

Solution to promote the Circular Economy in Agriculture in Vietnam for Sustainable Development

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Abstract

Currently, the overall tendency for green and sustainable economic development is creating a circular economy. In actuality, agricultural output is currently benefiting greatly from the growth of the circular economy. The creation of a circular economy helps address resource scarcity, save the environment, combat climate change, and increase economic efficiency. Vietnam's economy can grow quickly and sustainably by shifting to a circular economy production model. Comparing prior growth techniques to the digital age and implementing circular economic development connected with high technology will be a fantastic opportunity to boost growth efficiency. In actuality, Vietnam currently has a large number of agricultural circular economy models. These are models: Creating and using gas from waste and wastewater in livestock and farming; model combining cultivation, livestock, and aquaculture; agro-forestry model; garden-forest model; Circular model using agricultural by-products as a catalyst or creating other valuable products; model of moderation, linked to reducing the use of growth hormones, veterinary medications, pesticides, and artificial fertilizers in agriculture and animal husbandry. Unfortunately, there have been few studies and applications of the aforementioned models, which has made it difficult to build the agricultural sector sustainably. In this paper, we outline the current situation and propose solutions to develop a circular economy model in agriculture in Vietnam for sustainable development.

Keywords: Circular economy, Circular agriculture, Sustainable agricultural development

1. Introduction

A circular economy (CE) is an industrial system that is restored and regenerated, based on the conservation and enhancement of natural capital, optimizing resource productivity and promoting system efficiency [1]. The value of products, materials, and resources is maintained in the economy for as long as possible, and the economy works to produce minimal waste [2]. Currently, creating a CE is a common trend in green and sustainable economic development. In actuality, agricultural production is benefiting greatly from the

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advancement of CE. The creation of a circular economy helps address resource scarcity, save the environment, combat climate change, and increase economic efficiency. Vietnam's economy is developing quickly and sustainably as a result of the conversion of the production model to a CE. Comparing prior growth techniques to the digital age and implementing circular economic development connected with high technology will be a fantastic opportunity to boost growth efficiency. In contrast to the linear economy, a CE aims to utilize resources across the whole product life cycle. It also aims to reduce both the use of raw materials in the production chain and the waste generated as shown in Fig.1 [3]

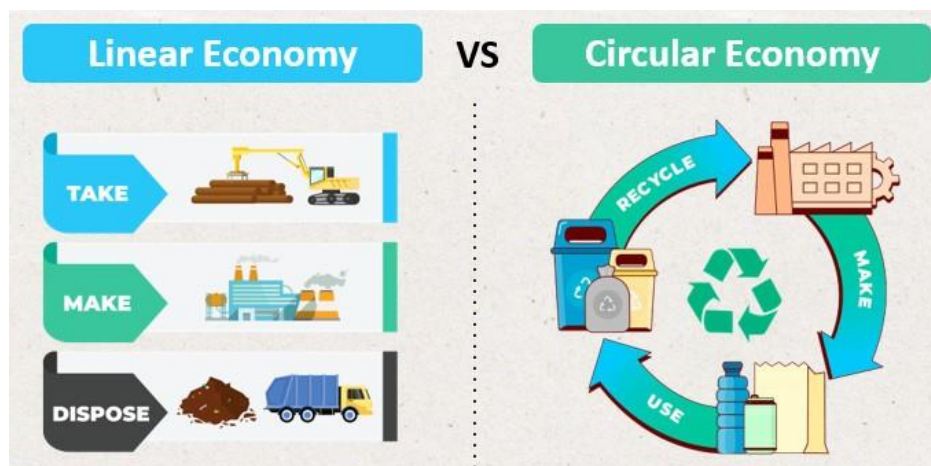


Figure 1. Difference between Linear Economy and Circular Economy

By using innovative technological solutions and processes to lower emissions and boost productivity, we can help Vietnam's agriculture sector grow and evolve in a sustainable way in the coming years. Its foundations include sustainable production, recycling trash to make new products, lowering pollution and the production's negative environmental effects, and restoring natural systems. In fact, in Vietnam, there are currently many CE models in agriculture. This paper outlines the current situation and proposes solutions to develop a CE model in agriculture in Vietnam.

The research shows that other words, such as circular bio economy, have been used to acknowledge the CE in agriculture. There are numerous studies that utilize the term "CE in agriculture," and each one has a unique viewpoint. Commodity agricultural production that minimizes the usage of outside inputs is referred to as CE [5]. According to a different author, CE in agriculture is the use of cutting-edge technology and production techniques in the field, with an emphasis on recycling waste and byproducts to meet sustainability and cost-effectiveness objectives. surroundings [6]. Closing nutritional loops and minimizing adverse environmental effects are key components of CE in agriculture, which is linked to the creation of crops that are less reliant on outside inputs [7]. It is suggested that CE models be used in agriculture to maximize the utilization of natural resources by utilizing waste, byproducts, and raw materials in a continuous cycle [8]. The principles for transitioning to an agricultural CE were proposed by [9]. The development and to provide of information of the circular economy models in Phu Tho province were clarified by [10]. The CE development project in Vietnam was approved by [11]. The decision emphasizes the approach focusing more directly and more specifically on the economic benefits of circular economy models. The development of an application for

sharing farm machinery in agriculture was addressed by [12]. The benefits and difficulties of digital transformation for the agriculture sector have been discussed in the aforementioned research. However, these studies have not yet come up with specific solutions and a digital transformation roadmap for the agricultural supply chain. Therefore, in this paper, we focus on analyzing the current advantages, difficulties, and challenges of the digital transformation process for agricultural supply chains. From there, we propose solutions and a roadmap to promote a circular economy in agriculture in Vietnam.

2. Methods

The research uses qualitative methods through the collection and synthesizing of secondary data from domestic and foreign articles, magazines, and specialized reports. The author specifically utilized keywords like "CE in agriculture," "Digital Transformation in agriculture," and "Model of CE in agriculture" to search for both domestic and foreign materials during the investigation. As a result, descriptive statistics are the primary strategy employed after reviewing relevant sources. To provide a foundation for acceptable solution proposals, analysis, data, and opinions are also included with legal papers, plans, strategies, and reports in Vietnam. In addition, the applied methodology is based on standard systematic review procedures that incorporate search strategy, record extraction, and reporting of results [13]. On the other hand, the literature review is a methodology for conducting research and offers an overview of different types of review, as well as some guidelines on how to conduct and evaluate a literature review paper [14].

3. Results and discussion

3.1 Current status of circular economy for agriculture in Vietnam

Vietnam's overall agricultural productivity is comparatively poor. Growing crop areas and more extensive use of inputs (chemicals, fertilizers) and natural resources (land, water) have been associated with agricultural growth. However, the nation lags behind its neighbors in the region, and its total factor productivity has recently declined. In addition, the industry, services, and urban development sectors compete domestically with the sector for the utilization of labor, land, and water resources. This reduces the possibility of economic growth and has a negative impact on farmers' income. The phrase "CE in agriculture" is relatively new in Vietnam. The agricultural sector has not yet developed mechanisms and policies to support the economic applications of CE, despite the fact that several policies related to the circular economy have produced opportunities to support the development of agricultural products through connections to the agricultural sector's circular economy. According to data from the General Statistics Office, the total volume of by-products in 2020 in the country is about 156.8 million tons, including 88.9 million tons of by-products from the crop industry (accounting for 56.7%); 61.4 million tons of livestock and poultry manure from the livestock industry (accounting for 39.1%); 5.5 million tons from the forestry industry (accounting for 3.5%) and nearly 1 million tons from the fisheries industry (0.64%). The rate of collection of crop by-products is about 52%, in livestock it is 75%, in forestry it is 50.2% and in aquaculture, it is 90% [15].

Currently, many types of CE models have been applied on many different scales and fields.

+ First, Typical rice farming model using rice husk as fuel: Vinh Binh commune, An Giang produces 16,000 tons of rice husk annually with a capacity of 80,000 tons; approximately 50% of the rice husk is used to dry rice for the factory (8,000 tons), with the remaining portion being processed into rice husk firewood for market sale. By selling rice husk firewood, the model lowers greenhouse gas emissions (CO₂), saves 30% on energy

expenses, and boosts revenues by 400,000 VND per ton, or 3.2 billion VND annually.

+ Second, by using straw to create straw mushrooms, the cyclical model of agricultural leftovers provides people with a sizable source of income. Many homes can either utilize biological products to break down straw into organic fertilizer to increase the amount of organic microorganisms in the soil, or they can bury straw in the ground to store fertilizer for the following crop. Straw can also be used as animal feed. One hectare of rice farming yields enough straw to grow 250–300 kg of fresh mushrooms. For every hectare under this technique, producers can make between 6 and 8 million VND by selling fresh mushrooms for 25,000–27,000 VND per kilogram.

+Third, the moderation paradigm aims to prevent adverse effects on the environment and public health by restricting the use of chemical pesticides, fertilizers, veterinary medications, and growth hormones in farming and animal husbandry. other actions, including putting bags around fruits on fruit bushes; Locating rice and crop varieties that are resistant to pests and aphids; Instead of applying chemical fertilizers to fruits and veggies, use microbial fertilizers.

+ Fourth, the model integrates agriculture, livestock, and aquaculture (e.g., rice - shrimp, rice - fish, garden - pond - barn model); combined agroforestry model, garden - forest model). Garden-pond-barn-biogas model; garden-pond-barn-forest in the provinces with mountains; garden-pond-lake in the Central provinces. This agricultural model's implementation not only results in great economic efficiency but also lower greenhouse gas emissions. As an alternative, after rice harvesting is complete, shrimp (or fish) are released into the field, where the scattered rice stubble and rice serve as a food source for shrimp and fish. In this model, shrimp and fish feces and leftover food (from shrimp and fish) will be used as fertilizer to supplement nutrients for rice plants. In particular, the "rice, shrimp" and "rice, fish" models have helped farmers raise their revenue by five to ten times in the same unit area compared to simply cultivating rice. They have also helped minimize epidemics, environmental degradation, and the creation of safe products.

+ Fifth, Models of the Production of poultry fertilizer as organic fertilizer as shown in Fig. 2.

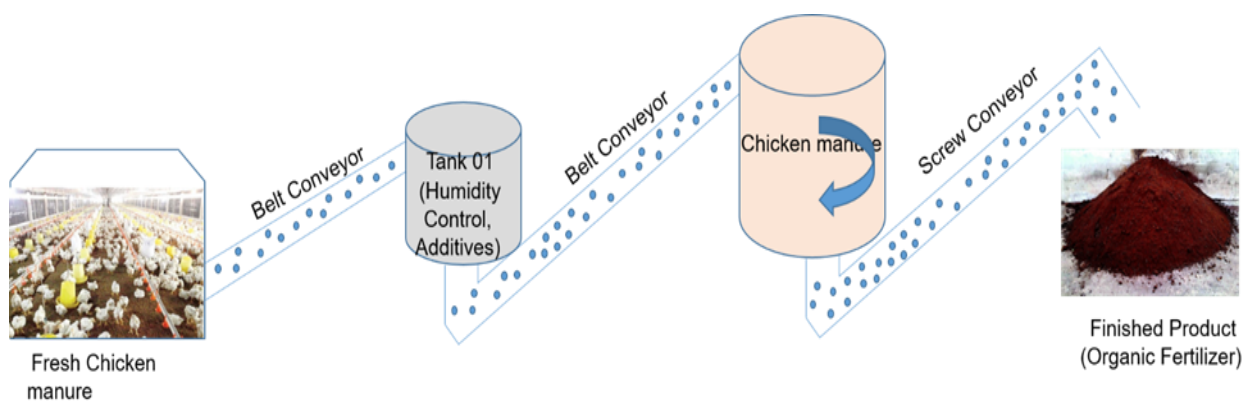


Figure 2. Example of Circular Model in Agriculture for production of poultry fertilizer as organic fertilizer

+ Sixth, models that integrate low-carbon agriculture with livestock, aquaculture, agroforestry, gardens, and forests; Building biogas digesters and composting (Fig. 2)

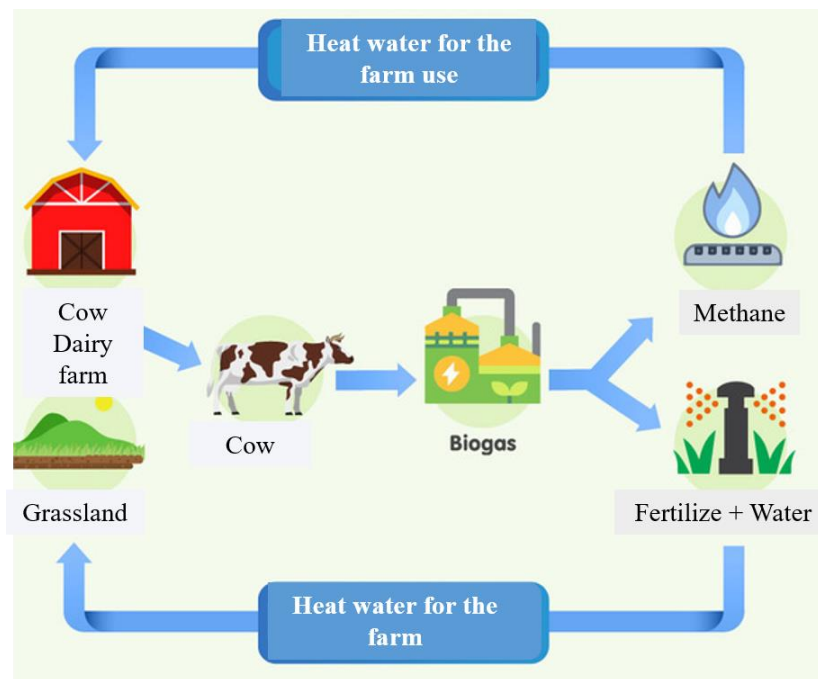


Figure 3. Example of Circular Model in Agriculture in Vietnam in Cow farm from Vinamilk Corporation

Based on research and related documents, CE brings high economic efficiency and is recognized and proven in practice, the CE model in Vietnam still faces difficulties. Many challenges and difficulties can be listed:

- The circular economy model's application is not very broad. mostly concentrated in big cities and provinces, or in well-liked and wealthy areas.

- Vietnam is still a developing nation that has numerous challenges with antiquated agricultural technology and equipment. As a result, there are numerous obstacles to overcome before the circular economy model can be applied to the processing of waste, the production of fertilizer and gas, or the use of cutting-edge, contemporary foreign technology in agriculture.

- The circular economy is also severely hampered by the current policy framework. Even though the Party and State have made their circular economic growth agenda clear in several documents, more precise and targeted measures are still required to help individuals with their problems. when used in procedures like buying machinery, importing raw supplies, etc.

- It is imperative to address the issue of financial resources in order to implement the circular economy model. People need to have enough money since using technology, machinery, or particular plant and animal species is necessary. People currently find it difficult to obtain funds for their first venture because the State's lending procedures still have a lot of limits.

- Shifting consumer perceptions is essential to promote the growth of the circular economy model. When farming, utilize chemicals rather than inexpensive products. Only recently has the usage of clean, organic agricultural goods been apparent in large cities. Because the output cannot be resolved, the use of expensive but clean agricultural products presents a significant obstacle to the local application of circular economic models.

- The pricing of clean-origin or organic agricultural products are not well supported by special policies.

3.2 Solution for the Development of a circular economy in Agriculture in Vietnam for sustainable development

+ Firstly, enhance communication to increase understanding and ability to apply circular economy principles in farming. Programs and communication strategies must be created to increase public and corporate understanding of the need for CE development in agriculture. Moreover, create forums, conferences, seminars, and online information pages about circular agriculture so that businesses and the general public can readily access knowledge, technology, and advancements in technical processes. This is because the agricultural production model adheres to a closed cycle, with byproducts being reused on site rather than released into the environment.

+ Second, in order to innovate the growth model, enhance growth quality, boost national competitiveness, and guarantee sustainable production and consumption, it is imperative to take the development of the circular economy into consideration

+ Third, examine, modify, add to, and enact new laws, policies, strategies, and processes to support the development of the circular economy in line with standards and in connection with ecological agriculture and agricultural economic development. , typical. Include the circular economy in all phases of project creation, waste management, reuse, and recycling, as well as strategy, planning, and programs. Using policy instruments to regulate producers' and consumers' obligations to recover, recycle, and reuse by-products...

+ Fourth, allocate funds to scientific and technological research pertaining to the circular economy, including models of high-tech production linkages, digital transformation, management organizations, and technology to prolong product life cycles.

+ Fifth, focus on strengthening the link between the circular production chain from the beginning of planning, production design, and product design; Establish markets and institutions (such as digitalization, traceability, market-based management tools, ecological services, carbon credits, etc.) for circular economy goods.

+ Establishing an ecosystem for the agricultural supply chain

In this ecosystem, the starting point is from farmers and breeders who provide production to consumers through intermediaries. All components in the ecosystem have two-way interactions so that the product cycle is continuously circulating. From this cycle, the product after consumption will be classified as waste and reused as fertilizer or food.

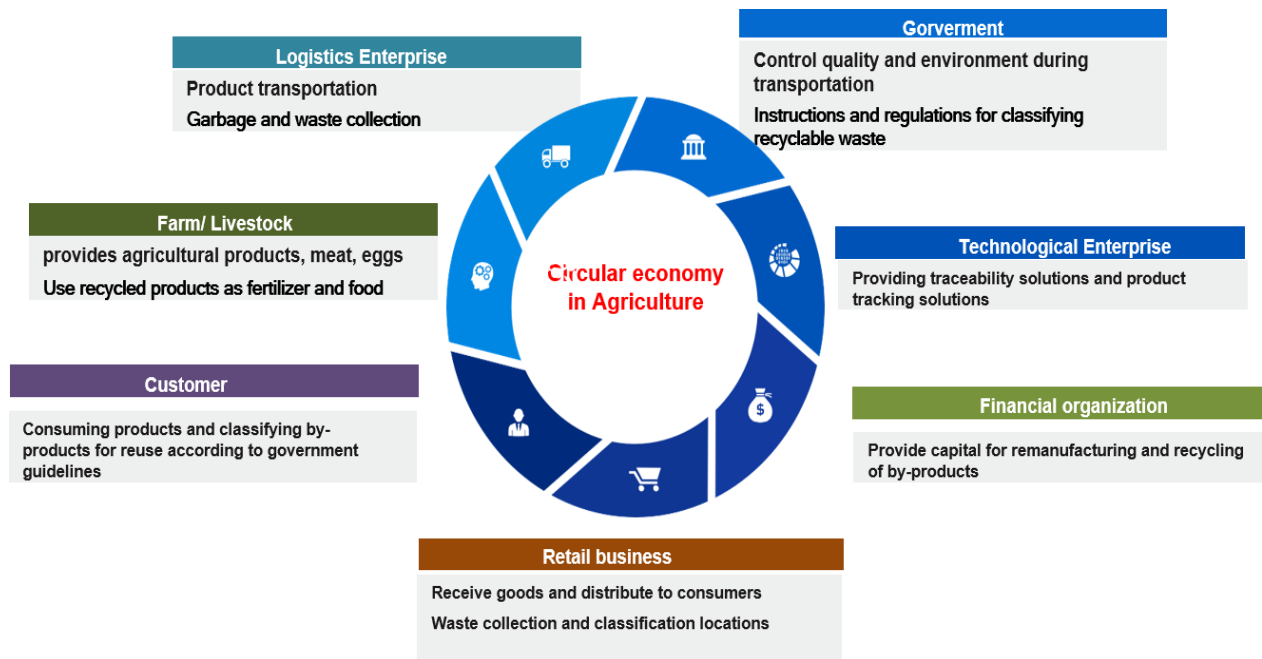


Figure 4. Proposal of a digital ecosystem for the agriculture supply chain to promote CE in agriculture

5. Conclusion

In Vietnam, agricultural production plays a key role in the development of the country's main economic foundation, especially during economic recession. However, changes in global conditions over the past few years have exposed serious issues facing the agriculture industry, such as depletion of natural resources and resource shortages. Simultaneously, new production techniques that promote sustainable agriculture are needed due to the fast urbanization and rising demand for safe, high-quality agricultural goods. In actuality, agricultural output is currently benefiting greatly from the growth of the circular economy. The creation of a CE helps address resource scarcity, save the environment, combat climate change, and increase economic efficiency. However creating and implementing these economic models calls for adjusting to particular circumstances, making the most use of the resources at hand, and actively involving stakeholders. In this paper, we focus on analyzing the current status of the CE model in agriculture and then propose some solutions to promote the development of the CE model in agriculture to make a meaningful contribution to the sustainable development of Vietnamese agriculture.

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References

- [1] A. Morl, *Delivering the Circular Economy: A Toolkit for Policymakers*, Isle of Wight: Ellen MacArthur Foundation, 2015.
- [2] European Commission (EC), *Communication from the Commission to European Parliament, the Council,*

- the European Economic and Social Committee and the Committee of Regions: On a Monitoring Framework for the Circular Economy, 2018.
- [3] E. MacArthur Foundation (EMAF) and McKinsey & Co, "Growth within: A circular economy vision for a competitive Europe," Ellen MacArthur Foundation (EMAF), SUN, McKinsey & Co, Technical Report, 2015.
- [4] N. Gontard, U. Sonesson, M. Birkved, M. Majone, D. Bolzonella, A. Celli, B., Batista, A. P., and A. Sebok, "A research challenge vision regarding management of agricultural waste in a circular bio-based economy," *Critical Reviews in Environmental Science and Technology*, Vol.48, No.6, pp. 614 – 654, 2018. DOI: <https://doi.org/10.1080/10643389.2018.1471957>.
- [5] S. Ward, "The 'circular economy' applied to the agrifood sector. Harnessing research and innovation for FOOD 2030" A science policy dialogue, 2017
- [6] T.A Toop, Ward, S. Oldfield, T. Hull, M. Kirby and M.K. Theodorou, "Agrocycle – Developing a circular economy in agriculture," *Energy Procedia*, Vol.123: pp. 76–80, 2017. DOI: <https://doi.org/10.1016/j.egypro.2017.07.269>
- [7] T. Oldfield, S. Ward, E. White, and N. Holden, "The 'circular economy' applied to the agriculture", 2016.
- [8] T. Haaranen, "opportunities for agriculture and forestry in the circular economy," EIP-AGRI workshop, pp. 28–29, 2015.
- [9] T.T. Quang, "Circular Economy Models in Agriculture in Vietnam," *Vietnam Science Journal*, Vol. 5, pp. 30-45, 2023. DOI: [http://dx.doi.org/10.56794/VSSR.5\(217\).30-45](http://dx.doi.org/10.56794/VSSR.5(217).30-45)
- [10] P.T. Thuy, T.T.T. Sinh, and N.H. Quan, "Development of Circular Economic Models in Agriculture in Phu Tho Province," *Journal of Science and Technology*, Hung Vuong University, Vol. 29, No. 4, pp.28-37, 2022.
- [11] Vietnamese Government, Decision No. 687/QDTTg approving the project of circular economy development in Vietnam dated June 07, 2022.
- [12] M.J. Koo, "A Study on Agricultural Machine Sharing Application," *International Journal of Advanced Smart Convergence*, Vol.12, No.4, pp. 464-469, 2023. DOI: <http://dx.doi.org/10.7236/IJASC.2023.12.4.464>
- [13] B. Kitchenham, and B. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," Software Engineering Group, School of Computer Science and Mathematics, EBSE Technical Report Version 2.3, p.65, 2007.
- [14] Snyder, H. (2019) "Literature review as a research methodology: An overview and guidelines", *Journal of Business Research*, Vol. 104, pp. 333-339, 2019 DOI: <https://doi.org/10.1016/j.jbusres.2019.07.039>.
- [15] General statistics office of Vietnam, Statistic data ,2020.