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FARMERS' AWARENESS ABOUT CIRCULAR ECONOMY MODEL: THE RESULTS OF A SURVEY CARRIED OUT IN THE MEKONG DELTA, VIETNAM

DOAN TAN SANG
PhD Candidate, College of Economics, Can Tho University, Vietnam.

LE NGUYEN DOAN KHOI*
Department of Scientific Research Affairs, Can Tho University, Vietnam.
*Corresponding Author Email: lndkhoi@ctu.edu.vn

NGUYEN THANH BINH
Mekong Delta Development Research Institute, Can Tho University, Vietnam.

Abstract

Farmers' understanding of the circular economy (CE) model is crucial for sustainable agriculture. While CE offers advantages like resource efficiency and waste reduction, farmers encounter obstacles in implementation, including limited knowledge and resources. Studies emphasize the need to increase awareness through targeted marketing and educational programs, stressing collaboration among stakeholders to enhance understanding and adoption of CE principles in agriculture. Integrating CE into farming practices can substantially improve environmental sustainability and economic resilience. Although the term "circular agriculture" is frequently used by scientists, practical application of circular principles remains restricted due to low public awareness. A study conducted in Vietnam's Mekong Delta region aimed to comprehend farmers' perceptions of circular agriculture and identify solutions for implementing circular principles in cattle production. Findings revealed a relatively small livestock production scale, averaging 3.6 cattle per household. A staggering 92% of respondents were unfamiliar with the term "circular agriculture." An evaluation scale ranging from 1 to 5 was used to assess knowledge levels about circular agriculture (reduce, reuse, recycle), revealing that 35% of households had no knowledge (level 1), 62% possessed minimal knowledge (level 2), and only 3% reached level 3.2 No respondents demonstrated deep or very deep understanding (levels 4 and 5). While 67% of cattle manure is reused for home cultivation and 24% is sold, 9% is directly discharged into the environment. **.**2 The Provincial Department of Agriculture and Rural Development should establish demonstration models of circular agriculture, such as biogas or manure composting methods, to minimize chemical fertilizer usage and promote waste recycling.

Keywords: Mekong Delta, Farmers 'Awareness, Circular Economy.

1. INTRODUCTION

The **linear economic model** employed over the past century is characterized by four stages: resource extraction, processing, use, and disposal. This model is deemed unsustainable due to its overexploitation of resources, significant waste generation, biodiversity loss, ecological imbalances, and environmental pollution1. Economically, the linear model incurs high production costs because it fails to utilize by-products efficiently1. Socially, the overexploitation of natural resources associated with this model can trigger conflicts, exacerbate wealth disparities, and fuel social inequality. In response to the shortcomings of the linear economy, the circular economy model emerged in the 1990s. This model envisions an economic system where waste from one process becomes a

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resource for another. The principles of a circular economy revolve around "R-strategies". The most prevalent principle, the 3Rs, encompasses:

Reduce: Minimize resource or input usage **Reuse:** Utilize resources again for the same or different purposes with minimal or no treatment **Recycle:** Reprocess resources/waste to be used again for the same or different purposes **Agriculture**, particularly animal husbandry, plays a crucial role in the global economy but also contributes significantly to greenhouse gas emissions. This has led to a strong push for the adoption of circular economy principles within agriculture to promote sustainable production and consumption. **Circular agriculture** emphasizes minimizing external inputs, closing nutrient loops, regenerating soil, and mitigating environmental impact3. The concept of circular agriculture has gained considerable traction, both in scientific research and government action programs aimed at sustainable development and climate change adaptation. Despite the growing interest in circular agriculture, there remain questions regarding farmers' understanding and practical implementation of circular economy principles. A study conducted in Vietnam's an Giang, Vinh Long, and Tra Vinh provinces sought to explore these questions.

2. LITERATURE REVIEW

This source discusses a framework for implementing a circular economy (CE) in agriculture. The authors reviewed papers on agriculture and CE from 2010 to March 2020 from the Scopus and Web of Science Core Collection databases. The starting point for the review was set at 2010 because the authors wanted to focus on more recent conceptual CE approaches that have been generalized since that year due to the activity of the Ellen MacArthur Foundation (EMF). A CE implementation framework should include the concept that defines it, the principles on which it is based, and the strategies for its implementation**.** The framework for CE implementation in agriculture is based on the findings from scientific literature analyzing CE aspects in the agricultural sector. Another important term when discussing CE implementation in agriculture is sustainability**.** The goal of CE is to create economic and social prosperity and protect the environment by preventing pollution, which will facilitate sustainable development.

Therefore, circular agriculture should become a pillar of the economy, rather than a subsidized sector, ensuring economic sustainability. Ensure the conservation of biodiversity and productivity over time in its agroecosystems, ensuring environmental sustainability. Contribute to providing food security, eradicating poverty, and improving health and living conditions, which is social sustainability. Circular agriculture must be regenerative, meaning that it maintains and upgrades the ecosystem's services. When developing circular production models, agriculture must evolve to include regenerative systems that close nutrient loops, minimize leakage, and maximize each loop's long-term value.

Research points to different aspects that should be considered when transferring the CE concept to agriculture. According to Ruiz et al. (2019), resource efficiency is the central axis in decision-making and economic practices to ensure greater added value and

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maintain resources within the production system for as long as possible. Achieving efficiency in circular agriculture models includes optimizing processes to minimize resource use and avoid waste (Jurgilevich et al., 2016; McCarthy et al., 2019; Sherwood, 2020). Another prominent term when discussing CE implementation in agriculture is sustainability. Because the CE aims to generate economic and social prosperity and protect the environment by preventing pollution, thus facilitating sustainable development (Burgo-Bencomo et al., 2019), circular agriculture should i) become a pillar of the economy, rather than a subsidized sector, ensuring economic sustainability (Bos and Broeze, 2020); ii) ensure the conservation of biodiversity and productivity over time in its agroecosystems, ensuring environmental sustainability (Jun and Xiang, 2011); and iii) generally contribute to providing food security, eradicating poverty, and improving health and living conditions, or social sustainability (Burgo-Bencomo et al., 2019; Kristensen et al., 2016).

Finally, it is widely recognized that circular agriculture must be regenerative, understood as a system that maintains and upgrades the ecosystem's services (Morseletto, 2020). In developing circular production models, agriculture must evolve to include regenerative systems that close nutrient loops, minimize leakage, and maximize each loop's long-term value (EMF, 2015; Morseletto, 2020). Therefore, CE in reference to agriculture can be defined as "the set of activities designed to not only ensure economic, environmental and social sustainability in agriculture through practices that pursue the efficient and effective use of resources in all phases of the value chain, but also guarantee the regeneration of and biodiversity in agro-ecosystems and the surrounding ecosystems".

3. RESEARCH METHODOLOGY

3.1 Site Description

Three provinces of the MRD (An Giang, Vĩnh Long and Tra Vinh) are chosen for the research implementation where their ecological conditions are different and agriculture production is popular in terms of culture area, production volume and export value. There are three districts, of which six villages, chosen for the interview. Three provinces have a great potential to apply 3Rs' principle in agriculture because it is a key agricultural production area of the country.

3.2 Household Survey

To understand farmers' perceptions of circular agriculture and solutions to apply the circular principles to the cattle production, a household survey was carried out in districts. Totally, there were 240 farmers involved in the survey. It was conducted in June and July 2024. The questionnaires consists of three main parts:
(i) general information about cattle raising households, (ii) people's awareness about circular agriculture and current status of livestock waste management, and (iii) solutions to apply circular agriculture in animal husbandry. Interview time is about one and half hour per household by asking directly.

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4. RESULTS AND DISCUSSION

4.1 Household Information

A household survey was conducted in June and July 2024 in the districts of An Giang, Vinh Long, and Tra Vinh provinces to understand farmers' perceptions of circular agriculture and its applications in cattle production1. Sixty farmers participated in the survey, which consisted of three parts: general information about cattle-raising households; awareness of circular agriculture and current livestock waste management practices; and solutions for applying circular agriculture in animal husbandry. The survey involved direct interviews with each household, lasting approximately one and a half hours

Table 1: Basic household information

Items	Mean (n=240)	Min	Max
Age of household head (years)	51.5	25	82
Years of schooling	4.3	0	14
Experience (years)	20.7	2	55
Family size (persons)	4.0	1	8
Total land area (ha)	0,82	0,003	10
Number of cattle (head)	3.6	1	11

(Source: Household survey, 2024)

Farmers have an average husbandry experience of 20.7 years. This is a traditional activity, so they accumulate a lot of experience year by year. Each household has an average of 4 members. Usually they are a couple and two children. The average land area is 0.82 ha per household. Most of the surveyed households have land to grow rice and grass for cattle. Cultivation and animal husbandry are the two main sources of household income, accounting for about 84%.

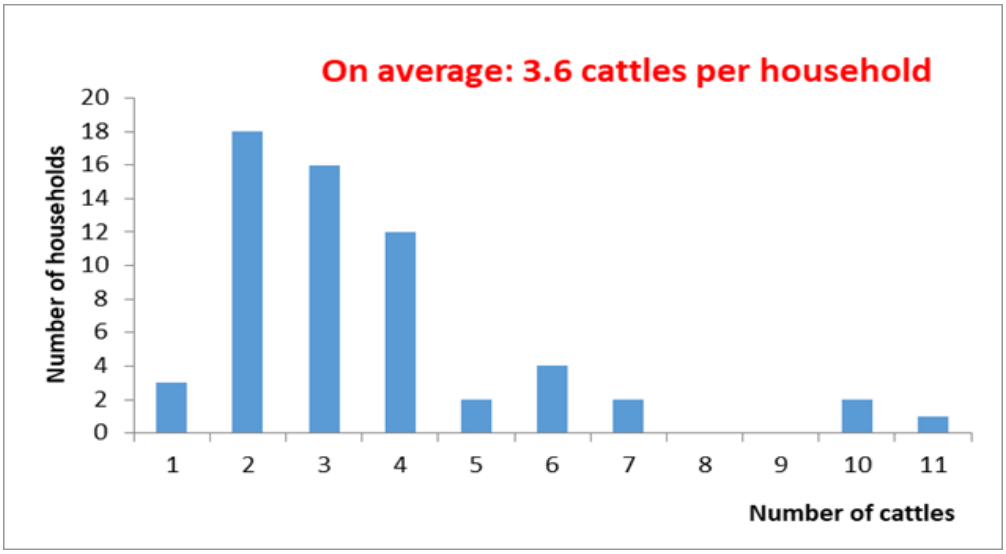

Figure 1: Scale of cattle production in research areas (Household survey, 2024)

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The average cattle holding per household is 3.6 heads. The largest percentage of households raise two cattle. The second and third largest groups raise three and four cattle, respectively. Few households raise seven or more cattle. These findings are similar to a study in Ben Tre province that reported an average of 3.8 cattle per household. Overall, the scale of cattle production is relatively small.

4.2 Farmer's perception of circular agriculture

A study was conducted to understand farmers' knowledge and practices related to circular agriculture, a concept that emphasizes reducing waste, reusing resources, and recycling. The results showed that 92% of the farmers had never heard of the term "circular agriculture."

Further investigation revealed a limited understanding of circular agriculture principles among the farmers.1 Only 8% had heard of the term, and the majority (97%) had a basic understanding or no knowledge at all.

While 67% of cattle manure was reused for home cultivation, there was no systematic composting method in place. Farmers primarily used manure directly, and liquid waste was entirely discharged into the environment.

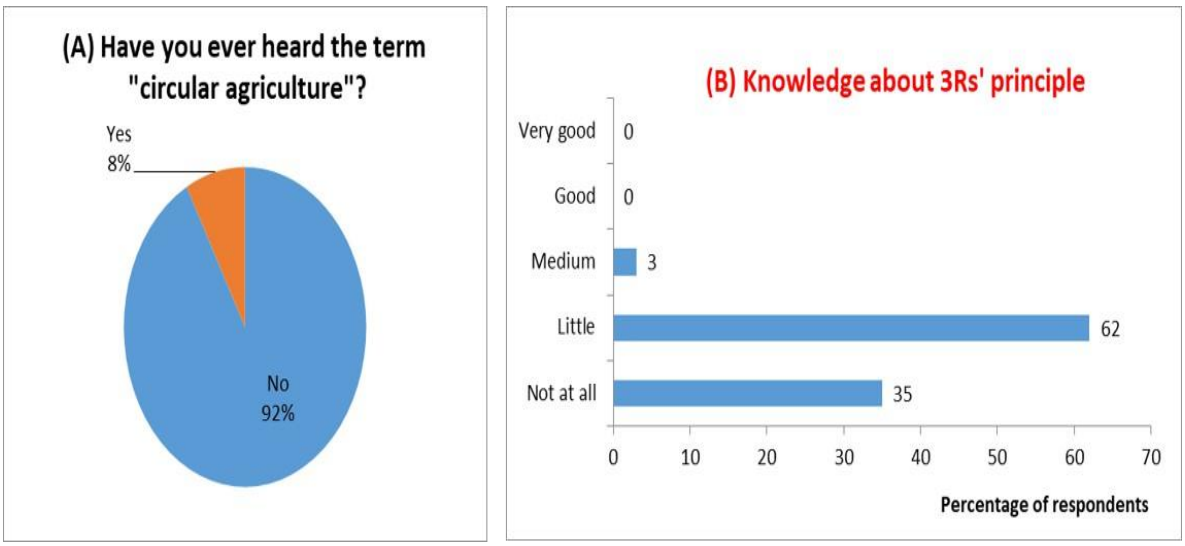

Figure 2: Farmers' perception of circular agriculture (Household survey, 2024)

The concept of a circular economy, while prevalent globally for over 30 years, is relatively new to Vietnam. It was formally introduced in Vietnam's Law on Environmental Protection 2020.1The law defines a circular economy as a model that emphasizes reducing resource extraction, extending product lifecycles, minimizing waste, and mitigating environmental impact through design, production, consumption, and service activities. Studies reveal that Vietnamese farmers lack awareness and understanding of the circular economy and its 3Rs principle. This knowledge gap highlights the need for educational initiatives to raise awareness among farmers.

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Promoting awareness is crucial to achieving the objectives outlined in the Law on Environmental Protection. Strategies for application of circular agriculture enhancing the awareness of circular agriculture's principles and benefits among government officials, policymakers, businesses, and local communities is crucial. Leveraging existing resources like livestock houses, land, agricultural by-products, and equipment is essential for expanding livestock production. This shift from small-scale to larger-scale operations can facilitate the implementation of the 3Rs principle. Investing in agricultural extension services to provide training, information exchange, field visits, and demonstrations of successful circular agriculture models, such as composting, biogas, and bio-fertilizers, is also important.

5. CONCLUSION

Cattle husbandry is important for local livelihoods, but production scale is limited and waste management is inefficient. People lack awareness about circular agriculture benefits, hindering sustainable agricultural development**.** To address these challenges and promote sustainable agriculture, it's crucial to raise awareness. This can be achieved through communication activities and extension services.1 These efforts will help people understand the importance of circular agriculture and its potential for sustainable development. By implementing these measures, the goals of sustainable agricultural development can be achieved in the future.

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