, WeChat, and other information channels.

The credibility of a case study can be increased by prolonged engagement, persistent observation, triangulation, referential adequacy materials, peer debriefing, and member checks (Lincoln & Guba, 1985). To increase construct validity, an interview of two experts together with information from other sources is used to triangulate the information provided by the interviewees [49]. Our prolonged engagement in the case allows us to verify the details in the operations of Ali's agricultural finance. In addition, the descriptive precision of the case is validated by the material sent by the interviewer during interview.

3.3. Coding and Data Analysis

Interview tape recordings are transcribed into textual material to facilitate coding. We follow the procedure proposed by Corbin and Strauss [45] to conduct coding and data analysis. Each researcher first codes the data independently. We then compare all the codes with coding in relevant literature to ensure reliability. Finally, the coding leads to the final explanation needed to construct the research framework.

An open method is adopted for coding to generate concepts and build a research framework. The original textual interview materials are labeled with different colors according to meanings. All tagged quotations are then translated into codes to derive concepts. Finally, similar concepts are classified

into categories with reference to the TBL perspective. Resulting concepts are constantly compared with corresponding descriptions to prevent bias and achieve great precision and consistency. Table 1 demonstrates the coding results.

Table 1. Examples of codes.

Category	Codes	Original Quotes
Objective Society	Social equality promotion	"We want to provide inclusive finance to serve all customers and SMEs equally"
	Peoples' wellbeing promotion	"We hope to bring convenience to rural life by helping farmers buy and sell products"
Objective Economy	Occupying rural and agricultural markets	"We find that traditional banks have missed a big market—rural financial market. It is our chance to grant consuming loans and business loans to ordinary peasantries to seize this market"
	Creating long-term agricultural industrial ecology value	"Profit is not our short-term goal for rural market. We care about industrial ecology value more than mere value of financing"
Objective Environment	Promote green agricultural production	"We hope to guide farmers to use environmentally friendly products to control raw materials used from the very start"
Performance Society	Accelerate agricultural development	"We plan to cooperate with more other big retailers and manufacturers to integrate scattered farmers to achieve agricultural intensive production"
	Benefit farmers' production and life	"Wang Nong Bao is a comprehensive insurance solution that includes all kinds of insurances for agricultural production such as agricultural product quality insurance and agricultural price index insurance. It has served 130 million farmers till now."
	Improve business of partners	"Cooperating with us, traditional financial institutions can enlarge their business" "We help to relieve the cash pressure for our supplier companies"
Performance Economy	Food safety	"We are working with Wal-mart on food safety problems related to hundreds of thousands of urban consumers"
	Business expansion and innovation	"Our agricultural finance business grows out from our business in rural places"
	New profit growth	"We have done a lot that banks have not done" "Only this platform is built up, can it (agricultural finance) be won from the national level"
Performance Environment	Green production	"Ali is known as a company of great feelings that is dedicated to the sustainable development of society"
		"Farmers can only use the purchase quota to buy specified products. Thus, production can be controlled from source material"

4. Case Analysis and Results

4.1. Case Description

In practice, AF designs four financial models to serve individual farmers and agri-businesses and promote agricultural sustainability.

4.1.1. Model 1: Supply Chain and Industry Model (to Business)

This model is essentially a supply chain finance (SCF) solution, which accounts for the most important one among all the finance models in AF's agricultural business because of its ability to promote sustainability from all three aspects. Figure 2 reveals the implementation of this model.

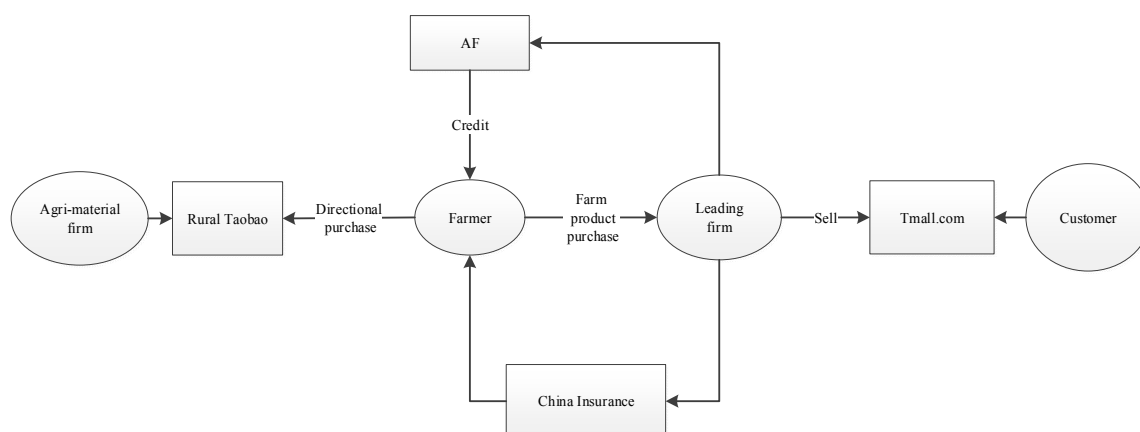


Figure 2. Supply chain and industry model.

Farmers usually face poor access to markets, and many of them sell their products on the local free market [50]. To help farmers sell products and accelerate reproduction, Ali applies agricultural SCF (ASCF) by cooperating with large agricultural processors. These agricultural enterprises purchase farm products from farmer suppliers. They either sell processed products directly at their online stores at T-Mall or sell final products to the supermarket owned by T-Mall. Ali functions as the bond among all entities: AF acts as the payment and settlement agent, and T-Mall functions as the intermediate retailing platform. A three-tier agricultural supply chain is formed when these enterprises sell their products to T-Mall supermarket, and then T-Mall supermarket sells products to consumers. In this supply chain, Ali is the retailer, and agricultural processors and farmers are Ali's first-tier and second-tier suppliers, respectively.

Farmer suppliers' capital needs are being met through AF with *Designated Purchase Credit* quota. AF deducts the procurement cost from the firms' sales revenue. When the procurement cost has been paid off, the rest of the sales revenue remains in the Alipay account of the firms. Farmers can only use designated purchase credit to purchase specific production materials and tools that are typically green brands from Rural Taobao, Ali's online rural marketplace. Cooperative agricultural firms provide technical support and guidance to farmer suppliers. Thus, there is additional information flowing from leading firms and AF to farmer suppliers to update and educate them about environmentally sound production processes and product requirements as recommended in the study of Ragatz, Handfield [51]. To secure the supply chain, the production of farmer suppliers and payment from the leading firm is insured by China Insurance (CI), which is the second oldest insurance company in China. As a state-owned enterprise, CI has greatly contributed to China's public welfare by offering a wide range of supportive insurance for agricultural production and farmer benefit.

The sales of products and acceleration of payment is enabled by two closed loops in the "supply chain and industry" model. One is the loop of payment. Farmers obtain designated purchase credit quota from AF, then purchase from Rural Taobao with the credit. During sale season, urban consumers buy finished products from T-Mall and pay with Alipay. When sales are realized, firms receive profit after procurement cost is deducted. A closed loop of capital flow is formed among the Alipay accounts of all parties in this supply chain. The other closed loop is the loop of products. Finished agricultural products and raw materials for production are all sold on two retailing platforms of Ali, namely, T-Mall and Rural Taobao, constructing a closed loop.

4.1.2. Model 2: Online and Offline Lending Model (to Business)

Agricultural SMEs usually experience difficulties obtaining loans from banks when they do not have credit records and their business sizes are small. Many of them have never cooperated with Ali before. How can AF reach them with insufficient information at the lowest cost? Without close cooperation at the supply chain level, reducing risk posted by insufficient information is a challenge. The need to share lending risk with other entities gives rise to the second model named as the “online and offline” model, which is demonstrated in Figure 3. AF cooperates with China Foundation for Poverty Alleviation (CFPA) and CI to provide loans to small agri-businesses. As one of the largest and most influential public organizations in poverty alleviation and public welfare in China, CFPA works closely with households in poverty. Owners of small agri-businesses report their financial needs to CFPA, and CFPA recommends real needs of owners with integrity to AF after checking and confirming their information in offline databases and field surveys. After further credit assessment, AF then includes these agri-businesses in the client database and lends money that is raised from urban individual investors to small business owners with certain interest rate, insured by CI. In this scenario, AF functions as the credit data evaluator and the bridge between capital demand and supply. With loans from AF, a small agri-business can purchase vehicles and production equipment to extend their scope of business. Urban individual investors can invest their spare fund in rural businesses.

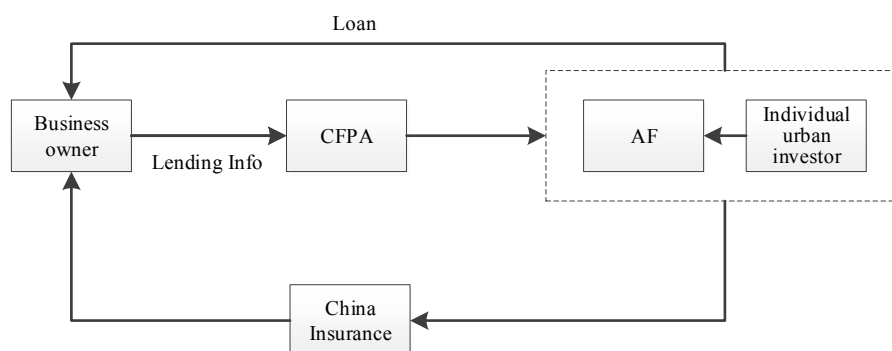


Figure 3. Online and offline lending model.

4.1.3. Model 3: Platform Data and Credit Model 1—Microcredit (to Individual)

Farmers have inadequate purchasing power because of liquidity constraints from seasonal payment [52] and absence of credit cards from limited bank access [53]. To improve the consumption level of ordinary farmers and growers, AF offers Microcredit product “Ant Check Later” to satisfy their everyday financial needs, as illustrated in Figure 4. The consumption level, repayment ability, and credit level of customers are evaluated based on their purchase and payment records from the platform. On the basis of personal evaluation, AF grants a monthly credit quota to each customer for consumption on T-Mall and other cooperative business entities.



Figure 4. Microcredit to individual.

With Microcredit quota, farmers can shop on T-Mall this month and pay the bill next month without interest. Credit is interest-free for up to 41 days. Payments can be made in installments at three-, six-, nine-, or 12-month intervals with interest rates varying from 2.5 percent to 8.8 percent. In this sense, Ant Check Later functions like credit cards. When shopping on T-Mall and Taobao, consumers can “buy first pay later” even without credit cards.

4.1.4. Model 4: Platform Data and Credit Model 2—Microloan (to Individual)

Farmers need cash to pay offline bills, such as education fees, which cannot be satisfied by Microcredit. In addition to Ant Check Later, AF provides a personal loan product to individuals, which is called Jiebei, which means “just borrow the money”. Jiebei allows each user a certain lending quota according to their credit level and repayment record. As shown in Figure 5, Jiebei is a Microloan that enables borrowers to withdraw cash after successful application. Jiebei is available to farmers as long as they have Alipay accounts and no bad records. The repayment condition is flexible, as the repayment starts immediately after loan disbursement. The risk of lending to farmers is controlled from two aspects. First, the credit level and loan quota are calculated based on the transaction and repayment records of users. Second, farmer users are suppliers of Ali. The sales revenue of the farmer’s products and his loan bills are in the same Alipay account, which is monitored by AF. If the farmer fails to pay the loan off by repayment due date, then Ali will charge an overdue fee each day. Once overdue repayment occurs, the loan quota of the user is reduced and even service permission becomes limited.



Figure 5. Microloan to individual.

4.2. Case Analysis

Analysis is conducted according to the research framework. A typology matrix is first applied to describe the four agricultural finance solutions that AF practices. Ali’s objectives to conduct agricultural finance are then elaborated. Afterward, the TBL framework is applied to analyze the performance of the practices. Finally, the influence of the moderating variables on the relationship between objectives and practices is analyzed.

4.2.1. Typology of Agricultural Finance Solutions

To further make sense of the four models, we classify Ali’s agricultural finance business solutions (Table 2). Contingency theory suggests that there is no single optimal answer to all complex decisions. They should be made contingent on various external factors [54]. AF classifies its rural customers into two groups (individual and business). This classification is based on the difference in the type of financial need and volume of financial demand. Individual farmers need financial services mainly for their daily expenses, whereas agri-businesses need financial support for business maintenance and expansion. The capital demands of businesses far exceed that of individuals. In addition, capital flows differ in operations. Financial products can also be categorized into two types: credit and cash. Two client groups and two product types constitute a two-dimensional matrix, which can describe the four agricultural finance solutions: Microcredit, Microloan, supply chain and industrial model, and online and offline lending.

Table 2. Typology of agricultural finance solutions.

		Type of financial product	
		Credit	Cash
Customer type	Business	Supply chain and industry model	Online and offline lending
	Individual	Microcredit	Microloan

The top-left quadrant of Figure 6 encompasses SCF solutions in the form of credit, which functions as advanced payment to farmer suppliers of corporate clients in the supply chain [55,56]. The “supply chain and industry” model employs SCF to eliminate delay payment to suppliers and involves large

manufacturers to buy farm products by batch and provide technical support to farmers. Designated purchase credit to farmer suppliers is an example solution, showing a complex application of online SCF by an e-commerce platform in agriculture, which is worth emphasizing.

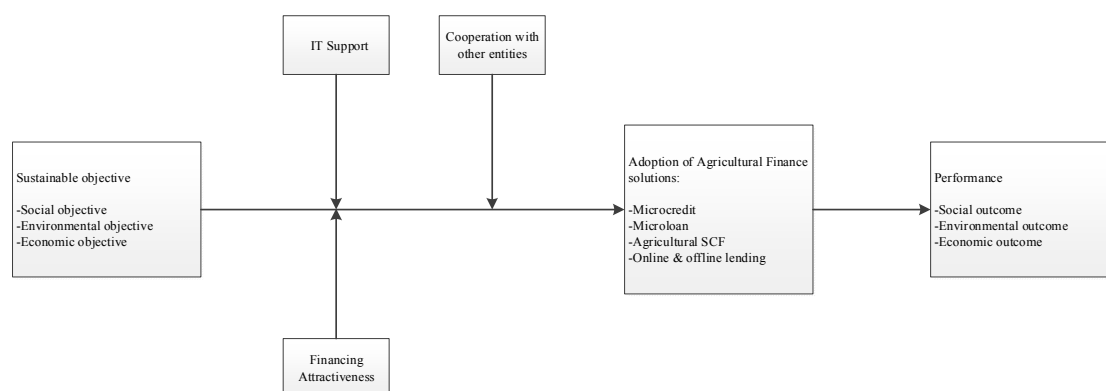


Figure 6. Reference framework.

The top-right quadrant illustrates loan solutions for small agri-businesses to broaden their credit access [27]. The matching of online capital supply and offline demand is realized through the cooperation between online financial and offline information providers like NGOs.

The bottom-left quadrant features short-term, interest-free Microcredit products for individual consumption. Microcredit improves the purchase power of individual consumers [28] and increases their willingness to pay and brings sales [57]. Individual farmers (those who have opened accounts on T-Mall and Alipay) shop on T-Mall or Taobao, and pay with Alipay. All historical behavior information is recorded and used for personal evaluation by Zhima Credit, an independent third-party credit agency of AF. Zhima Credit exploits cloud computing and machine learning technologies to analyze the credit level of consumers and calculate their credit scores, called Zhima Credit Score. Based on these scores, AF decides, updates, and grants monthly Microcredit quota to each user.

Finally, the bottom-right quadrant includes Microloan products to alleviate fund shortage of individual farmers [23]. These products aim to provide farmers with easy access to loans. Online personal loan service differs from personal loan from banks in terms of application process, mortgage requirement, and repayment condition. On the one hand, applying for Jiebei service is simpler than that of personal bank loan because Microloan credit assessment is also based on Zhima Credit. Zhima Credit can objectively show the credit status of individuals because it collects both platform and government data. On the other hand, Jiebei users can obtain loans without any mortgage, which is enabled by powerful credit agents and the risk control system of AF.

4.2.2. Motivation for Agricultural Finance Solutions

The objectives to practice agricultural finance from the interview records are summarized using the TBL framework and sustainability metrics [34,36]. Each objective does not result in the independent implementation of a certain agricultural financial solution. Instead, all solutions work together as the driving force that leads to the adoption of agricultural finance business.

Social Objective

Corporate social responsibility is an important motivation for companies to exert efforts for social benefit [58]. To support the development of small agri-businesses, AF adopts the “online and offline model” to provide them with business loans. To improve the daily consumption level of individual farmers, AF grants them with Microcredit, allowing late payment. Individual farmers can also avail of convenient Microloan to relieve temporary fund shortage. In an attempt to increase agricultural

commercialization and accelerate production, Ali provides ASCF by constructing a closed-loop supply chain with leading agricultural manufacturers and farmers. The concern about people's wellbeing motivates Ali to solve the food safety problem in China, which gives rise to the design of designated purchase credit in the "supply chain and industry model" to control materials used in cultivation and production.

Environmental Objective

Environmental sustainability is a critical objective that cannot be ignored [5,44]. As a leading retailer in the agricultural supply chain, Ali is concerned about environmental issues. However, Ali cannot ensure the green production of its suppliers [59]. Intending to reduce environmental pollution in agriculture, Ali uses SCF as an incentive mechanism to promote green production in the upstream supply chain. Farmer suppliers are encouraged and guided to buy environmentally friendly fertilizer and pesticide with designated purchase credit. The motivation to control non-toxic and harmless production from the very start drives the adoption of ASCF solution.

Economic Objective

The main goal of a company is to generate profits and grow [60]. Economic goal is indispensable when a company seeks sustainable operations because sustainable practice is a costly task that cannot survive long term without profit. Conducting business in agricultural finance is not pure philanthropy. The CEO of Ali, Jack Ma, has viewed agricultural finance as a blue sea worth exploring, one with great long-term commercial value. Driven by Ma's foresight and ambition to occupy the agricultural finance market, Ali invests capital to establish a platform for agricultural production to create an ecosystem for agriculture.

Based on the investigation of Ali's motivation to adopt agricultural finance, we propose that:

Proposition 1. *Sustainability objective can motivate companies to adopt agricultural finance solutions.*

4.2.3. Outcomes of Agricultural Finance Solutions

The outcomes are analyzed in the TBL framework.

Social Aspect

Ali's agricultural finance accelerates agricultural production and promotes social welfare [18,24]. Farmers benefit from ASCF, Microcredit and Microloan, as their production and living needs are better satisfied by increased purchasing power brought by credit and loan access than before [28]. Cash pressure experienced by Ali's supplier companies is reduced because Ali pays their farmer suppliers with purchase credit, greatly improving the financial performance of supplier companies. Certain food with Ali's green certification is available on T-Mall, and life-cycle information of these products is traceable. Despite the lacking system and limited categories, Ali's green food project is making optimistic growth. Traditional financial services are not socially sustainable because their high requirements for collateral block farmers from financing their needs, which aggravates financial exclusion and broadens social gaps between urban and rural regions. Despite the dependence on the network, AF's agricultural financial services contribute to the social equity by providing available, affordable, and convenient credit and loan access.

Environmental Aspect

The environmental gain from agricultural finance is a critical part of its sustainable performance, which is the aspect usually omitted in many previous research studies on financial solutions. Environmental sustainability is mainly achieved by the innovative practice of "supply chain and industry" model, which is essentially an ASCF solution. The designated purchase credit in this mode is effective in constraining the farming material selection of farmers because designated products

are usually from Ali's cooperation green brands. In this approach, farmers are guided to abandon cheap but contaminated fertilizers and pesticides they used in the past when they were strapped for cash and turn to environmentally friendly products such as Chia Tai fertilizer for planting and breeding. This outcome shows that SCF is an effective incentive to enhance supply chain cooperation and improve the environmental performance of the entire supply chain [39].

Economic Aspect

Adopting agricultural finance solutions can promote the competitiveness of adopters [61]. On the one hand, agricultural finance can bring corporate profit and economic growth, resulting in business expansion. According to recent data, farmers account for a large proportion of Chinese online consumers. In 2017, the retail sales in rural areas in China amounted to 1224.48 billion yuan [62]. Granting Microcredit to consumers increases their purchasing power, which turns originally impossible customers into actual ones. The grant also increases the willingness of consumers to pay [57], and retailing sales volume of adopters can grow. In addition, payoffs resulting from financial services bring profit to adopters. On the other hand, implementing agricultural finance improves the company image of adopters, thereby enhancing the competitiveness of enterprises. Sustainable operations in a supply chain, such as ASCF solution, can also contribute to a successful supply chain relationship through enhancing trust [63]. Competitive advantage and improved supply chain relationship contribute to the sustainable development of companies economically.

The findings from above are summarized in Propositions 2a, 2b, and 2c.

Proposition 2a. *Innovative agricultural finance solutions enable companies to achieve their social sustainability objectives.*

Proposition 2b. *Innovative agricultural finance solutions enable companies to achieve their economic sustainability objectives.*

Proposition 2c. *Innovative agricultural supply chain finance solutions enable companies to achieve their environmental sustainability objectives.*

4.2.4. Effect of Moderating Variables on the Practice of Agricultural Finance Solutions

The moderating variable analysis explains the effect of factors on the relationship between objectives and adopted solutions. Three moderating variables are identified, namely, IT support level, financing attractiveness, and cooperation with other entities.

Effect of Advanced IT Support

IT support level, as highlighted by AF managers, is one of the most relevant factors in implementing agricultural finance solutions. Ali has invested heavily in advanced technologies, such as big data, cloud computing, face recognition, and AI technology; fintech has brought tremendous advances to the finance market [64–66]. A similar factor is the digitalization of the transaction process, which is taken as one critical moderating variable in adopting financial solutions in a supply chain [55]. A general concept, IT support, is applied in this article because the financial services discussed are all web-based digital.

In the interview, AF managers highlighted the importance of fintech. Fintech is the portmanteau of "finance" and "technology," referring to technology used to deliver financial solutions [64]. Big data and cloud computing enable the calculation and evaluation of individual credit level, making rural financial service possible under imperfect credit systems. AI technologies reduce human intervention and labor costs. Face recognition technology helps complete the credit information of rural individuals and confirm user information. Mobile internet-based financial applications with friendly customer interface have also been attracting a large number of rural customers [66]. Fintech contributes greatly

to Ali's implementation of online agricultural finance solution in five major areas: rural finance and urban investment, risk management and control, TPP (Alipay), data security and monetization, and customer interface [64].

IT support benefits customers from two aspects. On the one hand, IT support makes innovative agricultural financial service available. The "platform data and credit model" is a typical service enabled by big data and data mining technology of cloud-based retailing and financing platforms. On the other hand, IT support makes financial service convenient. Advanced technologies, such as AI technique, enable financing platforms to make real-time and intelligent decisions. As addressed by a financial manager, "small and micro loans applicers can enjoy" "310 experience", which is 3 min to fill the application form, 1 min to finish credit check, and zero human intervention."

To financial providers, risk management system is powerful in monitoring and controlling risks, making it easier and cheaper to provide financial services in rural regions than traditional financing. The risks of "Microloan" and "online and offline lending" are controlled by a three-stage risk control method. Facial recognition technology is used to confirm user identity in the first stage (i.e., pre-loan stage). Multi-dimensional data from different channels are then used to evaluate credit level in the second stage (i.e., loaning stage). Finally, loan fund flows are monitored online at any time in the third stage (i.e., after-loan stage). Another critical technique that enables agricultural finance solutions is TPP method. TPP via mobile devices is suitable for customers in rural regions, where the availability of infrastructure, such as banks and ATMs, is poor. The Global Findex data shows that 10% of adults reported have a mobile money account only (no bank account) in East Africa, and that 26% of China's rural population did not have a bank account in 2014 [53]. Thanks to the rapid development of 3G and 4G mobile networks, rural residents can access the Internet through mobile devices, such as mobile phones, in China. This situation gives rise to the growth and prevalence of mobile TPP with 502 million Chinese using mobile payment [67]. Different from other payment methods like cash and credit card, mobile TPP method is not constrained by time and distance. Alipay accounts for more than half of the mobile payment volume in 2016, dominating the online payment market in China [68]. Ali's extension of finance business is based on alliances with other financial institutions linked through Alipay [69]. Having its own payment method means having control over capital flow, which brings other benefits to companies. For instance, the precondition of designated purchase credit in the "supply chain and industry model" is the settlement control enabled by Alipay.

The analysis confirms that a high IT support level enables the adoption of innovative agricultural finance solutions, which can be summarized in the following proposition:

Proposition 3. *Advanced IT support enables innovative agricultural finance solutions.*

Effect of Financing Attractiveness

Financing attractiveness is another critical moderating variable. Financial attractiveness is the bargaining power of focal companies toward financial institutions when seeking to improve the financial performance of their upstream/downstream supply chain [55]. Recent literature has confirmed that it is the ability of microfinance institutions to provide desired loan amounts to small users [70]. As financial solutions in this context are not merely financially oriented, financial attractiveness is divided into that toward cooperative institutions and that toward customers in this research. Financial attractiveness toward cooperative institutions refers to the appeal of large customer base, whereas that toward customers refers to easy availability and convenience of financing. These aspects are coded as financial attractiveness of agricultural finance adopters.

Providing ASCF and "online and offline lending" solutions requires offline teams and resources to manage offline farmer suppliers and collect the offline information of clients. The major strength of AF as a light asset company lies in its online capabilities, whereas its offline resources are not comparable with traditional financial institutions. Besides, AF needs insurance from other financial companies to

secure its provision of financial products. Thus, AF must attract these financial institutions to work with. Its large customer base is attractive to them for the ability to bring business.

AF also needs to attract customers by providing favorable services to meet their needs. Scarce credit access is the first urgent financial problem of rural clients. According to our interview, low financing rate may not be the prime appeal to SMEs and individual debtors. Although the interest rate of Jiebei (Microloans to individuals) can be higher than that of other loans from banks, Jiebei lending remains indispensable for three reasons. First, Jiebei is more available to rural debtors than bank loans. Farmers may not be eligible for bank loans, but as long as they have Alipay accounts and transaction records, they can apply for Microloans from AF. Second, Jiebei allows flexible repayment condition and loan amounts. The flexible repayment condition is the main reason why Microloans are an advantage [70]. Farmers usually only need short-term and small loans, for example, a one-thousand-yuan loan for 20 days. Despite the higher interest rate, the total interest is lower than that of bank loans. Third, convenient financing due to the prevalence of Alipay is another attractive aspect for customers. All these advantages attract customers to use AF.

To summarize, based on the importance of attractiveness to cooperative financial institutions and rural customers, it is possible to form a third proposition:

Proposition 4. *The financial attractiveness of companies enables innovative agricultural finance solutions.*

Effect of Cooperation with Other Entities

Cooperation with other entities, such as financial institutions, large agricultural manufacturers, and other large retailers, is another enabler highlighted in the interview regarding the implementation of agricultural finance solutions, especially “supply chain and industrial” and “online and offline lending” solutions. Internal cooperation between different organizations is an essential facilitator in promoting sustainability [71]. Collaboration improves the performance of financial solution adopters and their upstream/downstream supply chain [55]. In addition, increased inter-firm collaborative capabilities improve the three pillars of sustainable performance in a supply chain [37,39]. Motivated by sustainable objectives, agricultural finance adopters hope to improve the sustainability of the entire supply chain, which requires close collaboration among all participants in the supply chain.

Reaching farmers in the rural areas of developing countries, where credit systems are particularly imperfect, is difficult. Ali believes that offline credit information can be reliable to reach offline clients. Collecting their offline credit information greatly relies on cooperation with other entities, such as traditional insurers and non-profit organizations. To increase the inclusiveness of financial service and reduce risks caused by incomplete credit information, AF works with CI and CFPA to provide scattered farmers who are not in Ali’s database with loans via “online and offline lending” model. CFPA is rooted in grassroot masses with broad and deep offline information networks of individuals and small businesses in need of help. The offline work of CFPA compensates for the missing credit information of the capital demand side. To reduce risks of providing loans, AF buys insurance from CI to secure capital investment from urban investors in rural debtors. Cooperation of Zhong An Insurance is another example that inter-collaboration helps reduce financial risks. In the “supply chain and industrial” model, the Zhong An Insurance offline team not only monitors the offline financial behavior of farmer suppliers but also manages their offline information. In conclusion, sustainability-driven application of agricultural finance stresses the importance of cooperation among adopters and other entities to increase inclusiveness and reduce risks.

The effect of cooperation with other entities is concluded in the fifth proposition:

Proposition 5. *Cooperation with other entities enables innovative inclusive agricultural finance solutions.*

4.3. Reference Framework

The five propositions developed from the above analysis can be summarized and illustrated in a reference framework presented in Figure 6. Our analysis shows that the motivation of companies to implement agricultural finance comes from the integration of three sustainability dimensions and that adopting complex agricultural finance solutions is favorable to achieve comprehensive sustainable goals of improving social equity and welfare, promoting agricultural economy development, and increasing environmental friendliness of companies. The effective implementation of these solutions is influenced by three moderating variables.

5. Discussion

5.1. Agricultural Supply Chain Finance as a Critical Force to Promote Comprehensive Sustainability

The “supply chain and industry model” is an example of ASCF solution that brings social, economic, and environmental benefits. Committing to sustainability can lead to increased collaboration capability in the supply chain, which results in its improved sustainable performance [39]. SCF can also improve the strength of supply chain links, including great collaboration capability [39,56,72]. Environmental benefit brought by ASCF solutions is achieved by providing designated purchase credit to farmer suppliers to encourage them to purchase environmentally friendly materials. This approach shows that SCF is an efficient incentive to promote green production in the upstream supply chain. An interesting idea inspired by this practice is that designated credit quota for purchasing green products can be granted to downstream supply chain consumers to motivate green consumption. We recommend Ali to design green purchase quota for consumers according to their consumption habits and add it to consumer accounts as a part of Microcredit. This recommendation can increase the sales of green products and simultaneously reduce risks of poor sales of green farmer products, further lowering agricultural supply chain risks.

Although SCF is the only solution that contributes to sustainability in all three dimensions, other types of agricultural finance solutions are crucial in accelerating sustainable development of agriculture and rural regions. These additional solutions (two consumer finance solutions and one innovative lending solution) are helpful in alleviating two major issues facing the considerable rural population in developing countries, that is, low purchasing power and poor credit access. Innovation in agricultural finance requires hybrid solutions, among which ASCF is the core.

5.2. Indispensable Role of IT Support Together with Financial Attractiveness

IT support level and financial attractiveness are two indispensable moderating variables affecting all four agricultural finance solutions. IT support is highlighted as the technical enabler of implementing these solutions, whereas financial attractiveness is the soft power to attract partners and customers. High IT support level is the fundamental enabler of adopting innovative financial solutions for its ability to reduce financial risk and increase service efficiency. Among all technologies, mobile TPP method plays a crucial role in increasing convenient financial services and implementing ASCF. Although Internet technologies contribute to the realization of inclusive online finance, data security and personal data protection incite the financial service concerns of providers, customers, and governments.

Financial attractiveness is the other enabler, which is not treated as an indispensable factor in adopting innovative financial solutions in extant literature [55]. The different objectives of adopting financial solutions and definitions of financial attractiveness based on such objectives are the fundamental reasons. In previous studies, adopters are assumed to be the focal companies that employ financial solutions as financially oriented approaches to improve the financial performance of themselves or upstream/downstream supply chain. Thus, financial attractiveness is defined as the ability of adopters to withstand pressure on net operating working capital (NOWC) and negotiate interest collar with financial institutions [72,73]. However, the current research defines financial

attractiveness according to different objectives—financial attractiveness toward cooperative institutions and toward customers. This difference in definition can be explained by the fact that agricultural finance is adopted by financial companies as a business, instead of an internal operation or cooperation mode among supply chain players.

5.3. Farmers' Access to the Internet and Its Influence on the Social Sustainability of Online Financing

According to *The 40th China Statistical Report on Internet Development*, 54.6% of the population are users of the Internet, and 34% of the rural population use the Internet in China [67]. Not using the Internet does not mean no easy access to the Internet. China Mobile claims that 4G network has covered 99% of Chinese population. Data in the report shows that the lack of internet access and internet devices only causes 6.2% and 9.3% of non-internet users not to use the Internet. The rest of the non-internet users do not use the Internet for personal reasons. Besides, Ali's financial services are easily available through mobile network devices like mobile phone. It can be seen that almost all farmers can easily access the Internet and Ali's financial service, as long as they are willing to use it.

6. Conclusions

We conducted an in-depth case study of Ali's practice in agricultural finance to present a broad picture in which sustainable objectives can be strong drivers leading to the adoption of agricultural finance, especially ASCF solutions. The contribution of this paper in advancing knowledge about agricultural finance and sustainability lies in several aspects. First, this study introduces a comprehensive sustainability perspective to agricultural finance and gives empirical evidence on how an IT-enabled intermediate platform is motivated by sustainability objectives to provide comprehensive agricultural finance solutions, and how these innovative financial solutions contribute to sustainability. Second, ASCF solutions ("supply chain and industry model") also supplement SCF practice. SCF can be adopted as an incentive to encourage sustainable operations in the supply chain. Supply chain perspective or financial perspective is inadequate to analyze ASCF because neither considers the environmental influence on the supply chain. Thus, SCF theory should be supplemented by sustainability theory in analyzing ASCF. Third, this article identifies three moderating variables, namely, IT support, financial attractiveness, and cooperation with other entities. We show that advanced IT support, like fintech, is indispensable in conducting online financial solutions. The two definitions of financial attractiveness are also necessary soft advantages for companies to adopt agricultural finance as a new business. Fourth, to the best of our knowledge, this study is deeper in context than previous empirical research on agricultural finance which commonly used regional and macro levels [18,24]. This research investigates agricultural finance at business and micro levels. Moreover, the financial service provider selected for this research is an e-business company affiliated with an online financial company, instead of a traditional financial institution. Our case selection helps enlighten research on online finance providers.

This study also provides rich and useful insights for managers from retailing companies. First, this research shows that finance should be a means, rather than a goal, in promoting sustainable development. Second, corporate sustainable operations should not be confined in internal resource conservation and emission control, but instead, extended to the supply chain [1]. Companies have more options to improve the sustainability of their supply chain because providing attractive financial service as an incentive to encourage sustainable practice in the supply chain is efficient and rewarding in multi-aspects. Third, this research provides a comprehensive understanding of the existing ASCF solutions, mechanisms, and requirements, thus giving managers valuable knowledge and reference when making decisions in providing agricultural financial services. Fourth, identifying different moderating variables helps managers who desire to adopt agricultural finance solutions. In the detailed operation of agricultural finance solutions, advanced IT support, especially fintech, is a priority that companies should value and invest in.

This study bears potential limitations. Single case study method is rich and deep in context, but lacks universality. The sample Chinese company is also not geographically generalizable. Moreover, this study only considers three moderating variables, disregarding other possible factors. Future research should apply a multiple case study method and consider other moderate variables. Furthermore, the contribution of this study is naturally explorative, so future research should focus on theory testing. Finally, exploring the finance field from a sustainability perspective aims to determine how corporate effort in agricultural finance can contribute to agricultural sustainability. Further research in this field should develop quantitative methods to measure benefits and costs of different agricultural finance solutions at both company and supply chain levels.

Acknowledgments: We acknowledge the financial support of two National Science Foundation of China Grants No. 71472049 and 71629001.

Author Contributions: Qi Zhou contributed to drafting this manuscript. Xiangfeng Chen assisted in developing the concept and research design. Shuting Li provided the research idea and revised the draft.

Conflicts of Interest: The authors declare no conflict of interest.

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