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Developing a circular business model: The case of agriculture and agro-industry innovations

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Abstract: This research aims to explore the integration of circular economy practices within Vietnam's agriculture and agro-industry sectors by examining the experiences of leading companies that have implemented circular business models. By analyzing case studies of eight companies—including An Dinh Co. Ltd., BUYO Bioplastics, Carafoods, Happyhands, Loc Troi Group, Phuc Sinh Corporation, Vinasamex, and Thanh Long International JSC, the study identifies key circular strategies, including resource circularity, efficiency, and substitution. These strategies have yielded environmental, economic, and social benefits, including reducing greenhouse gas, improved farmers' financial returns, and job creation. Key challenges include limited financial resources, insufficient market demand for circular products, difficulties meeting stringent international quality standards, and low farmer engagement in sustainable practices. Based on these findings, the paper proposes policy recommendations, such as green financing, consumer awareness initiatives, and support for international certification, to overcome these barriers and enhance the adoption of circular business models. These recommendations aim to enable Vietnam's agriculture and agro-industry sectors to overcome existing limitations, promoting a circular economy framework that supports environmental sustainability, economic resilience, and social progress.

Keywords: Circular business model, agriculture and agro-industry innovation, Vietnam.

1. Introduction

Vietnam's agriculture and agro-industry sectors are vital to the country's economy, contributing significantly to the national GDP and employing a large portion of the population (ADB, 2021). Despite their economic importance, these sectors are increasingly strained by environmental issues, including inefficient waste management, resource depletion, and the urgent need for sustainable production practices. Globally, the transition from a linear to a circular economy is recognized as essential for achieving sustainable development goals and addressing climate change. However, the importance of this shift is particularly pronounced for developing economies like Vietnam, where agriculture remains a foundational industry with significant environmental impacts. The circular economy aims to create a closed-loop system where materials and resources are continuously reused

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and recycled, as emphasized in the 2020 Law on Environmental Protection (Trieu, 2024). For Vietnam, adopting circular economy principles focused on reducing waste, reusing resources, and minimizing environmental impact is increasingly critical (Anh et al., 2024).

The circular economy presents a transformative approach to overcoming these environmental challenges, particularly in agriculture and agro-industry, where vast amounts of organic waste and by-products are generated. By integrating circular business models, companies can repurpose waste into valuable products, enhance resource efficiency, and significantly lower their environmental impact (Sharma, 2024). In Vietnam, several forward-thinking companies within these sectors have already embraced these principles, pioneering sustainable production methods and setting new standards for responsible industry practices.

This paper provides a comprehensive analysis of circular business models within Vietnam's agricultural and agro-industry sectors, building on prior research that broadly explores circular economy concepts. By analyzing case studies of pioneering companies in Vietnam, this research highlights context-specific challenges, offering policy recommendations and business strategies that will support Vietnam's transition to a circular economy. This paper focuses on a group of pioneering companies—An Dinh Co. Ltd., BUYO Bioplastics, Carafoods, Happyhands, Loc Troi Group, Phuc Sinh Corporation, Vinasamex, and Thanh Long International JSC—that are actively integrating circular economy practices into their operations. Through strategies such as utilizing agricultural by-products, adopting sustainable farming methods, and transforming waste into marketable products, these companies are advancing the development of a more sustainable and efficient agricultural sector in Vietnam.

2. Literature review

2.1. Definition of the circular business model

A circular economy is resource-efficient based on three fundamental principles: zero-waste and pollution design, keeping materials and products in use for as long as possible, and regenerating natural ecosystems (Ellen MacArthur Foundation, 2019). The circular business model concept has been defined by various scholars over time. One of the earliest definitions described it as "the rationale of how an organization creates, delivers, and captures value within closed material loops" (Mentink, 2014). More recently, Geissdoerfer et al. (2020) offered a broader perspective, describing a circular business model as one that "cycles, extends, intensifies, and/or dematerializes material and energy loops to minimize resource input and reduce waste and emissions within an organization." This approach includes strategies such as recycling (cycling), extending the use phase (extending), enhancing the intensity of use (intensifying), and replacing products with services or software solutions (dematerializing). Figure 1 by Geissdoerfer et al. (2020) visually overviews this circular business model definition.

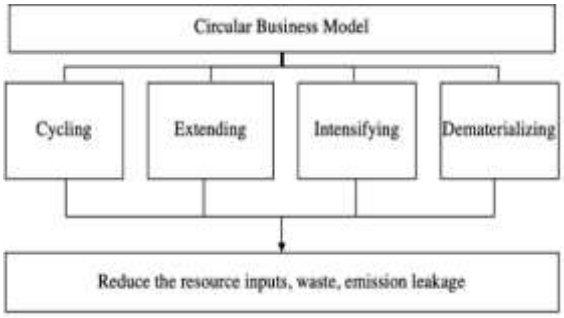

Figure 1: The concept of circular business model
Source: Geissdoerfer et al. (2020).

Building on these definitions, Switch Asia (2023) highlights three core pillars of the circular economy's triple bottom line: resource circularity, resource efficiency, and resource substitution. Resource circularity emphasizes the continuous cycling of materials for repeated uses, extending their lifecycle and minimizing waste. Resource efficiency focuses on optimizing materials, water, and energy use to reduce overall consumption and increase sustainability. Finally, resource substitution promotes replacing conventional resources with more sustainable alternatives throughout the industrial process, supporting environmental goals at every stage.

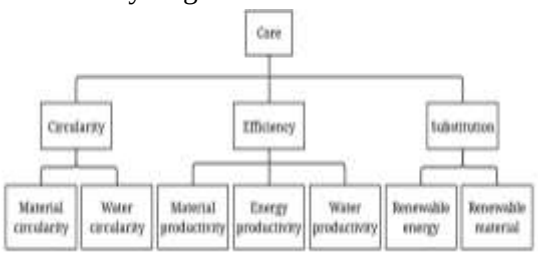

Figure 2: Circular economy's triple bottom line
Source: Switch Asia (2023).

2.2. Opportunities and challenges of the circular business model in agriculture and agro-industry sectors

2.2.1. Opportunities

In Vietnam, circular agriculture is a robust foundation for the circular economy within the agricultural sector. While the concept of "Circular Agriculture" is relatively new, the Government has long pursued a circular economy approach, including in agriculture. According to Shen and colleagues, governments play a crucial role in shaping and promoting

Circular Economy behavior among citizens and businesses. This commitment to developing circular agriculture is evident in various official documents issued since 1998, including Directive No. 36/CT-TW (1998), Resolution No. 41-NQ/TW (2004), Directive No. 29/CT-TW (2009) from the Party Central Committee, and Resolution No. 24/NQ-TW (2013) from the Central Executive Committee. The Party's stance on circular agriculture is further detailed in state legal documents, such as the Environmental Protection Strategy (EPS) and the Green Growth Strategy, as outlined in Decree No. 38/2015/ND-CP. Additionally, the concept of a circular economy is explicitly referenced in Article 142 of the Environmental Protection Law (Anh et al., 2024).

Additionally, businesses adopting a circular business model can enhance their reputation among consumers and strengthen their value networks with partners (Shao et al., 2020). The material cycles in circular business models can operate at the meso level, where companies function as interdependent agents within an industrial zone (Kirchherr et al., 2017). In this setting, companies actively engage with suppliers, expanding their networks to ensure the circularity of resources (Lewandowski, 2016).

2.2.2. Challenges

Agricultural businesses in Vietnam often embody the distinctive characteristics of the local farming community, such as lower education levels, small-scale operations, remote locations from urban centers, limited capital, and a spontaneous approach to business. These factors shape farmers' awareness of environmental impacts, leading to a tendency to overlook environmental issues in their practices, even when some awareness exists. Simane et al. (2024) underscore similar challenges in Ethiopian agro-food sectors, where knowledge gaps and insufficient training obstruct the adoption of circular economy principles. Vietnam faces comparable obstacles, as smallholder farmers frequently lack the technical expertise necessary to implement circular practices without external assistance.

Financial conditions are pivotal to the successful implementation of circular economy practices among businesses and households. According to Xie et al. (2022), access to financial resources is among the most critical factors for adopting a circular economy model. Sharma et al. further highlights that transitioning to a circular economy entails significant costs, as businesses must invest in information technology, upgrade production technologies, and train employees to support the new model. Additionally, Khan and Mahajan (2023) identify financial limitations as a critical barrier for small and medium-sized enterprises (SMEs) in Indian agribusinesses, which struggle to cover the upfront costs of adopting circular practices and achieving international standards. This finding is highly relevant for Vietnam, where most agricultural businesses are small-scale and constrained by limited financial resources.

Another barrier to the growth of the circular economy is low consumer awareness and weak market demand for innovative, sustainable products. Many consumers are unfamiliar with circular products designed to minimize waste and promote resource efficiency (Coderoni & Perito, 2020). This lack of familiarity impacts companies striving to produce environmentally friendly items by making it difficult to achieve the customer base needed for profitability.

3. Business case analysis

3.1. Overview of the companies and circular economy practices

3.1.1. An Dinh Co. Ltd.

Pathway to a low-carbon cultivation: New rice farming practices to reduce GHG emissions and improve yields in Thai Binh province of Vietnam

An Dinh Co. Ltd. is one of the largest rice producers in Northern Vietnam, focusing on sustainable rice farming practices. The company has implemented low-carbon rice cultivation methods using alternate wetting and drying (AWD) techniques. This innovation reduces water consumption and methane emissions from rice paddies by controlling water levels during cultivation. Additionally, the company optimizes fertilizer use, further reducing greenhouse gas emissions while enhancing rice yields.

3.1.2. BUYO Bioplastics

From biowaste to bioplastics

Founded in 2022, BUYO produces biodegradable plastics from agricultural waste, such as cassava pulp and spent grain from breweries. The company aims to replace traditional petroleum-based plastics with eco-friendly, compostable alternatives. BUYO's innovative approach involves converting agricultural by-products into bioplastic materials that decompose naturally within a year, reducing plastic pollution.

3.1.3. Carafoods

Circular economy of tropical fruits

Carafoods transforms tropical fruits, such as mango and dragon fruit, into enzyme-based products like organic fertilizers, skincare products, and health supplements. The company implements a zero-waste processing approach, utilizing all parts of the fruit, including peels and seeds, to ensure that no material goes to waste. This holistic use of agricultural produce maximizes resource efficiency and creates value-added products that serve multiple industries.

3.1.4. Happyhands

Greening bamboo and rattan production

Happyhands, based in Chuong My Village, produces handcrafted bamboo and rattan

products by repurposing waste materials from its production processes. The company's use of bamboo offcuts and rattan waste for new products such as trays, mirrors, and drinking straws exemplifies its commitment to reducing waste. Furthermore, Happyhands employs eco-friendly production methods, such as thermo-forming techniques, that reduce the need for glues and chemicals, making the production process more sustainable.

3.1.5. Loc Troi Group

Low-carbon transition in the rice sector

Loc Troi Group is a leader in Vietnam's rice industry, implementing the Sustainable Rice Platform (SRP) model, which focuses on reducing water consumption, lowering fertilizer use, and cutting greenhouse gas emissions. Loc Troi works with thousands of smallholder farmers to adopt climate-smart agricultural practices, such as alternate wetting and drying (AWD) and integrated pest management (IPM), which help mitigate the environmental impact of rice farming while improving productivity.

3.1.6. Phuc Sinh Corporation

Premium cascara tea from previously discarded coffee waste

Phuc Sinh Corporation is one of Vietnam's largest coffee producers and exporters. The company has pioneered the production of cascara tea, a high-value product made from the husks of coffee cherries, which are typically discarded as waste. By transforming coffee husks into a premium tea product, Phuc Sinh creates additional revenue streams while reducing agricultural waste.

3.1.7. Vinasamex

Using cinnamon waste as fuel for product drying

Vinasamex is a producer and exporter of organic cinnamon and star anise. The company has adopted a circular economy model by using cinnamon by-products, such as branches and leaves, as biofuel for its drying process. This innovative approach eliminates the need for coal in production, reducing the company's reliance on non-renewable energy sources and lowering its carbon emissions.

3.1.8. Thanh Long International JSC

Bioplastics made from coffee husk and agricultural by-products

Thanh Long International JSC produces biodegradable plastics from coffee husks, an agricultural by-product of coffee processing. The company transforms this waste material into bioplastic resins that decompose within 6-12 months, providing a sustainable alternative to traditional plastics. By converting coffee husks into eco-friendly packaging materials, Thanh Long contributes to waste reduction and supports the global shift toward biodegradable solutions.

3.2. Circular economy strategies

These companies have integrated circular economy strategies into their business models by focusing on resource circularity, resource efficiency, and resource substitution.

3.2.1. Resource circularity

- BUYO Bioplastics: Transforms biowaste-like brewery by-products into biodegradable plastics, keeping waste in productive use.
- Carafoods: Uses all parts of tropical fruits for enzyme drinks and organic products, turning waste into value-added items.
- Happyhands: Repurposes bamboo and rattan scraps into items like straws and mirrors, reducing waste and pollution.
- Phuc Sinh: Produces cascara tea from coffee husks, creating new value from coffee by-products.
- Thanh Long: Converts coffee husks into bioplastics, preventing waste while producing sustainable materials.

3.2.2. Resource Efficiency

- An Dinh: Implements efficient water and fertilizer use in rice farming, reducing emissions and resource usage.
- Loc Troi Group: Uses Sustainable Rice Platform standards for efficient water and nutrient management in rice production.
- Vinasamex: Substitutes coal with cinnamon by-products for drying, cutting energy costs and emissions.

3.2.3. Resource Substitution

- BUYO Bioplastics: Replaces fossil-based materials with biowaste in plastic production, reducing the carbon footprint.
- Vinasamex: Uses cinnamon biomass instead of coal, lowering fossil fuel dependence.
- Thanh Long: Develops biodegradable plastics from agricultural by-products, substituting conventional plastics.

3.3. Benefits and costs for companies

The following table summarizes the costs, benefits to firms, and societal impacts of circular business initiatives implemented by eight companies (Table 1).

3.3.1 Environmental impact

An Dinh Co. Ltd. has significantly reduced greenhouse gas emissions, cutting them by 60% through optimized rice farming techniques that include better water management and efficient fertilization. These efforts lower emissions and contribute to improving soil quality and preserving biodiversity. Vinasamex, by repurposing cinnamon by-products as biofuel, has replaced coal in its operations, resulting in a marked decrease in CO2 emissions. The company's initiative has diverted 7,300 m3 of waste from landfills, cutting energy consumption by over half. Additionally, Thanh Long International JSC has contributed to reducing environmental degradation by producing bioplastics derived from agricultural waste, offering an eco-friendly alternative to conventional plastic and lowering the environmental costs associated with plastic production.

Table 1: Benefits and costs of circular economic model for companies

Company	Initiative	Costs	Benefits to firms	Societal impacts
An Dinh	Low-carbon rice farming methods	- Training for 6,000 farmers on efficient planting, AWD irrigation, enzyme application for straw decomposition	- 15-20% increase in rice yield - Reduces fertilizer use by 40%, resulting in lower costs	- Reduces methane emissions by 60% - Provides higher income to farmers with a 7% revenue increase per "sao" (360 m² plot)
BUYO Bioplastics	Biodegradable plastics from biowaste	- Investment in factory and equipment to reach a production capacity of 10 MT/month - Patent application costs for bioplastics	- Low operating costs due to biowaste sourcing, high export potential - National Innovation Technopreneur Contest award winner	- Reuses 100% of biowaste, reducing landfill waste - Contributes to Vietnam's net-zero 2050 goals with significant GHG reduction
Carafoods	Utilization of tropical fruit by-products (enzymes, organic products)	- Initial crowdfunding of USD 250,000 through the 'Love Vietnam' campaign - Equipment and facility upgrades to increase enzyme and product output	- 20% customer base growth annually - Enzyme drinks priced at VND 370,000–390,000/L, 7-8 times cheaper than imported alternatives	- Supports farmers with higher income from fruit by-products, reduces organic waste - Creates value from previously discarded fruit parts
Happyhands	Repurposing bamboo and rattan scraps for handicrafts	- New product line costs and thermo-formation tech for efficient assembly	- Annual revenue of USD 1-2.5 million - Exports up to 70% of products to the EU, USA, Japan	- Converts 85% of rattan and bamboo scraps into products, reduces waste and burning emissions - Provides jobs for 1,200 artisans, mainly rural women
Loc Troi Group	SRP-certified sustainable rice farming	- Investment in SRP standards and AWD irrigation; certification and monitoring	- 9% cost reduction in rice production - 14% higher net returns per ha; stable SRP rice demand in export markets	- Reduces GHG emissions by 25% - Conserves water and fertilizer use - Supports 3,500 farmers with sustainable income and environmental practices
Phuc Sinh	Cascara tea from coffee husks	- USD 2 million invested in processing line (UV drying, freeze-drying, automated packaging)	- Premium pricing in export markets: USD 99/kg, contributing 5% to total revenue in Son La factory	- Reduces air pollution from waste burning - Increases coffee sector revenue - Supports sustainable income for small coffee farmers
Thanh Long	Bioplastics from coffee husk and agricultural by-products	- USD 10 million investment in new facility with 20,000 MT annual capacity in Bac Ninh province	- Access to EU and US markets - Reduces production costs with coffee husk sourcing from Minh Tien Group	- Reduces plastic waste pollution; biodegradable plastics decompose within 6–12 months - Supports the circular economy in coffee production
Vinasamex	Cinnamon by-products as fuel for drying	- Factory relocation costs; biomass processing line for cinnamon by-products	- 20% annual revenue growth - Decreases energy cost from 1.44% to 0.65% of revenue by switching to cinnamon biomass	- Avoids 550 MT of coal annually - Cuts GHG emissions significantly - Boosts income for farmers selling cinnamon by-products

Source: SwitchAsia (2024).

3.3.2. Economic impact

Phuc Sinh Corporation, for instance, has unlocked new revenue opportunities by transforming coffee husks into cascara tea, which commands prices 7–8 times higher than traditional coffee. This not only increases the profitability of coffee farming but also benefits smallholder farmers, particularly in economically disadvantaged regions. Loc Troi Group has enhanced the financial viability of rice farming through its Sustainable Rice Platform (SRP). Farmers have seen a 14% increase in net returns per hectare by improving productivity and lowering input costs. Similarly, Vinasamex has experienced robust revenue growth, exceeding 20 per cent annually, due to its sustainable business practices and successful expansion into premium international markets.

3.3.3. Social impact

Happyhands has created employment for over 1,200 artisans, primarily from rural areas, using bamboo and rattan waste to produce handcrafted goods. This initiative preserves traditional craftsmanship and provides income opportunities for vulnerable groups, particularly women. Loc Troi Group has had a profound social effect by offering training programs that equip farmers with the skills to implement sustainable agricultural practices. This training leads to improved income and more efficient resource management. Additionally, An Dinh has helped farmers improve their financial situation by linking sustainable farming practices, such as greenhouse gas reduction techniques, to direct economic benefits, such as increased yields and higher income.

4. Challenges and limitations

The transition to circular economy models presents significant business opportunities in the agriculture and agro-industry sectors. However, companies commonly face several challenges and limitations when implementing green initiatives.

4.1. Financial resources

When a company seeks to adopt a circular business model, it generally requires a significant financial investment to obtain or upgrade the necessary technology and infrastructure (Aranda-Usón et al., 2019). For instance, Thanh Long International JSC, which produces bioplastics from coffee husks, has invested $10 million to set up a large-scale production facility with a planned expansion in capacity. However, the recovery period is estimated at two years, posing financial risks without immediate market demand growth. Similarly, Vinasamex has faced difficulties securing the financial resources needed to expand its sustainable drying processes using cinnamon by-products as biofuel. While it has seen significant growth, the high cost of upgrading equipment and increasing capacity limits how quickly the company can scale its operations. Both companies demonstrate the financial limitations inherent in shifting to sustainable models, where the initial investment often outweighs short-term returns, making access to capital critical for further development.

4.2. Market demand and consumer awareness

Low consumer awareness about the benefits of green products generally does not drive a shift in consumption patterns. This lack of demand-side pressure especially affects smaller organizations, which may lead to them feeling little urgency to meet sustainability criteria or develop circular business models. However, a successful transition to a circular economy requires a fundamental shift in consumer lifestyles and behaviors (Rizos et al., 2016). Phuc Sinh Corporation, for example, developed cascara tea from coffee husks, a novel product with significant environmental benefits, yet it faces challenges in building demand, particularly in the domestic market where consumers are less familiar with this product. Similarly, Carafoods struggles to create consumer demand for its fruit enzyme-based products, which have yet to gain widespread recognition in Vietnam. For companies like Phuc Sinh and Carafoods, building both awareness and demand is essential to achieve the economies of scale needed for profitability while supporting the broader adoption of circular economy principles.

4.3. Compliance with international quality standards

Meeting strict international quality standards, particularly for export markets, presents another critical challenge for these companies. Research by Jaffee and Henson (2004) indicates that these standards can act as a barrier to agro-food exports, often due to countries lacking the technical and administrative capacities necessary for compliance or because these standards can be applied in a discriminatory or protectionist manner. Vinasamex, which exports organic cinnamon and star anise to high-end markets such as the EU, Japan, and Korea, must adhere to rigorous organic certification requirements, which increase production costs and require stringent quality control mechanisms. The need for compliance with these international standards creates additional operational and financial burdens, as companies must ensure that their entire production process meets the necessary certifications and audits, which can limit their ability to scale rapidly or enter new markets.

4.4. Adoption of sustainable practices

Engaging and educating partners, particularly farmers, on the benefits of adopting sustainable practices is a significant challenge

for companies like An Dinh, Phuc Sinh Corporation, and Loc Troi Group. An Dinh faces resistance from farmers when implementing greenhouse gas reduction techniques, as many are reluctant to change practices without clear financial incentives, despite the environmental benefits. To overcome this, An Dinh has linked these methods to increased yields and income. Similarly, Phuc Sinh Corporation struggles to encourage smallholder coffee farmers to transition to organic farming methods. Many farmers view this shift as costly and risky, which hinders the broader implementation of sustainable coffee practices. For Loc Troi Group, the complex technical requirements of the Sustainable Rice Platform model present a significant barrier, as many farmers lack the skills necessary for adoption, even with the company's training and support. Furthermore, the SRP brand's limited recognition within the industry reduces motivation for broader adoption.

5. Policy recommendations for promoting circular business models

Vietnam's agriculture and agro-industry sectors hold substantial potential for adopting circular economy practices, which can significantly reduce environmental impacts, enhance resource efficiency, and create new economic opportunities. However, transitioning to a circular business model faces challenges. Targeted policy actions and business strategies are essential to overcome these challenges and foster the broader adoption of circular economy principles.

First, introducing green financing programs is essential to help businesses overcome the high initial capital investments required for circular economy projects. The Government should offer low-interest loans, green grants, and tax incentives to reduce the financial burden on companies adopting sustainable practices. Promoting public-private partnerships (PPPs) would encourage private sector involvement and share the financial risks, enabling businesses to scale up their circular economy initiatives.

Second, a national campaign is needed to raise consumer awareness about the benefits of circular products. Shifting consumer perceptions is essential to promote the growth of the circular economy model (Tran et al., 2024). Many Vietnamese consumers are unfamiliar with sustainable goods, limiting market demand. The Government should lead a consumer education campaign, supported by green labeling, to make eco-friendly products more visible and attractive. Additionally, implementing green public procurement policies would ensure stable demand as government agencies prioritize purchasing circular products.

Third, the Government should direct industry associations and trade bodies to assist companies in meeting international certification standards. These organizations can be tasked with providing technical support, resources, and training programs to help businesses navigate complex certification processes. By collaborating with international certification bodies and offering guidance, industry associations can reduce companies' costs and administrative burdens, enabling them to comply with international standards more efficiently. This would be particularly beneficial for companies looking to expand into export markets while reducing reliance on government resources.

Finally, fostering collaboration between businesses and local communities is vital to promoting sustainable production practices. Beyond financial incentives for farmers, the Government should promote cooperative models that enable businesses and smallholder farmers to collaborate on sustainable farming techniques. A critical factor in successfully implementing these partnerships lies in effective stakeholder engagement, which requires a clear understanding and appreciation of power dynamics in corporate-community interactions. Companies must be transparent about their and stakeholders' reasons for participation, actively creating structures and processes that support a sustainable decision-making framework. This approach not only enhances sustainable practices but also contributes to building resilient and sustainable communities (Muthuri et al., 2012).

6. Conclusion

The transition to a circular economy presents significant opportunities for Vietnam's agriculture and agro-industry sectors, offering the potential for increased sustainability, economic resilience, and global competitiveness. However, the adoption of circular business models is hindered by key challenges, including financial constraints, limited market demand, complex certification processes, and difficulties engaging farmers in sustainable practices.

To address these barriers, targeted government interventions are crucial. Green financing mechanisms will enable companies to overcome the high initial capital investment required for sustainable projects. Raising consumer awareness through national campaigns will create a more robust demand for circular products while directing industry associations and trade bodies to support companies navigating international certification standards, easing their access to global markets. Finally, fostering collaboration between businesses and local communities will help promote sustainable production practices and build capacity for circular economy initiatives.

By implementing these strategic recommendations, the Vietnamese Government can effectively accelerate the transition to a circular economy, driving both environmental

sustainability and long-term economic growth across key sectors.

7. Future research opportunities

While this paper focuses on some Circular Business Models in Vietnam's agriculture and agro-industry sectors and gives policy recommendations for promoting the model, future research could strengthen the practical applications. Key areas for future research include exploring accessible financial mechanisms, such as green financing and micro-loans, to support circular initiatives; developing implementation frameworks tailored to small-scale businesses; and examining consumer attitudes to increase market demand for circular products. Further, research into effective capacity-building models, resilient environmental strategies adapted to local climates, and longitudinal studies on the economic impacts of circular practices would provide valuable insights. Addressing these areas will create more actionable and sustainable circular economy strategies for developing countries.

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