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Research Article

FACTORS INFLUENCING FARMERS' INTENTIONS TO PARTICIPATE IN THE CIRCULAR ECONOMY IN THE MEKONG DELTA, VIETNAM

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Abstract

Developing the circular economy model in Vietnam today still faces several shortcomings. It has not attracted a significant number of farmers to participate, and participation is uneven across different localities and regions. This situation presents a challenge for researchers and policymakers to study and devise effective solutions. Based on survey data from 370 farmers in the Mekong Delta, Vietnam, and utilizing Partial Least Squares-Structural Equation Modeling (PLS-SEM) with Bootstrap analysis for reliable testing, this study identifies key factors influencing farmers' intentions to engage in the circular economy model. These factors include "Attitude towards the circular economy" and "Subjective Norms".

Keywords: Circular economy, Attitude, Subjective norms, Intention to participate, Partial Least Squares-Structural Equation Modeling (PLS-SEM), Mekong Delta, Vietnam.

INTRODUCTION

Around the world, the circular economy (CE) has garnered increasing attention from society, companies, and public authorities in recent years (Korhonen and Honkasalo, 2017). The most recognized economic model remains the traditional one, which is based on continuous growth and intensive resource use (Kirchherr *et al*., 2017). CE has emerged as an alternative to this paradigm, owing to its fundamentally positive impact on the environment, its various functions, and its interaction with the economic system (Ghisellini *et al*., 2016). In Vietnam, the development of the circular economy model has only begun to receive attention since 2021. However, it currently faces several shortcomings, including limited participation and uneven engagement across different localities and regions. This situation poses challenges for researchers and policymakers, who need to understand the factors influencing participation in the circular economy model to devise effective solutions. This research focuses on identifying the factors that influence intentions to participate in the circular economy model, developing a quantitative model for this relationship, and exploring policy implications derived from the research results. A survey of 370 farmers in the Mekong Delta, Vietnam was conducted to establish a practical basis for the measurement model. The Mekong Delta holds significant importance in Vietnam concerning politics, the economy, social matters, defense, security, and trade with the Association of Southeast Asian Nations (ASEAN) and the Mekong River sub-region. The region encompasses a natural area of 39,734 km², accounting for 12.2% of the country's total land area, and has a population of approximately 18 million, representing 19% of the nation's population. With around 150 district-level units and nearly 10 million farming households, the Mekong Delta's gross regional domestic product (GRDP) reached about 970 trillion VND in 2022, accounting for 11.95% of the country's total GDP. The total product per capita in the area reached 56.02 million VND per person per year, with a workforce trained at a rate of 62.8%. The Delta is recognized as the largest rice granary and a major center for fruit and seafood production in the country, contributing 31.37% of the agricultural sector's GDP, over 50% of rice output, 65% of aquaculture production, 70% of fruit, 95% of rice exports, and 60% of exported seafood output, thereby playing a crucial role in ensuring national and export food security. Additionally, the Mekong Delta features a complex system of rivers and canals, numerous large gardens and forests, and is home to four biosphere reserves, national parks, and natural reserves that have been recognized as Ramsar sites by the Secretariat of the Ramsar Convention (Le Duc Tho and Nguyen Quoc Thanh, 2023).

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MATERIALS AND METHODS

Background Theories

Circular Economy: The concept of Circular Economy (CE) was first officially introduced by Pearce and Turner (1990). It refers to a new economic model grounded in the fundamental principle that "everything is an input to something else," which stands in stark contrast to traditional economic perspectives. Simply put, CE involves transforming the waste output of one industry into input resources for another industry or facilitating the circulation of resources within a business itself. CE contributes to increasing value for businesses and producers, reducing resource exploitation, lowering waste treatment costs, and minimizing environmental pollution.

Theory of Circular Economy: CE aims to replace the traditional economic model. Its primary objectives are to promote the reuse of resources and to introduce inputs back

into the economy, thereby avoiding waste generation and reducing the high consumption of non-renewable resources (Kristoffersen *et al*., 2020). CE models advocate for the sustainable use of natural resources, resulting in decreased impacts on ecosystems and human well-being (López-Páez and Requena, 2005). The goal of CE is to create a zero-emission economic system with a closed production cycle, transitioning from environmental exploitation to industrial transformation, ultimately reaching final consumers through clean energy sources. The material cycle in CE operates on the philosophy of viewing waste as a resource, aiming to minimize waste through the design of materials, products, technical systems, and even business models (Nobre and Tavares, 2021). The CE model is applicable to any economic sector. In agriculture, for instance, this model allows for the retention of residues from agricultural biomass and food processing within the food system as renewable resources (inputs), thereby reducing the need for new inputs from outside the system (Schouten, 2020). The adoption of CE solutions is essential for achieving food security and agricultural sustainability (Nodin *et al*., 2022). By applying CE principles in agriculture, nitrogen losses can be minimized, while CO2 and other greenhouse gases can be absorbed and sequestered (Johnson *et al*., 2007). In recent years, the agricultural sector in developed countries has implemented various sustainable technologies focusing on circular agriculture, which contributes to reducing waste and greenhouse gas emissions while producing high-quality food.

Theory of Planned Behavior: Ajzen and Fishbein (1980) asserted that the intention to perform a behavior is influenced by three key factors: attitude toward the behavior, subjective norms, and perceived behavioral control. The three basic determinants in this theory are: (i) Personal Factors: The individual's attitude towards the behavior, reflecting the positive or negative assessment of performing that behavior; (ii) Subjective Norms: The individual's intention to perceive social pressure, which relates to the perception of normative expectations or pressures; and (iii) Perceived Behavioral Control: This determinant refers to the individual's self-efficacy or their perceived ability to perform the behavior. This theory is widely utilized by researchers to study human behavior through actions. The four main variables of the Theory of Planned Behavior (TPB) include attitude towards the behavior, subjective norm, perceived behavioral control, and intention. The theory emphasizes the importance of attitudes, subjective norms, and perceived behavioral control in the formation of behavioral intentions. In the field of insurance, TPB is frequently applied to predict and influence behavior, including behaviors related to technology use (Omar and Owusu-Frimpong, 2007; Schiffman and Kanuk, 2007; Brahmana *et al*., 2013; Nomi and Sabbir, 2020; Ajzen, 2020). The concepts and theories discussed above are relevant to this study, as it is essential to clarify the nature of behavioral intentions and understand the reasons why farmers engage in the implementation of the circular economy.

Attitudes towards and intention to participate in the circular economy: In Vietnam, the term "circular economy" is defined in Article 142 of the Law on Environmental Protection 2020. According to this legislation, the circular economy is an economic model that aims to reduce the exploitation of raw materials, extend product life cycles, limit waste generation, and minimize negative environmental impacts throughout the processes of design, production, consumption, and service delivery (Vietnam National Assembly, 2020).

Customer Attitudes: According to Robbins (2001), attitudes are evaluative judgments about objects, people, or events that shape behaviors and influence marketing effectiveness. They encompass an individual's evaluation, emotional attachment, perceived risk, and propensity to act toward certain objects or ideas. Additionally, attitudes reflect an individual's evaluation, emotional connection, perceived behavioral control, confidence in the benefits received, beliefs, and inclination to act toward a given object or idea (Kotler, 2003; Schiffman and Kanuk, 2007; Lee, 2009; Park *et al*., 2016; Meng *et al*., 2022; Lauwere *et al*., 2022; Dong *et al*., 2023).Cainelli*et al.* (2020) demonstrated that the circular economy (CE) creates new business opportunities through recycled products and services. The practices of reducing, reusing, and recycling materials, along with improving and innovating value chains and supply chains, will attract investors toward cleaner industrial production methods. According to Saavedra *et al*. (2018), the CE model minimizes waste and the need for raw materials by reintegrating them back into the production process. Consequently, manufacturers must prioritize waste treatment, which includes process-based approaches to waste removal. Gray *et al*. (2021) argued that the CE offers substantial benefits in enhancing the efficient use of resources, particularly urban and industrial waste, while balancing economic, environmental, and social factors. These advantages are recognized as key benefits of the circular economy (Zhijun and Nailing, 2007; Muranko *et al*., 2018).Research on online customers in China and Malaysia indicates that perceived behavioral control is the most significant factor influencing customer attitudes (Cheung *et al*., 2013; Wang *et al*., 2017; Damalas, 2021). A study conducted in the Netherlands by Lauwere*et al*. (2022) found that perceived benefits and risk perceptions also affect attitudes toward the circular economy. Therefore, attitudes serve as an overall assessment, reflecting trust in product benefits, customer feedback, and risk perception when making choices about products or services.

Based on the literature review presented above, the following hypotheses are proposed for this study:

H1: Confidence in the benefits of the circular economy positively influences attitudes towards it.
H2: Positive social feedback enhances attitudes towards the circular economy.
H3: Perceived behavioral control positively impacts attitudes toward the circular economy.

According to the theories of reasoned action (Ajzen and Fishbein, 1980) and planned behavior (Ajzen, 1991), attitude towards a behavior is a crucial predictor of an individual's behavioral intention. Factors influencing insurance decisions include awareness, attitudes, health status, insurance measures, risk protection, and investment options. Zeweld *et al.* (2017) demonstrated in an agricultural study in Ethiopia that farmer attitudes play a key role in deciding to participate in the circular economy. Similarly, in India, factors like beliefs, knowledge, motivation, financial ability, and service quality impact insurance decisions (Syan *et al*., 2019). Research on circular economy participation among farmers in China by Zhu *et al*. (2021) indicated that attitudes influence the decision to recycle straw, while Lauwere *et al*. (2022) found in the Netherlands that farmer attitudes significantly affect participation in circular economy practices. In Vietnam, Tran *et al.* (2022) observed that attitudes affect willingness to engage in circular economy activities, while Herrera *et al.*

(2023) in Europe showed that attitudes impact decisions to implement emission reduction innovations. Qasemi*et al.* (2023) in Iran found that attitudes towards sustainable agricultural development affect intentions to participate in the circular economy. Finally, a study by Zhang and Wang (2024) on ecological agriculture in China noted that attitudes influence intentions to adopt circular economy models.These findings underscore the importance of attitudes in shaping intentions to participate in circular economy initiatives. Based on the literature review, this study proposes the following hypothesis:

H4: Attitudes towards the circular economy positively impact the intention to engage in circular economy applications.

Subjective Norm and Intention to Participate in the Circular Economy: According to Ajzen and Fishbein (1980), subjective norms are perceptions shaped by social environments such as family, friends, colleagues, and public opinion that influence an individual's decision to purchase a product or service (Omar and Owusu-Frimpong, 2007; Amin *et al*., 2015). These norms enhance trust and motivation, particularly in the workplace, where group dependence and personal relationships are valued (Venkatesh and Davis, 2000; Hillhouse *et al*., 2000; Pawlak *et al*., 2004; Husted and Allen, 2008; Khatun, 2010; Rezaei *et al*., 2018; Meng *et al*., 2022). They also significantly impact technology acceptance; for instance, studies in Malaysia indicated that promotion, perceived usefulness, attitudes, and beliefs positively affect intentions to purchase medical insurance (Guan *et al*., 2020). Research on farmers' decisions to participate in the circular economy in the Netherlands by Lauwere *et al.* (2022) demonstrated that beliefs influence subjective norms. Furthermore, Herrera *et al.* (2023) found that government support creates incentives for farmers in Europe to engage in circular economy models. Based on these experimental studies, the authors propose the following hypotheses:

H5: Beliefs positively affect attitudes towards subjective norms.
H6: Motivation has a positive effect on attitudes towards subjective norms.

Subjective norms significantly influence customer behavior across various industries, including the service sector in Southeast Europe (Ham *et al*., 2015), health services in China (Wu *et al*., 2022), and Islamic, life, and health insurance in Malaysia and India (Rahim and Amind, 2011; Wilfred, 2020). Factors such as attitudes towards social insurance, subjective norms, access to information, insurance products, prices, promotions, incentives, insurance knowledge, income protection, risk attitudes, and rising medical costs all influence insurance intentions. Studies conducted in Pakistan, Bangladesh, Thailand, and Indonesia (Hassan and Abbas, 2019; Nomi and Sabbir, 2020; Nursiana, 2021) yield similar findings. Research on people's attitudes towards the circular economy in Vietnam by Tran *et al.* (2022) revealed that subjective norms affect willingness to engage in circular economy practices. Additionally, a study in China by Xu *et al.* (2007) found that environmental awareness, subjective norms, and self-efficacy positively impact green purchase intentions. Research on farmers' participation in food safety practices in Iran by Rezaei *et al*. (2018) indicates that subjective norms influence farmers' intentions to engage in the circular economy. Hamzah and Tanwir (2021) demonstrated in Malaysia that subjective norms positively affect green purchase intentions. Further studies on farmers' decisions to participate in the circular economy in China by Zhu *et al.* (2021) and in the Netherlands by Lauwere *et al*. (2022) confirm that subjective norms influence recycling decisions. A study conducted in India by Bhujel and Joshi (2023) also highlights the impact of subjective norms on decisions to engage in the circular economy. Moreover, Herrera *et al.* (2023) reiterated that government support creates incentives for farmers to participate in circular economy models. Research on farmers participating in environmental protection in China by Dong *et al.* (2023) demonstrated that subjective norms affect their decisions. Studies on farmers' willingness to recover discarded agricultural plastic films in China by Zhao *et al.* (2023) and on practicing ecological agriculture by Zhang and Wang (2024) further support the assertion that subjective norms influence intentions to participate in circular economy models.

Based on empirical studies, the authors propose the following hypothesis:

H7: Subjective norms have a positive impact on the intention to participate in the circular economy.

RESEARCH MODEL

A theoretical overview and empirical research are necessary to advance the theory, provide additional empirical evidence, and offer managerial insights into the factors influencing behavioral intentions. Previous studies have examined the impact of these relationships and measured them using various independent quantitative methods, such as exploratory factor analysis, linear regression, or binary logistic regression, alongside individual statistical tests. However, these studies do not provide a comprehensive foundation for an analytical framework on insurance purchase intentions. Thus, the aim of this study is to build on prior findings related to factors influencing behavioral intentions and to analyze the integration of these relationships within a structural equation model. The research team selected a model for the Mekong Delta, Vietnam as shown in Figure 1.

RESEARCH METHODS

Measurement

All scales were adapted from previous studies to fit the research context in Vietnam. We implemented a three-step procedure for conducting the survey. First, we conducted a preliminary survey using the expert method, involving discussions with 10 agricultural management experts with at least five years of experience in relevant agencies, such as department heads and leaders in agricultural organizations, as well as ten experts managing agricultural enterprises in Can Tho City, Vietnam. Based on their input, we adjustedto ensure the questionnaire was appropriate for the Vietnamese agricultural sector. Second, a pilot survey was conducted with 20 respondents engaged in agricultural production using the circular economy model to ensure the questionnaire was free of errors and contained relevant content. Respondents were chosen based on their willingness to participate in the study. Third, a full survey was administered to farmers involved in the production and trade of agricultural products across five provinces and cities: Kien Giang, Ca Mau, Tien Giang, An

Giang, and Can Tho City. A total of 400 respondents completed the questionnaire. A five-point Likert scale, ranging from "strongly disagree" to "strongly agree," was used to measure all observed variables. To assess constructs such as "Evaluation of social response","Attitude towards the circular economy", "Motivation", "Subjective norms",and "Intention to participate in the circular economy". Sixteen observed variables were included in the questionnaire. Measurement items were based on the scale used in a study on insurance in Bangladesh (Nomi and Sabbir, 2020) and a study on the circular economy in Vietnam (Tran *et al*., 2022).Measurement items were further tailored by the authors to align with the Vietnamese agricultural context, following specialized discussions. For constructs like "Confidence in benefits", "Evaluation of social feedback", and "Belief". Twelve observed variables were used, adapted from Tran *et al.* (2022) to suit Vietnam's agricultural development context, as informed by expert consultations. The detailed measurement tables for the scales and observed variables are provided in the appendix (Table A).

Data Collection and Processing

The authors conducted a questionnaire survey across five provinces and cities in the Mekong Delta, Vietnam chosen for their extensive use of agricultural models that closely align with Vietnam's circular economy approach. These include the VAC model in agriculture (Garden - Pond - Livestock), models for collecting agricultural waste such as tree trunks, straw, and rice husks, models for recycling organic waste into microbial fertilizers, bioaquatic models in aquaculture, and household biogas systems. Respondents included household and farm owners, as well as members of agricultural cooperatives. The survey was conducted from March to May 2023. After data processing, 370 valid observations were obtained and used for data analysis. Given the theoretical model's set of interrelated variables, we used Partial Least Squares - Structural Equation Modeling (PLS-SEM) to test the proposed hypotheses (Anderson and Gerbing, 1988; Kline, 2011). The Structural Equation Modeling was conducted in four steps: (i) testing the reliability of the scales, (ii) performing Exploratory Factor Analysis (EFA), (iii) conducting Confirmatory Factor Analysis (CFA), and (iv) executing the Structural Equation Modeling (SEM). Data analysis was carried out using SPSS and AMOS software, version 26.0.

RESULTS

Information aboutsurvey objects:

Table 1. Characteristics of survey objects (n = 370)

	Frequency	%		Frequency	%
Gender			Income		
Male	318	86	<15	65	18
Female	52	14	15–25	162	44
Total	370	100	26–30	94	25
Ages			>50	49	13
<30	73	20	Total	370	100
31–45	203	55	Marital status		
46–55	60	16	Single	135	37
>55	34	9	Married	235	64
Total	370	100	Total	370	100
Education level					
Post graduate	16	4			
College & university	120	32			
High school	206	56			
Other	28	8			
Total	370	100			

Source: Extract research results from SPSS software, 2024.

Table 1 provides details of the questionnaire responses. Among the 370 survey participants, 86% were male. Age distribution was as follows: under 30 (20%), 31–45 (55%), 46–55 (16%), and over 55 (9%). Education levels were categorized into four groups: High School (56%), College & University (32%), Postgraduate (4%), and Other (8%). Additionally, 64% of respondents were married. The majority reported a monthly income of 15–25 million VND (44%).

Scale reliability analysis

Table 2. Scale reliability test and rejected observed variables

No.	Scale	Observed variable are excluded	Alpha coefficients	Conclusion
1	CON	None	0.795	Quality
2	SOCR	None	0.844	Good quality
3	BEL	None	0.838	Good quality
4	MOT	None	0.833	Good quality
5	PBC	None	0.814	Good quality
6	ATT	None	0.845	Good quality
7	NORM	None	0.839	Good quality
8	INT	None	0.832	Good quality

Source: Extract research results from SPSS software, 2024.

The results in Table 2 indicate that all observed variables satisfy the reliability criteria for the scale, with Cronbach's alpha coefficients >0.6 and item-total correlations >0.3 (Nunnally & Burnstein, 1994).

Exploratory Factor Analysis

Table 3. Pattern matrix

	Component							
	1	2	3	4	5	6	7	8
SOCR3	0.847							
SOCR4	0.837							
SOCR2	0.819							
SOCR1	0.804							
PBC4		0.830						
PBC2		0.819						
PBC3		0.797						
PBC1		0.764						
CON4			0.814					
CON3			0.798					
CON2			0.791					
CON1			0.739					
ATT2				0.898				
ATT3				0.862				
ATT1				0.861				
BEL3					0.860			
BEL4					0.828			
BEL1					0.798			
BEL2					0.796			
MOT3						0.855		
MOT4						0.817		
MOT2						0.800		
MOT1						0.792		
NORM3							0.878	
NORM2							0.870	
NORM1							0.861	
INT3								0.877
INT1								0.877
INT2								0.843
Kaiser-Meyer-Olkin Measure			0.798	0.719		0.829	0.726	0.719
Bartlett's test			0.000	0.000		0.000	0.000	0.000
Eigen values			2.143	2.291		1.864	2.270	2.248
% of Extracted variance			65.228	76.356		67.283	75.662	74.946

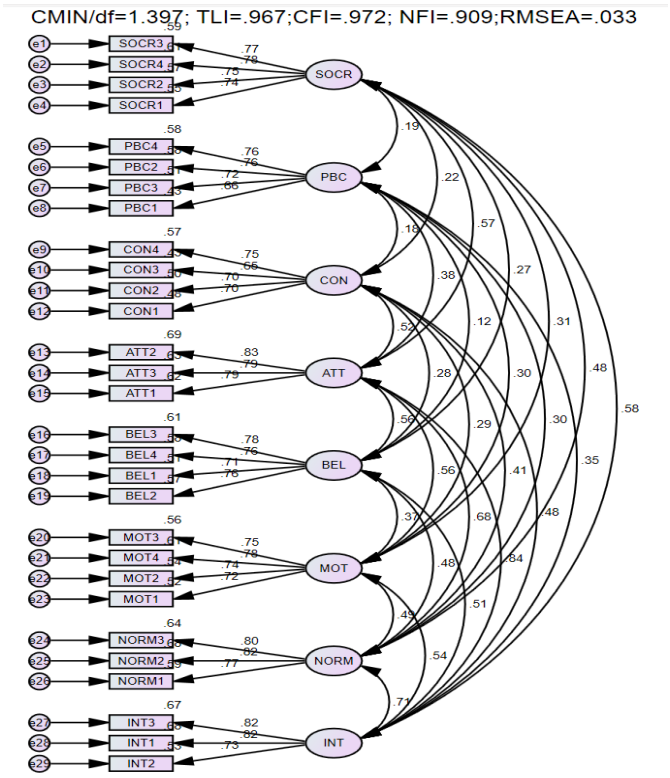
Source: Extract research results from SPSS software, 2024.

Note: 0.5< KMO <1; Bartlett's test has a significance level of less than 0.05; factor loadings of observed variables >0.3; extracted variance >50%; and Eigenvalue >1 (Hair *et al*., 2006).

Table 3 shows that the ATT factors are extracted into three components corresponding to the measured variables of the theoretical model, with a total variance explained of 65.228% and an Eigenvalue of 2.143. The EFA of ATT resulted in three observed variables, with an extracted variance of 76.356% at an Eigenvalue of 2.291. The factors for NORM are extracted into two components corresponding to the model's measured variables, with a total variance explained of 67.283% and an Eigenvalue of 1.864. The EFA of NORM resulted in three observed variables, with an extracted variance of 75.662% at an Eigenvalue of 2.270. Additionally, the EFA of INT extracted three observed variables, with an extracted variance of 74.946% and an Eigenvalue of 2.248. The Promax rotation method was applied.

Confirmatory Factor Analysis

The measurement models that are consistent with the actual data must be consistent with five criteria: (i) Cmin/df, (ii) TLI, (iii) CFI, (iv) NFI, and (v) RMSEA (Gefen *et al*., 2011).



Source: Extract research results from AMOS software, 2024.

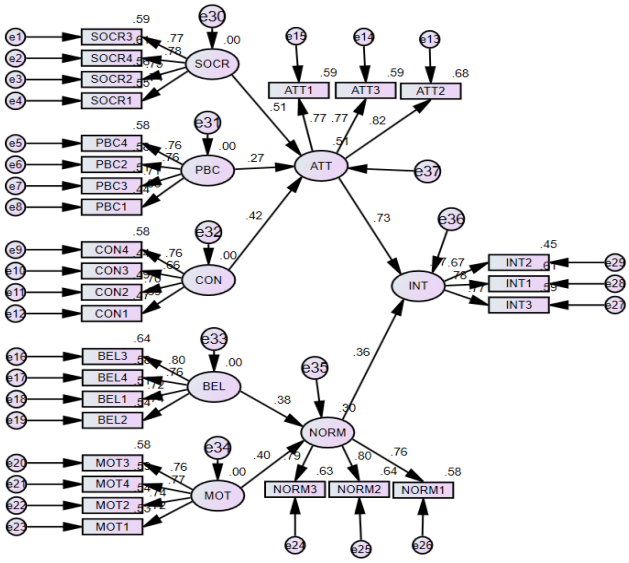
Figure 2. Confirmatory factor analysis results

Table 4 shows that the measurement model is consistent with the actual data.

The results presented in Figure 3 showed the model has a value of Cmin/df = 2.186; TLI = 0.903; CFI = 0.911; NFI = 0.849; and RMSEA = 0.057. Thus, the integrated model fits the actual data.

In Table 5, all hypotheses are accepted with a 95% confidence level or higher (P_value ≤ 0.05).

Table 6 shows the factors affecting ATT, listed in order of influence from highest to lowest: SOCR, CON, and PBC. The factors affecting NORM are presented in order of influence as follows: MOT and BEL. For PCOM, the influencing factors are ATT and NORM.



Source: Extract research results from AMOS software, 2024.

Figure 3. Results of structural equation modeling

Using bootstrap to analyze the reliability of PLS-SEM results

Methods for analyzing structural equations often require large sample sizes (Anderson and Gerbing, 1988); however, academic research frequently encounters limitations in sample size. In such cases, Bootstrap is a suitable alternative (Schumacker and Lomax, 2010). The Bootstrap method is a resampling technique where the original sample serves as the population. This method generates random samples from the original dataset, typically comprising 1,000 observations. The estimated results from these samples are averaged, which tends to approximate the population estimate. The smaller the difference between the average value of the Bootstrap regression coefficients and the model estimates derived from the original sample, the more reliable the conclusions drawn from the model estimates are.

Table 4. The fit indices of the CFA

No.	Measures	Indicator standard values	Model value	Results
1	C min/df	$\chi 2$/ d.f.<3 good fit; <5 accepted; the smaller the better (Bentler and Bonett, 1980; Bagozii and Jy, 1988)	1.397	Good
2	TLI (Tucker-Lewis Index)	TLI: the closer it is to 1, the more appropriate; TLI >0.90 is consistent; TLI ≥0.95 is in good agreement (Hu and Bentler, 1995)	0.967	Good
3	CFI (Comparative Fit Index)	CFI >0.90; 0< CFI <1, the closer to 1, the more suitable (Hu and Bentler, 1995).	0.972	Good
4	NFI (Normal Fit Index)	NFI, the closer it is to 1, the more suitable. NFI close to 0.90 is accepted; NFI >0.95 is, a good fit (Chin and Todd, 1995; Hu & Bentler, 1995).	0.909	Good
5	RMSEA (Root Mean Square Error Approximation)	RMSEA <0.05, the model fits well; RMSEA <0.08, accepted; the smaller the better (Browne and Cudeck, 1993)	0.033	Good

Source: Extract research results from AMOS software, 2024.

Table 5. The model fits the actual data in this study

Hypothesis	Path			Estimate	S.E.	C.R.	P	Decision
H2	ATT	<---	SOCR	0.59	0.066	8.89	***	Accept
H3	ATT	<---	PBC	0.327	0.063	5.165	***	Accept
H1	ATT	<---	CON	0.464	0.063	7.412	***	Accept
H5	NORM	<---	BEL	0.405	0.063	6.452	***	Accept
H6	NORM	<---	MOT	0.409	0.063	6.536	***	Accept
H7	INT	<---	NORM	0.338	0.048	6.978	***	Accept
H4	INT	<---	ATT	0.623	0.053	11.747	***	Accept

Source: Extract research results from AMOS software, 2024
Note: *** (P_value = 0.000 / Sig. = 0.000).

Table 6. The magnitude of the impact

Impacts			Regression coefficient	%	Position
Impact on ATT					
ATT = f(SOCR, PERR, CON)					
ATT	<---	SOCR	0.590	42.7	1
ATT	<---	PBC	0.327	23.7	3
ATT	<---	CON	0.464	33.6	2
Total			1.381	100	
Impact on NORM					
NORM = f (BEL, MOT)					
NORM	<---	BEL	0.405	49.8	2
NORM	<---	MOT	0.409	50.2	1
Total			0.814	100	
Impact on INT					
INT = f (NORM, ATT)					
INT	<---	NORM	0.338	35.2	2
INT	<---	ATT	0.623	64.8	1
Total			0.961	100	

Source: Extract research results from AMOS software, 2024

Table 7. Bootstrap implementation results

Parameter			SE	SE-SE	Mean	Bias	SE-Bias	*CR
ATT	<---	SOCR	0.065	0.001	0.592	0.002	0.002	1
ATT	<---	PBC	0.068	0.002	0.328	0.001	0.002	0.5
ATT	<---	CON	0.069	0.002	0.466	0.002	0.002	1
NORM	<---	BEL	0.072	0.002	0.408	0.003	0.002	1.5
NORM	<---	MOT	0.063	0.001	0.408	-0.001	0.002	-0.5
INT	<---	NORM	0.056	0.001	0.341	0.003	0.002	1.5
INT	<---	ATT	0.056	0.001	0.623	-0.001	0.002	-0.5

Source: Extract research results from AMOS software, 2024
*CR (Critical Ratios) = (Bias) / (SE-Bias)

The absolute value of the CR is less than or equal to 2, indicating that the bias is very small and the difference is not statistically significant at the 95% confidence level (Hair *et al*., 2006). The regression coefficient results obtained before applying Bootstrap are considered reliable, with a confidence level of 95% or higher. Table 7 presents the regression coefficient results before Bootstrap, confirming their reliability.

DISCUSSION

Firstly, the study identified "Attitude" as comprising three components: Evaluation of Social Feedback, Trust in Benefits, and Perception of Risks. This finding aligns with the hypothesis regarding the measurement of "Attitude" and is consistent with results from the Indonesian study by Nursiana *et al.* (2021) and research on public attitudes towards the circular economy in Vietnam by Tran *et al.* (2022). To enhance farmers' attitudes towards the circular economy, the agricultural sector should focus on: (i) assessing social feedback, (ii) correcting perceptions of potential risks, and (iii) disseminating information about the effectiveness of the model to improve farmers' confidence in applying the circular economy model. Secondly, "Subjective Norms" are influenced by "Belief" and "Motivation". This is consistent with findings from the Indonesian study by Tam *et al*. (2021) and Tran *et al.* (2022) research on attitudes towards the circular economy in Vietnam. Therefore, to leverage "Subjective Norms", agricultural extension units should promote the circular economy model through mass media, particularly using the eWOM application via Facebook, TikTok, television, and radio. Thirdly, both "Attitude" and "Subjective Norms" positively impact farmers' intentions to participate in the circular economy. This finding aligns with research conducted in Thailand by Thamtarana & Sornsaruht (2024), research in Bangladesh by Nomi and Sabbir (2020), and Tran *et al.* (2022) study on attitudes towards the circular economy in Vietnam. To encourage farmers to engage with the circular economy model, "Attitude" and "Subjective Norms" are pivotal components of the circular economy development strategy in the Mekong Delta and Vietnam as a whole. The current study aims to expand the theoretical framework and provide empirical evidence regarding farmers' intentions to participate in circular economy models, drawing from data in the Mekong Delta, Vietnam. The findings underscore the significant roles of "Attitude" and "Subjective Norms" in influencing intentions to engage in the circular economy model. The study also offers insights into the interconnected relationships between these factors through structural equation modeling.

However, the study has certain limitations. The survey subjects were drawn exclusively from five provinces and cities in the Mekong Delta, Vietnam which limits the generalizability of the findings. Future research should include surveys from additional provinces and cities, and regions to enhance the overall applicability of the results. Furthermore, this study only examines the relationships between "Attitude","Subjective Norms", and "Intention to Participate" leaving out other factors that may also influence participation.

Conclusion

The current study obtains its target of extending the theoretical framework of the related research area to strengthen the methodology in the field. It also provides important empirical evidence of the relationship among Attitude toward Attitude Toward Circular Economy, Subjective norms, and their impact on Intention to Participate in the Circular Economy, illustrated by the empirical evidence in the Mekong Delta, Vietnam. The findings highlight the strong role of "Attitude" and "Subjective Norm" in Intention to Participate in the Circular Economy. Hence, this study provides some insights into the current research about the relationship between Attitude toward voluntary social insurance, Subjective norms, and Intention to Intention to Participate in the Circular Economy. Besides its above crucial contributions, there are still some limitations in this study that leaves room for coming studies. First, the subjects were drawn from only the Mekong Delta in Vietnam, which limits the external validity of this study. Future studies should apply similar methods to cases of other regions and make comparisons to enhance the power of the findings. Finally, this paper focuses on the relationship between Attitude toward Circular Economy, Subjective norms, and Intention to Participate in the Circular Economy. Future studies can examine the effect of other factors on the intention to Participate in the Circular Economy to better understand the overall factors determining the intention into Intention to Participate in the Circular Economy in Vietnam.

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APPENDIX

Table A. Scales and observable variables

No.	Scales and Observed Variables	Code
I	Confidence in Benefits	CON
1	I know the basic principles of the circular economy well.	CON1
2	I clearly understand the economic and environmental efficiency of the circular economy compared to traditional economics.	CON2
3	The circular economy brings benefits by utilizing all resources in agricultural production.	CON3
4	I believe farmers in the Mekong Delta are well aware of the circular economy.	CON4
II	Evaluation of Social Response	SOCR
5	Those who have been applying the circular economy inspire me.	SOCR1
6	I have heard about the circular economy through mass media.	SOCR2
7	Local governments and agencies have policies to encourage farmers to transition to a circular economy.	SOCR3
8	If the state supports me with a loan from a formal credit institution, I will participate.	SOCR4
III	Perceived Behavioral Control	PBC
9	I am eligible to participate in the circular economy.	PBC1
10	I have many ways to access information to choose from for implementing the circular economy.	PBC2
11	Thanks to training from Agricultural Extension Officers, I have the knowledge needed to apply the circular economy.	PBC3
12	I have the support of friends and successful farmers in my area to participate in the implementation of the circular economy.	PBC4
IV	Attitude Toward Circular Economy	ATT
13	Participating in the circular economy is definitely the right thing to do.	ATT1
14	Because the state has supportive policies, I participate in circular economy activities.	ATT2
15	I believe that the circular economy is beneficial for me and my community.	ATT3
V	Belief	BEL
16	The circular economy is a production and business method that harmonizes economic, social, and environmental factors.	BEL1
17	Agricultural Extension staff are capable of guiding farmers in sustainable agricultural production.	BEL2
18	Farmers' moral responsibility should be linked to technical innovation and agricultural technology.	BEL3
19	The diversity of resulting products aligns with farmers' selection goals.	BEL4
VI	Motivation	MOT
20	I recognize that consumers of agricultural products today are concerned about product quality and safety.	MOT1
21	Because the government has supportive policies, I participate in circular economy activities.	MOT2
22	I believe that the circular economy provides sustainable livelihoods for farmers.	MOT3
VII	Subjective Norms	NORM
23	Many people are currently interested in purchasing clean agricultural products.	NORM1
24	My friends and other important individuals in my life want me to apply circular economy principles in agricultural production and business.	NORM2
25	Most of the people important to me believe I should adopt the circular economy.	NORM3
VII	Intention to Participate in the Circular Economy	INT
26	I will join the circular economy.	INT1
27	I will encourage my relatives to join the circular economy.	INT2
28	I want to participate in the circular economy now.	INT3

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