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# Drivers of Successful Adoption of Eco-innovation: Case Studies of Agricultural Cooperatives in Vietnam

Huong Lan Pham, Huong Thu Nguyen, Ha Thanh Nguyen, and Hung Vu Nguyen

National Economics University, Hanoi, Vietnam

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## ABSTRACT

**R**esearch shows that external factors dominate the key determinants of eco-innovation (EI) adoption in organizations in the agriculture sector. Studies are needed to understand the link between internal organizational capabilities and EI adoption. Given the heterogeneity in the types of agricultural cooperatives based on their origin, this study sought to fill this gap by exploring how opportunity, motivation, and ability affect the adoption of EI by agricultural cooperatives. Using a qualitative methodology, we examined seven farming cooperatives in Vietnam and found three dominant drivers of cooperatives' formation: market, technology, and authority. Market-driven cooperatives are characterized by the presence of opportunity, motivation, and ability; technology-driven ones by motivation and ability; and authority-driven ones by motivation only. This study contributes to the literature on agricultural cooperatives and EI. It offers recommendations to leaders of cooperatives and policymakers.

**Keywords:** agricultural cooperatives, origins, opportunity-motivation-ability (OMA) framework, eco-innovation, Vietnam, case study

**JEL codes:** Q01, Q13, Q42, Q55

## INTRODUCTION

**T**echnological innovation is crucial for the competitive advantage and sustainability of agricultural cooperatives in developing nations (Luo, Guo, and Jia 2017; Garnevska, Liu, and Shadbolt 2011). On the other hand, increasing levels of agricultural pollution, soil degradation, and climate change, pose challenges to ecological habitats and the improvement of agricultural practices (Jhariya, Meena, and Banerjee 2021). Therefore, incorporating eco-innovation (EI) strategies, such as adopting water management practices, reducing pesticide usage, and establishing waste

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management and recycling systems, could promote sustainability among agricultural cooperatives for the purposes of rural development and ensuring food security (Polat 2010).

The current literature on EI adoption presents several limitations, however. First, despite the EI's potential to provide significant competitive advantage, research on EI adoption in agriculture has been surprisingly neglected (Oduro, Macarrio, and De Nisco 2021). Second, the little research done had focused on traditional investor-owned firms. These studies showed that EI adoption had been dominated by external drivers, including regulatory pressures, government policy, environmental regulations, technology level, and market forces (Nazzaro et al. 2019). More studies are needed to understand the link between internal organizational capabilities and EI adoption (Demirel and Kesidou 2019). Since cooperatives differ significantly from traditional investor-owned enterprises based on objectives, governance, and financial structure—resulting in disparities in innovation management (Drivas and Giannakas 2006; 2007)—the identified external factors may not fully explain how agricultural cooperatives successfully adopt EI. Third, past studies on EI adoption had been conducted primarily in the context of developed countries (He et al. 2018). Agricultural cooperatives in developing economies are strongly influenced by sociopolitical factors. These may directly affect their EI adoption by providing resources and setting constraints, and indirectly by establishing and developing the cooperatives' paths, resulting in different patterns in EI adoption.

This study explored how agricultural cooperatives in a developing country adopt EI. It investigated the characteristics of their environmental factors and how such factors are integrated with their internal capabilities for successful EI adoption. So, it is pivotal to understand how the agricultural cooperatives originated to shed light on the impact of these factors on the cooperatives' EI adoption.

Given the aforementioned gaps in the literature, this study aimed to answer two main questions: (1) what are the drivers of the

formation of agricultural cooperatives that lead to heterogeneity in the types of agricultural cooperatives? and (2) under each type of cooperatives, what factors enable successful EI adoption by agricultural cooperatives?

Also, this research contributes to the literature on (1) agricultural cooperatives by identifying different drivers of agricultural cooperatives' formation and demonstrating how these drivers act as the context for EI adoption; and (2) EI literature by showing how the integration of external factors and internal organizational capabilities can help organizations to successfully adopt EI based on the opportunity-motivation-ability (OMA) framework.

## LITERATURE REVIEW AND THEORETICAL FRAMEWORK

### Economic Justifications for Establishing Agricultural Cooperatives

The economic justification for the creation of agricultural cooperatives is primarily based on three market failure arguments: (1) farmers lack bargaining power (Valentinov and Iliopoulos 2013); (2) high transaction costs and poor economies of scale (Valentinov and Iliopoulos 2013); and (3) missing markets and/or services (Valentinov 2007).

Further, sociopolitical forces have received less attention in the literature. Cross-subsidies from donors and government support can also be used to stimulate the development of cooperatives in developing nations. In fact, cooperatives in these nations have been formed only for receiving subsidies or some other short-term economic objectives, rather than meeting underlying needs (Guo 2010), or serving the ruling parties' political and social objectives, rather than to address farmers' needs (Birchall 2010).

## Eco-innovation in Agriculture

### *Determinants of eco-innovation in agriculture*

EI can be defined as “the production, assimilation, or exploitation of a product, production process, service, management, or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution, and other negative impacts of resource use (including energy use) compared to relevant alternatives” (Kemp and Pearson 2007, 7). Based on this definition and the *Oslo Manual* (OECD 2015), we can distinguish between technological and nontechnological EI. The former refers to eco-products and eco-production processes. The latter refers to management, marketing, or business methods that reduce the negative environmental impacts of a company’s activities. This study focuses on technological EI, which is more popular in developing countries.

Past research had focused on external factors of EI adoption, which can be classified into regulatory push and pull, technology push, and market pull. However, the empirical studies that identified these external factors had been inconclusive. Notarnicola et al. (2016) show the following as market-pull factors: an increase in consumer green demand and increased willingness to pay extra for environment-friendly products and/or services. However, Aloise and Macke (2017) find that market factors are not determinants of EI adoption. Further, Nazzaro et al. (2019) argue that regulation has enabled the agrifood industry to address a prominent issue involving the processing of waste materials, as well as sustainable production systems. Although some studies show a positive influence of subsidies on the development of EIs (Marzucchi and Montresor 2017), others report that public grants have a nonsignificant influence on EI adoption (Jové-Llopis and Segarra-Blasco 2018; Mothe, Nguyen-Thi, and Triguero 2018). Finally, technology push is also considered a key driver of EI adoption (Sáez-Martínez, Díaz-García, and Gonzalez-

Moreno 2016). On the other hand, firm-specific factors such as internal capabilities have received less attention from researchers (Demirel and Kesidou 2019).

### *Opportunity-motivation-ability framework*

This study uses the OMA framework as the theoretical foundation by which to examine pro-environmental behavior (Ölander and Thøgersen 1995). This framework explains the underlying forces that drive individuals or organizations to participate with a particular behavior (Rothschild 1999). It holds that an individual’s or organization’s decision-making behavior is significantly affected by its opportunity, motivation, and ability (MacInnis, Moorman, and Jaworski 1991). The OMA framework is regarded as a comprehensive and flexible approach to explain EI adoption at multiple levels, from the firm level to the external environment level.

In the OMA framework, motivation catalyzes an organization’s inclination to take action, opportunity encompasses the contextual factors that facilitate specific organizational activities, while ability pertains to the organization’s resources and capabilities (Jiang et al. 2018; Yen 2018). In this study, we regard motivation as a cooperative’s willingness to adopt EI, opportunity as a situation in which the behavior toward EI is advantageous, and ability as whether a cooperative has appropriate resources and capabilities to implement EI.

## METHODOLOGY

### **Research Context**

Cooperatives, in general, and agricultural cooperatives, in particular, have gone through different development periods in Vietnam. The first period, 1954–59, is considered as the country’s golden age of cooperatives development. The second period is from 1960 to 1986, during which the state forced the development of cooperatives

**Table 1. General information on the cooperatives**

	Year of Formation	Location	Core Members	Associate Members	Cultivated Land (ha)	Main Products
NASV	2013	Moc Chau, Son La	1	38	20	Vegetables
DSOA	2017	Luong Son, Hoa Binh	2	33	3.4	Vegetables
QTC	2019	Moc Chau, Son La	2	22	60	Temperate fruits
BTCF	2017	Son La	11	800	1,500	Coffee
VIBA	2018	Luong Son, Hoa Binh	1	27	30	Bananas
TLTC	2016	Moc Chau, Son La	5	400	86	Tea
APC	2019	Son La	2	13	50	Fruits

in northern Vietnam. Additionally, given the mechanism of a centrally planned economy, the autonomy of cooperatives was not recognized (Sultan and Wolz 2012). When Vietnam introduced its *Doi Moi* (renovation) policy in 1986, the private sector was recognized, which somehow reduced the role and advantages of cooperatives. Between 1997 and 2002, the cooperatives sector was restructured and contracted due to market economy purification and integration. Cooperatives that were not voluntarily founded and lacked autonomy encountered many challenges and were eventually terminated. The years from 2003 onward mark the recovery of cooperatives, partly stimulated by the new Law on Cooperatives (Wolz and Pham 2010).

To address the shortcomings of agriculture, in general, and agricultural cooperatives, in particular, Vietnam has implemented numerous policy reforms to develop an agriculture sector that is diverse, sustainable, and with high value-added. One of these is the promotion of EI adoption by agricultural cooperatives. In this regard, standards were introduced such as Vietnamese Good Agricultural Practices (VietGAP), Participatory Guarantee System (PSG) organic, and other sustainable agricultural practices. These practices are regarded as EI in the context of Vietnamese agriculture because they change the plantation's technology and processes to become more eco-friendly and with greater concern for food safety.

### Research Design

This study used a multiple-case study design considering that: (1) agricultural cooperatives' EI is under-researched; (2) EI adoption by agricultural cooperatives in Vietnam is assumed to be context-specific (Flyvbjerg 2006); and (3) determinants for the successful adoption of EI in different types of agricultural cooperatives are complex, so a case study is appropriate (Yin 2009).

### Sample Selection

This study examined seven agricultural cooperatives in the midlands and northern mountainous provinces of Vietnam. Multiple case studies were done to identify the differences and commonalities among the cases (Yin 2009). Each case was selected based on two criteria: (1) it is a farming cooperative that grows either annual or perennial crops such as vegetables, fruits, tea, and coffee; and (2) it has adopted EI for at least three years. The background information of the seven cooperatives studied is summarized in Table 1.

### Data Collection and Analysis

For data collection, we conducted semistructured interviews with provincial, district, and commune officials, as well as leaders, core members, and associate members of the cooperatives. Interviewees were identified through purposive and snowball sampling (Lofland 1995). Discussions with leaders of the people's committees

at the provincial, district, and commune levels often led to introductions to officials directly involved in the cooperatives to be studied. We then approached the board of directors of the cooperatives for in-depth interviews. In turn, the directors referred core members and associate members involved in EI adoption. A total of 50 interviews were conducted in January and April 2021, each lasting about 60–120 minutes (Table 2).

Before the interview, the interviewees were sent a brief guide on the interview process. Information gathered from the semistructured interviews were cross-checked against written sources such as local government reports and newspaper articles, as well as supplementary interviews with government officials.

We followed the procedure delineated by Miles and Huberman (1994) in performing a within-case analysis, employing iterative coding techniques. Each researcher independently encoded the data and subsequently compared them between the field researcher and other co-authors to guarantee uniformity, a procedure that resulted in clarification and, occasionally, redefinition of the constructs. The cross-case analysis was then performed, and findings were tabulated to identify common themes. The authors utilized the clustering technique to analyze the data, which involved grouping and conceptualizing items at a case level. The authors then constructed a “causal model”, which is a collection of interconnected interactions among variables.

## FINDINGS

### Origins of Cooperatives

#### *Origins of market-driven cooperatives*

Our study categorized the Vietnam Banana Cooperative (VIBA) and Bich Thao Coffee Cooperative (BTCF) as market-driven cooperatives. Smallholder farmers usually cannot fulfill the requirements of big companies (customers) in terms of product quantity and

**Table 2. Case studies and fieldwork schedules**

Location	Authorities and Case Interviewees	No. of Interviewees
Luong Son, Hoa Binh	Vice chairperson of the District People's Committee	1
	Commune leaders	2
	<b>Vietnam Banana Cooperative (VIBA)</b>	
	Leader	1
	Members	4
	Local journalist	1
	<b>Dong Suong Organic Agricultural Cooperative</b>	
	Leaders	2
	Members	4
	Local journalist	1
Son La City, Son La	Vice chairperson of the Provincial People's Committee	1
	Provincial Department of Agriculture	2
	City official	1
	District Cooperatives Alliance	2
	<b>Bich Thao Coffee Cooperative</b>	
	Leader	1
	Members	4
	Field workers	4
	Moc Chau District official	1
	<b>Tan Lap Tea Cooperative</b>	
Moc Chau, Son La	Leader	1
	Members	4
	<b>Natural Safe Vegetable Cooperative</b>	
	Leader	1
	Members	4
	<b>Quyêt Thanh Cooperative</b>	
	Leader	1
	Members	3
	<b>An Phu Cooperative</b>	
	Leaders	2
	Members	2
Total no. of interviews		50

quality. Thus, forming cooperatives may help farmers gain economies of scale and improve their bargaining power. In our study, cooperatives of this type were formed under the leadership of one or several business-minded members who had connections with customers, learned about



their demands, and then grouped farmers to satisfy these demands.

### *Bich Thao Coffee Cooperative (BTCF)*

Mr. Thao has been growing coffee since 1994. His farming business had suffered from “good season–bad price” paradox because of the unstable market demand and unfair exchanges with product middlemen. In 2014, he was introduced to European coffee roasters through the connection of some overseas Vietnamese (*Viet Kieu*). They were keenly interested in the caliber and taste of arabica coffee cultivated in Son La. However, they saw the need for Thao to enhance the production process to elevate product quality and adhere to European standards. Additionally, they encouraged the establishment of an entity, such as a cooperative, to enhance economies of scale, facilitate adherence to sustainable production practices, guarantee product quality, and ensure that the legal requirements for exportation are met.

Thus, the BTCF was established in 2017, initially with 11 core members who grew coffee on 15 ha of land. This number had risen to 800 associate members cultivating a total area of 150 ha. The BTCF adopted an eco-innovative approach from seedling selection through cultivation, harvesting, and processing. The improved seedlings (named THA1) help to grow specialty coffee that is disease-resistant and of high quality and productivity. Coffee trees are cultivated on permitted arable land without pesticides. Organic manure is applied in most stages, whereas inorganic fertilizer is used only in the early stages. Ripened coffee cherries are handpicked and subjected to anaerobic fermentation, a new processing technology introduced to the cooperative. In contrast to traditional wet processing methods, which cause water pollution, anaerobic fermentation allows fresh coffee fruits to develop novel and tasteful flavors. The flesh is collected to produce coffee flesh tea, a highly profitable by-product.

### *Vietnam Banana Cooperative (VIBA)*

In 2014, Mr. Duc (a fresh graduate) tried his hand at fruit business. During this time, he had accumulated knowledge by researching and from experience in selling several popular products in the market. He found that banana is very popular in Hanoi market because it is cheap, available all year round, high yielding, and suits the local weather conditions and farming practices. He learned that supermarkets and convenience stores require strict quality standards for products supplied to them. These must be branded and grown according to VietGAP standards, labeled with a traceability stamp, and must look nice. Supermarkets require a stable supply of products.

In 2016, Duc developed a banana cultivation process according to VietGAP standards on 1.5 ha of his family land. He received a loan of VND 200 million (USD 7,866) from the Thrive Hanoi program under the condition that he would provide training and seedlings to 20 poor households. This led to the establishment of VIBA in 2018, with Duc as leader and 20 poor households as members. VIBA proceeded to conduct large-scale banana production to fulfill market demands. It adopted EI practices that adhere to VietGAP standards, from seedling selection through cultivation, harvesting, and processing. Duc chose a tissue culture method to propagate a banana variety that is pest-resistant, high yielding, high quality, and climate change ready. The lead tree is raised in the cooperative’s nursery and cut into a coir before being potted. Lead plants are screened and propagated carefully. Chemical fertilizers and plant protection products are used but with a three-month withholding period. These result in large and beautiful bananas, which are then harvested, cleaned, ripened in a cold room with bioethylene gas, labeled, packed, and delivered to customers.

### ***Origins of technology-driven cooperatives***

Technology-driven cooperatives are founded mainly to facilitate the adoption of new technologies. In our study, three cooperatives were established for this reason: the Natural and Safe

Vegetables Cooperative (NASV), Dong Suong Organic Agriculture Cooperative (DSOA), and Quyet Thanh Cooperative (QT). In farming, the adoption of technological EI, such as VietGAP or organic standards, often requires sufficient land and investment. As trading land with and among farmers is discouraged by the government, forming a cooperative addresses these requirements as members plant on their own lands following the same production techniques and processes. In the three cases studied, farmers were equipped with new technology through capacity-building projects of official development assistance (ODA) or nongovernmental organizations (NGOs). They then formed cooperatives to scale up technology adoption and commercialize their products.

#### *Natural Safe Vegetable Cooperative (NASV)*

Mrs. Luyen, who migrated from Ha Tay to Moc Chau, Son La in 1980, has been growing vegetables without having a brand or following any standards. In 2013, she participated in a project funded by the Australian government through the Australian Centre for International Agricultural Research (ACIAR) and implemented by project partners in Vietnam and Australia. The project had supported smallholders on production optimization and postharvest, including safe production techniques (according to VietGAP standards), bookkeeping, packaging, and certification to supply high quality counter-seasonal temperate vegetables from the highlands of North Vietnam to urban retail markets in Hanoi. After participating in the project, Luyen wanted to upscale and outscale her production using the safe production techniques she learned from the project. However, she encountered some obstacles because her farm area is small. Thus, she founded NASV in December 2013 along with two friends. Now, NASV has 78 members and together they produce 32 different vegetables and fruits according to VietGAP standards on a total of 20 ha.

#### *Dong Suong Organic Agricultural Cooperative (DSOA) (vegetables cooperative)*

In 2005, Danish NGO Agricultural Development Denmark Asia (i.e., ADDA) received a grant from the Danish International Development Agency (i.e., DANIDA) to start the largest initiative in organic farming in Vietnam, in collaboration with the Vietnamese Farmers Union, a national organization. The project aimed to increase awareness and knowledge of farmers on organic agriculture, and to assist them in producing, certifying, and marketing organic products. From November 2010 to December 2012, the project selected and consolidated groups of determined farmers to do sustainable organic agriculture in Luong Son, Hoa Binh. Among them was the group led by Ms. Thuc (a former corporate accountant). After the project's completion in 2012, many farmers did not maintain their organic production. On the other hand, the group led by Thuc decided to expand their organic production, in terms of production scale and number of commodities. Thus, DSOA was founded in September 2017, with 33 members initially, to ensure the stable and consistent quality of produce. Together, their cultivated land covers 3.1 ha.

#### *Quyet Thanh Cooperative (QT) (temperate fruits cooperative)*

Because of his passion for agriculture, Mr. Quyet (a former driver) started cultivating corn, peanuts, and rice in 1995. In 1996, he gradually switched to fruit trees, initially growing plum and then peach, pear, persimmon, and avocado. However, due to poor orchard management, Quyet had to chop down his fruit trees.

In 2016, Quyet participated in a project funded by the Australian Agency for International Development (i.e., AusAid) through ACIAR, in collaboration with partners from Vietnam and Australia. The project helped overcome barriers to adoption of improved varieties and to correct cultivation techniques that constrain the development of the temperate fruit industry in Son La. It also aimed to develop competitive,



consumer-driven marketing, and value-chain models for engagement with more profitable markets. As a project participant, Quyet was invited to go to Australia to participate in training courses on safe production standards for temperate fruit trees, where he was admitted as a member of the Australian Temperate Fruit Association. He became a contact person for temperate plants and seeds sent from Australia to Son La for testing, hybridization, and transfer. Quyet's resolve to embrace temperate fruit technology to prevent regular oversupply issues in Vietnam encountered an economies of scale constraint; that is, his acreage was too small. He subsequently convinced other households in the neighborhood to join him in this technology. The QT was founded in August 2019 with 22 members initially. It grows temperate fruits according to VietGAP standards on a total land area of 60 ha. In addition, the cooperative uses anti-hail nets to increase output and does branch pruning and trimming combined with fertilization to reduce workload and labor.

### ***Origins of authority-driven cooperatives***

Authority-driven cooperatives are established mainly to meet the political and social goals of local authorities. Our study placed the Tan Lap Tea Cooperative (TLTC) and An Phu Cooperative (AP) in this category because both cooperatives were established based on the suggestion of local authorities to create livelihoods and jobs and to help farmers have stable income. These cooperatives were formed to be eligible for government support such as training, administrative procedures, and tax incentives. Support from NGO and ODA projects or cooperation with customers was not available when these cooperatives were established.

#### ***Tan Lap Tea Cooperative (TLTC)***

In 2013, the TLTC was transformed under the Law on Cooperatives 2012. Despite its initial reservations stemming from the presence of a neglected raw material area and poor and outdated infrastructure, the newly appointed TLTC board of directors, with encouragement from the local

authorities, started investing in a production line and machinery system and restored the tea planting areas. The local authorities believed that restoring the brand name of Tan Lap tea, which has a long history and is renowned for its pure and natural flavor, can help the TLTC gain a competitive advantage and create stable livelihoods for the local farmers. The transformed TLTC went into official operation on 18 July 2016, with five core members and nearly 400 associate members. It now covers 100 ha of tea trees, of which 2 ha are designated for safe tea cultivation according to organic production standards. However, the adoption of organic tea production has been slow. The TLTC's challenges in this regard include the requirement to have a fence, chemical residues, and low yield.

#### ***An Phu Cooperative (AP) (fruits cooperative)***

Mr. Trung, a former hydroelectric worker, decided to plant a Taiwanese dragon fruit variety on his family's land. Because of his insufficient knowledge and expertise, however, the plant failed to bear any fruit. Trung persisted in discovering and evaluating domestic dragon fruit cultivars. In 2017, he began to cultivate a red-flesh dragon fruit, using seedlings obtained from Ninh Thuan. Two years later, the red-flesh dragon fruit trees bore their first fruit. Given the red-flesh dragon fruit tree's compatibility with Son La's soil conditions and its significant economic potential, the government approached Trung in 2019 with a proposal to establish a cooperative. The aim was to consolidate farmers' production efforts, provide employment opportunities, and ensure a stable income for the farmers involved. Thus, AP was founded in October 2019 with 13 core members initially and 8 associate members. It has a total cultivated area of 50 ha that grows a number of fruits. Of this, 5 ha are designated for safe dragon fruit cultivation according to VietGAP standards. However, VietGAP adoption has not been successful. Many associate members who were initially VietGAP-compliant have returned to the conventional methods of producing dragon fruit.

## **Impact of Opportunity, Motivation, and Ability on Eco-innovation Adoption**

### ***Market-driven cooperatives***

In general, market-driven cooperatives follow the responding EI mode, where core members of the cooperatives connected with targeted customers to learn about their demands, and then acquire appropriate technologies and train members on how to apply them to satisfy customer demands. The success of this mode rests on the cooperatives' ability to select, transfer, and implement appropriate technologies. Successful EI adoption by market-driven cooperatives is explained by factors related to the three elements in the OMA framework: opportunity, motivation, and ability.

### ***Opportunity***

The customers' green demands were considered a favorable situation for the adoption of EI practices by VIBA and BTCE, the two market-driven cooperatives. However, because of different destination markets, customer demand also varies. The BTCE's main markets are developed countries such as Germany, France, and the US, which require sustainable production practices. VIBA's primary market demand is consistent and sufficient provision of bananas that comply with VietGAP. Such customer expectations offer opportunities for these cooperatives to attract new customers and gain legitimacy, provided they appropriately respond to changing market needs. In the long run, EI adoption will reduce environmental damage and improve the quality of agricultural products, which will ultimately help increase the cooperatives' income. This is because customers are willing to track the environmental impacts of a product and pay a price premium for a product perceived as environmentally sustainable. Thus, customers' green demands serve as an opportunity-enhancing factor that would help BTCE and VIBA achieve competitiveness in the long run.

### ***Motivation***

The cooperatives can capitalize on opportunities if they can appropriately and timely respond to customers' green demands. The EI practices (VietGAP and UTZ) that suit the changing market needs usually have complex processes, high cost, high risk, and slow returns under positive spillovers overtime. Agricultural cooperatives, as small businesses, have a tendency for risk aversion and lack the financial capability and technical initiative to apply EI practices that are slow to take effect and entail much effort. Hence, the customers' provision of technical and financial assistance to the BTCE and VIBA has played a pivotal role in motivating these cooperatives to adopt EI. Such support not only helped the cooperatives increase their environmental awareness but also their confidence to adopt EI because their concerns have been resolved.

First, technical support from customers helps cooperatives feel confident to master the complex production process, thus overcoming the risk of uncertainty (i.e., the risk that the products do not appropriately meet customer needs). In this scenario, the customer's engagement in transferring the appropriate technology works to minimize the risk that the products will be refused and the cooperatives will not enjoy the price premium, thus there will be no increase in their income. In the BTCE, the customer sent experts to provide technical training in coffee production that adheres to UTZ standards, from preparing seedlings and transplanting to harvesting and processing. In the case of VIBA, the supermarket sent experts to provide guidance on VietGAP.

Second, financial support from the customers works to offset the extra costs associated with adopting EI practices, thereby increasing the potential benefits of the cooperatives and enhancing their motivation to adopt EI. The BTCE spent VND 3 billion (USD 118,000) to acquire the new technology through contract research and development (R&D) from its customers, which was then sponsored by the customers after the first order was satisfactorily completed. Similarly, VIBA's customer provided it

with a machine that measures chemical residues, so the cooperative can ensure the quality of its products before these are sent to the supermarket. Additional financial support from the government, although unsubstantial and untimely, mitigated some costs related to EI adoption. For example, the government provided the BTCF with factories valued VND 1.5 billion (USD 59,000) out of the total cost of VND 16 billion (USD 630,000) and a packaging system; it also provided VIBA with machinery and equipment for its new factory.

### *Ability*

The successful EI adoption by the BTCF and VIBA is contingent on their having internal capabilities. Without the necessary competencies, cooperatives would have low likelihood and effectiveness of technology adoption, notwithstanding their tremendous motivation. In BTCF and VIBA, human capital and financial capital emerged as two important capabilities of cooperatives that influenced their successful EI adoption.

First, in terms of human capital, the chairpersons of the BTCF and VIBA, being the lead entrepreneurs for their cooperatives, possess the production knowledge and experience, and a strong information acquisition and cognitive ability for the technical support provided by their customers. BTCF's technical officer was sent to training courses in coffee cupping while VIBA's technical officer proactively accumulated knowledge from customers through "learning by doing," adjusting knowledge accordingly. The EI technology was then transferred to the cooperative's associate members. Mr. Duc provided the members with technical knowledge and on-the-job training from soil preparation, plantation management (irrigation, manure application, plant care, etc.), to harvesting. Similarly, BTCF associate members were taught how to plant, harvest, and process coffee using sound farm management practices that also care for the environment. The associate members of both the BTCF and VIBA showed strong commitment to the EI practices mainly because of the strict inspection mechanisms

conducted by the cooperatives and the customers. For example, the BTCF uses a combination of geographic information system (i.e., GIS), computer mapping, and tracking of changes in each member's coffee output to detect any irregularity in the plantation areas, which may involve the occupation of forestland. VIBA requires its members to keep their record books, which have a long withholding period, to ensure strict compliance. A member who violates the requirements may be subjected to contract termination and may face the risk of being kicked out of the cooperative.

Second, satisfying the customers' green demand requires the cooperative to invest in R&D for technology transfer. The BTCF spent VND 3 billion (USD 118,000) to acquire the "honey coffee" technology through contract R&D from its customers. It also needed to mobilize funds to build a coffee processing factory with an area of nearly 1,120 m<sup>2</sup>, capable of processing 20 t of coffee beans a day. The total investment of such processing factory amounted to VND 16 billion (USD 630,000). In addition, the cooperative also purchased automatic machinery and equipment to replace manual production methods. Such facilities enabled the BTCF to operate a closed coffee processing system, from preliminary processing with a high-tech continuous coffee peeling machine to peeling coffee, drying, roasting, and wastewater treatment. Similarly, VIBA invested in a preliminary processing factory with an area of about 1,000 m<sup>2</sup>.

### ***Technology-driven cooperatives***

Technology-driven cooperatives follow the prospecting EI mode, where core members learn about new technologies, form a cooperative to scale up technology adoption, and then push products to the market. The success of this mode depends primarily on the cooperative's ability to transfer the technology to associate members and to market products to customers. Successful EI adoption under this mode is explained by factors related to two elements in the OMA framework: motivation and ability.

## Motivation

In technology-driven cooperatives, the support of NGO/ODA-funded projects enables cooperatives to overcome technical uncertainties, high costs, and high risks related to technology adoption as regards production and commercialization of produce. Such support has played a crucial role in bolstering the internal drive of NASV, DSOA, and QT. These cooperatives were willing to adopt EI not only because they understood the environmental benefits to be gained from participating in the NGO/ODA-funded projects, but also because their apprehensions associated with EI adoption were effectively addressed. These projects provided the cooperatives with a solid foundation to maintain their sustainable agricultural production.

First, the technical support provided by NGO/ODA-funded projects helped reduce technical uncertainties. Experts from the projects provided on-site training, making it easier for the farmers to understand the process and have the chance to apply what they had learned with the experts' supervision. In the case of NASV, the NGO/ODA-funded project supported the smallholders on production optimization and postharvest system, including safe production techniques (according to VietGAP standards), bookkeeping, packaging, and certification. In the case of DSOA, the NGO/ODA-funded project conducted training in organic agriculture according to PSG requirements, using organic or biological matter as additives. The experts also provided guidance on how to apply sustainable farming technologies, such as composting. In the case of QT, the project's experts guided the QT leader on temperate fruit cultivation techniques and modern nursery practices. The cooperative planted modern varieties with specific traits that addresses current issues in production.

Second, the financial support provided by NGO/ODA-funded projects or by the government (after the projects' completion) can be used to offset the extra costs associated with adopting EI practices, thereby increasing their potential benefits and enhancing the cooperatives'

motivation to adopt. In the case of NASV, the NGO/ODA-funded project provided basic infrastructure (5,000 m<sup>2</sup> of net houses) and equipment such as three plows, a lawn mower, and a generator. In the case of DSOA, the government provided infrastructure, such as processing houses, composting houses, irrigation systems, and net houses. For QT, the government mainly provided financial support for drying and processing products, packaging, designing labels.

Third, the projects' support on market connection helps address the cooperatives' distrust of market mechanisms. Quality certifications and brand building can highlight the premium feature of the product, improve income expectation from agricultural products, encourage the cooperatives to adopt EI practices, and promote the intrinsic incentives. In the three cases studied, the NGO/ODA-funded projects raised consumer awareness through activities such as fairs, field visits, and social marketing campaigns. They also developed marketing channels or the supply chain to link the production groups with the market through an organic vegetables company. Although this support on market connection has ended following the projects' completion, the cooperatives can continue to maintain the long-term trading relationship with middlemen, wholesalers, and retailers by investing in social capital and quality assurance.

## Ability

In the three cases studied, human capital, financial capital, and social capital emerged as the three important capabilities of cooperatives that influence successful EI adoption.

First, the technical capacity of a cooperative's chairperson, being the leader, acts as a prerequisite for the cooperative's reform and EI adoption. In the three cases studied, the chairpersons have production knowledge and experience, and a strong information acquisition and cognitive ability for the technical support provided by NGO/ODA-funded projects. These capabilities can reduce the learning cost of the cooperatives and lead to technology adoption. The EI technology is then transferred to the associate members of the

cooperative. Associate members are those who did not participate in the capacity-building projects but want to adopt the production standards and sell produce through the cooperative's contracts. In the three cooperatives studied, the leader and core members possess the ability to share knowledge when providing on-the-field training to associate members. The associate members of the three cooperatives studied showed a strong commitment to EI adoption mostly because the cooperatives organize either an internal or a combination of both internal and external inspections of the production and postharvest operations. In NASV, the inspection process was carried out by the chairperson and the external inspection agencies. DSOA, on the other hand, has adopted a multilayer inspection mechanism, which includes cross-member inspections, cooperative inspection, PSG inspection, and buyer inspection. In QT, monitoring is performed by the technical officer and the cooperative before harvesting.

Second, since financial support from NGO/ODA-funded projects had ended following the projects' completion, and financial support from the government is not always timely and substantial, it is pivotal for cooperatives to employ different funding and effectively use financial resources to enhance EI activities. NASV invested in a system that tests for chemical residues before sending its vegetable products to the supermarkets; it also built a processing house and a postharvest packaging system. DSOA invested in a composting process that uses animal waste, smoked rice straw, and locally available plants. QT has an R&D fund designated for research on modern varieties; it recently used this fund to develop an anti-hail system to protect the temperate fruit trees against climatic changes. Moreover, these cooperatives also invested funds in branding, which is a prerequisite to the successful commercialization of EI products.

Third, as marketing support was no longer available after the NGO/ODA-funded projects' completion, NASV, DSOA, and QT had to invest in their social capital to maintain existing contracts and search for more contracts with wholesalers (vegetables companies) and retailers (supermarkets).

### ***Authority-driven cooperatives***

Authority-driven cooperatives follow the hesitating EI mode, where because EI adoption is mainly driven by the government, the cooperatives do not commit resources to adopt EI, thereby adoption is hesitant and indecisive. Failure to adopt EI under this mode is also explained by factors related to opportunity, motivation, and ability.

### ***Motivation***

Government pressure serves as the initial catalyst in implementing EI practices in TLTC and AP. The general agricultural policy in Moc Chau is to shift from traditional agricultural production to sustainable agriculture, with the aim of increasing the value of agricultural production. Both TLTC and AP designated a small portion of their production areas for organic agriculture and VietGAP standards believing that the cooperatives will have initial financial benefits and subsequent governmental support. Also, it is a way to show loyalty to the government.

The government's support is not sufficient to enable successful EI adoption, however. In terms of technical support, the government assists TLTC and AP by facilitating their participation in training courses and transfer of scientific and technological knowledge through the agricultural extension services. The financial support, on the other hand, is not significant for TLTC and AP to successfully adopt organic agriculture and VietGAP standards. The TLTC encountered several challenges in transitioning its conventional tea growing area to an organic one. These challenges included the need to allocate a distinct hill for tea cultivation, secure sufficient financial resources and labor to install PVC or metal fences across the entire region, and provide farmers with adequate price subsidies for fertilizer. The financial support provided by the government is only in the form of administrative matters and small assistance, such as product packaging. For AP, the government provides legal assistance in completing production certification documents to apply for VietGAP standards. It also supports the

labels of origin and product packaging. However, what AP needs is financial support from the government so it can invest in a bigger land area to enable production processes that comply with VietGAP standards. This is because production adhering to VietGAP needs to be large-scale to be effective. The financial support received by the TLTC and AP from the government is not sufficient to compensate for the high costs and high risks associated with EI adoption, resulting in the cooperatives' low motivation.

### *Opportunity*

The TLTC and AP lack firm contracts with customers that demand quality products. The markets for TLTC's teas are domestic such as Son La, Hanoi, and some neighboring provinces, as well as foreign markets including Middle Eastern countries such as Afghanistan and Pakistan, which exhibit a relatively lower concern for adherence to standards. In the case of AP, its marketing challenge arises from its dragon fruits being mainly sold to middlemen who have more bargaining power. Thus, even when the dragon fruits are produced according to VietGAP standards, AP is unable to negotiate for a higher price and is forced to sell the products unbranded or under another brand. In short, both TLTC and AP do not have favorable opportunities to enable EI adoption.

### *Ability*

In terms of human capital, both the TLTC and AP have management staff and members who are largely untrained and lack experience and technical knowledge, causing difficulties in applying EI practices. Also, associate members are not strongly committed to EI practices since adoption benefits are uncertain while the investment requirements are real and immediate. Therefore, most AP farmers decided to stop adopting VietGAP, pointing out the extra work involved in keeping a diary and growing VietGAP-compliant fruits, but having little benefits in return. In the case of the TLTC, the members are not willing to follow organic farming because

the organic trees are unable to have high yield, especially in the initial years, as it takes time for the originally weak, chemical-fertilizer-dependent trees to grow more resilient, as well as for the soil to improve. Regarding financial capacity, the TLTC and AP do not have capital to invest in bigger land areas needed for organic farming or VietGAP standards.

Figure 1 and Table 3 present the drivers for EI adoption associated with the three types of cooperatives.

## **Discussion**

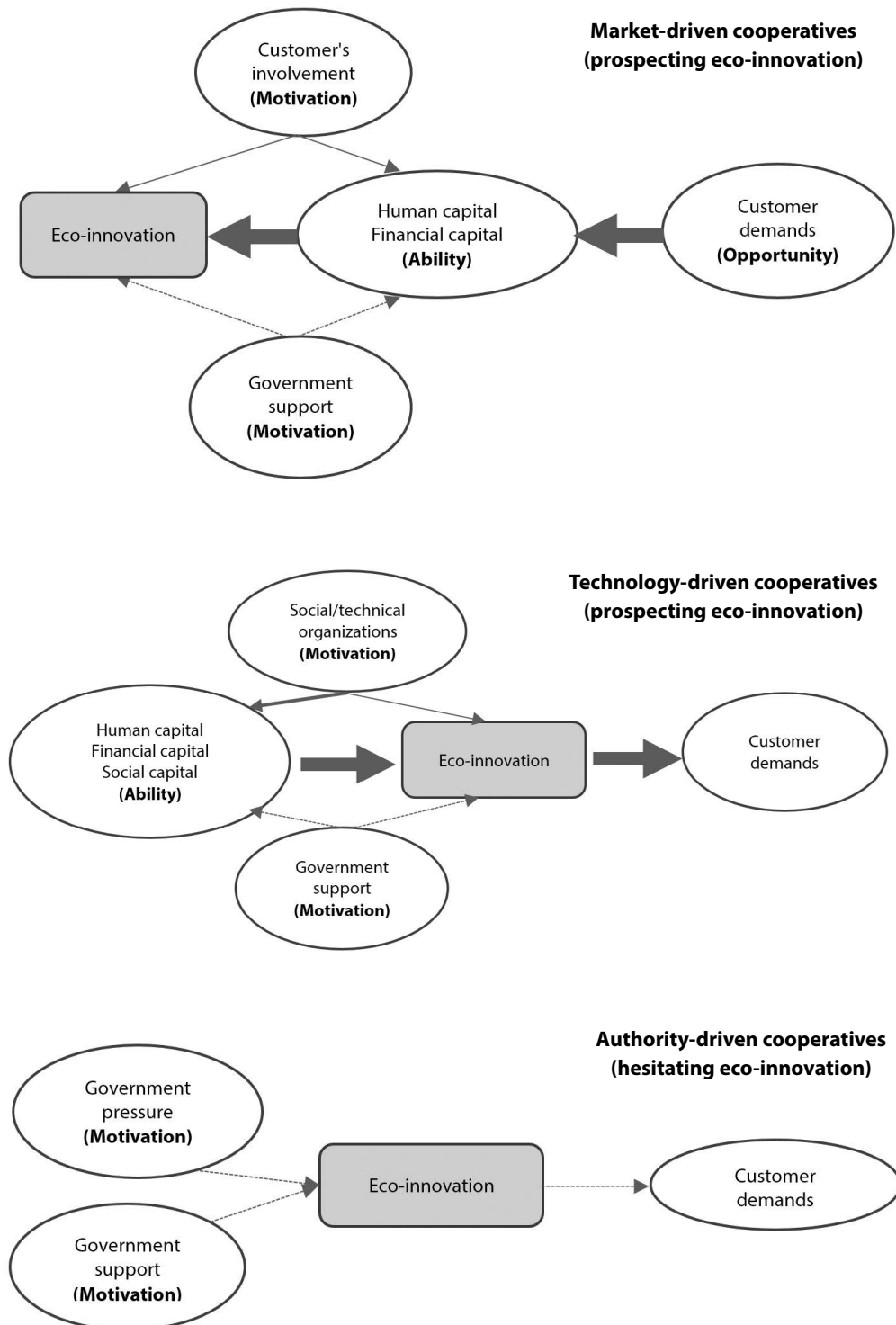
Three EI modes associated with three dominant drivers of cooperatives' formation were identified. Each mode is distinguished by a unique configuration based on the three elements of the OMA framework: opportunity, motivation, and ability.

Market-driven cooperatives are formed primarily to respond to market demands. The driver for their formation has to do with strengthening the engagement and bargaining position of farmers when markets are available and relatively developed (Karantininis and Zago 2001; Sexton 1990). Often, big and profitable customers have specific requirements on product quality and quantity, which small farmers may not be able to fulfill individually.

Market-driven cooperatives follow the responding EI mode; their EI adoption behavior is influenced by factors related to opportunity, motivation, and ability. Regarding opportunity, we found that customer demands serve as a favorable condition for EI adoption. This result confirms the stream of EI literature that supports market demand as determinant of EI (Lin, Tan, and Geng 2013; Mondéjar-Jiménez et al. 2015). For the BTCF and VIBA, the opportunity provided by customer demands were internalized and turned into the cooperatives' willingness to adopt EI because customer involvement, which is considered as motivation, is present. This result addresses a gap in the EI literature wherein the role of users (customers) has not been adequately addressed (De Jesus and Mendonça 2018).



**Figure 1. Three eco-innovation modes of Vietnam's agricultural cooperatives and the associated drivers for successful EI adoption**



**Table 3. Drivers of eco-innovation adoption by agricultural cooperatives under the OMA framework**

<b>Factor</b>	<b>Type</b>	<b>Market-driven cooperatives (EI mode: responding)</b>	<b>Technology-driven cooperatives (EI mode: prospecting)</b>	<b>Authority-driven cooperatives (EI mode: hesitating)</b>
<b>Opportunity</b>		Customer demand	N/A*	N/A*
<b>Motivation</b>		<i>Customer's engagement</i> (intrinsic motivation) → Technical support → Financial support	<i>NGO/ODA funded projects</i> (before the cooperatives' establishment; intrinsic motivation) → Technical support → Financial support → Marketing support	<i>Government pressure</i> (extrinsic motivation)
		<i>Government support</i> → Financial support (low)	<i>Government support</i> (before and after cooperatives' establishment) → Technical support (follow up) → Financial support (low) → Marketing support (low)	<i>Government support</i> → Technical support (medium) → Financial support (low)
<b>Ability</b>		Human capital Financial capital	Human capital Financial capital Social capital	N/A*

\* Not available: factors of the OMA framework cannot be found for this type of cooperative

Only by intensively interacting with customers (i.e., users of EI products) could the cooperatives select, transfer, and implement the appropriate technology to suit customer preferences. The cooperatives can capitalize on the opportunities presented by customers' demands. The studied cooperatives' internal capabilities, such as human capital and financial capital, were also found to play an important role in EI adoption. This finding is similar to those of Xiang, Zhang, and Worthington (2018) and Saunila (2018), who report the impact of human and financial capital on firm EI performance.

The driver of the formation of technology-driven cooperatives has to do with achieving economies of scale (Abate 2018; Valentinov and Iliopoulos 2013). Such cooperatives are established to facilitate the adoption of new technologies, which usually require sufficient land and financial investment. Therefore, forming a cooperative is a good solution because it enables land pooling (without trading) among farmers.

Technology-driven cooperatives follow the prospecting EI mode, and their EI adoption behavior is influenced by factors related to motivation and ability. We found that the support provided by NGO/ODA-funded projects motivated the cooperatives to adopt EI. This supports the literature on the effectiveness of science-push approaches to EI, which involve substantial levels of novelty and innovativeness (Nemet 2009). The prospecting EI mode is similar to the responding EI mode in that the former also stresses the importance of cooperatives having human and financial capital. However, successful EI adoption by technology-driven cooperatives highlights the importance of social capital of the cooperative's leaders. This finding is in line with EI literature on social capital being a requirement to acquire EI competency (Cai and Zhou 2014; Huang and Li 2015).

Authority-driven cooperatives are established mainly to meet the political and social objectives of local authorities. This driver supports the empirical observation of Bernard et al. (2010)

that the majority of Ethiopian agricultural cooperatives were created under the impulse of an external partner such as public cooperatives offices. In fact, various levels of political or social factors could be driving the presence of agricultural cooperatives. This mode is characterized by piecemeal adoption of EI, primarily as a response to regulatory demands. We found that government pressure acts as the motivation for EI adoption. However, it does not guarantee successful adoption because government support is not sufficient to compensate for the high costs and risks associated with adopting EI. While this finding confirms the stream of EI literature in which government support has an impact on EI adoption, it also aligns with existing literature that suggests that regulatory pressure does not significantly impact EIs (Eiadat et al. 2008).

## CONCLUSION

This study sought answers to two questions: (1) what are the drivers of the formation of agricultural cooperatives, which lead to heterogeneity in the types of agricultural cooperatives? and (2) under each type of cooperatives, what factors enable successful EI adoption by agricultural cooperatives?

Regarding the first question, we found three types of cooperatives based on three dominant drivers of their formation. The technology-driven cooperatives follow the prospecting EI mode, where the core members connect with targeted customers, and then acquire the appropriate technologies and train members on how to apply them to satisfy customer demands. In contrast, market-driven cooperatives follow the responding EI mode, where core members form cooperatives to scale up technology adoption, and then push their products to the market. Authority-driven cooperatives, on the other hand, follow the hesitating EI mode, where the cooperatives' adoption of EI practices is politically motivated and conducted in a piecemeal manner.

Regarding the second question, under each EI mode, we identified the factors affecting the

way cooperatives eco-innovate based on the OMA framework. Successful EI adoption by market-driven cooperatives is influenced by factors related to opportunity, motivation, and ability. Motivation- and ability-related factors influence technology-driven cooperatives, while only motivation-related factors influence authority-driven cooperatives. It is optimal for cooperatives to possess all three factors. If opportunity is lacking, it is pivotal for cooperatives to have stronger motivation and better ability.

This study contributes to the literature on EI and agricultural cooperatives by providing insights into how motivation, opportunity, and ability influence successful adoption of EI in agricultural cooperatives. It extends previous work to bring novel contributions to the literature in at least two ways. First, this study enriches the application of the OMA framework in the context of EI. We consider support from NGOs/ODA-funded projects, customer demand, customer involvement, and government support as external stimuli; and human capital, financial capital, and social capital as internal abilities for EI adoption. In doing so, we responded to the call for research efforts that link external factors and internal organizational capabilities to EI adoption (Demirel and Kesidou 2019). Second, our research contributes to the literature on agricultural cooperatives' EI adoption as this study addresses the call for more research on EI in the agriculture sector (Oduro, Macarrio, and De Nisco 2021).

This study has several implications for cooperatives' leaders and for policymakers. It is important for managers to be aware of their cooperative's origins and their associated EI modes. Those that are technology-driven and follow the prospecting mode would need to strengthen their cooperatives' marketing and sales capacity by building more social ties or networks. Market-driven cooperatives following the responding mode would need to engage proficient technicians who can effectively identify and educate members on suitable technology. Moreover, it is crucial for cooperatives to have a strong framework for effective technology adoption and subsequent monitoring of associate

members, a requirement that can also be applied to technology-driven cooperatives. Finally, authority-driven cooperatives, which follow the hesitating mode, would need to seriously reevaluate their overall business strategy and devote time and effort to developing their human and social capital.

For policymakers, the most important implication is that the one-size-fits-all policy may not be effective in promoting EI among agricultural cooperatives. Instead, policy interventions need to be tailored according to the different types of cooperatives. As indicated in the cases studied, direct financial support from governments to cooperatives is rarely sufficient. Alternatively, local governments have the potential to establish various grants that would allow research organizations, universities, and NGOs to apply and run small projects aimed at improving cooperatives' managerial, technical, and decision-making capabilities. The allocation of funds and implementation of projects could potentially facilitate the expansion of market access for cooperatives, enabling them to reach customers in developed countries. This, in turn, has the potential to stimulate the adoption of eco-innovative practices and enhance capacity-building efforts for farmers. Government should mobilize the media to enhance consumer knowledge of food security and certified produce. These initiatives would foster stable demands for the eco-innovative production of cooperatives.

Readers should be cautious about the limitations of this study. First, most of the cases studied had been in operation for a relatively short time (3–5 years), thus, the influence of a cooperative's origin on EI practices is apparent. Over time, this influence may fade. Second, we relied on a small number of cases in Vietnam, raising questions about the generalizability of the study. Future studies should employ larger samples, covering a broader range of cooperatives, to validate our results.

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