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SUSTAINABLE GROWTH OF A FIRM THROUGH CIRCULAR ECONOMY PRACTICES: DISCLOSING THE CASE OF AGRI-FOOD PROCESSING SECTORS IN THE NORTH WESTERN PROVINCE

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ABSTRACT

In Sri Lanka, small and medium-scale enterprises (SMEs) in the agri-food sector play a vital role in economic development, yet face growing pressure to adopt sustainable practices in response to climate change, resource scarcity, and regulatory demands, etc. Shifts towards a circular economy (CE) in agriculture have been acclaimed as a pathway for creating value through innovation, enabling firms to simultaneously achieve economic growth and environmental sustainability. On this understanding, this study examines how different social system factors: market forces, government regulations, and judicial mechanisms influence the adoption of CE practices among agri-food processing SMEs in the North Western Province of Sri Lanka. Using a quantitative approach, data were gathered through structured questionnaires from a sample of 50 SMEs, selected via random sampling from records of the Provincial Environmental Authority. The survey assessed adoption across five CE activity areas: Take, Make, Distribute, Use, and Recover, while also measuring the perceived influence of five incentive categories: Cost implications; Sales and revenue; Existing regulations; Anticipated regulations, and Liability laws, to which responses were assessed using Likert scales. The results suggest that nearly half of the firms studied possess a 'high' level of CE adoption, while others reported 'moderate' or 'low' adoption. An Incentive Index was developed by dividing the aggregated scores provided on the Likert scales by the maximum potential score to normalize the results. The Measurement

*Model derived indicates strong Internal Consistency and Reliability (Cronbach's alpha values). The results from Multiple Linear Regression (IBM SPSS) showed that existing government regulation (EGR) had a significant influence (β = 0.541, **p < 0.001), emphasizing the role of policy enforcement in fostering innovative, value-creating, sustainable practices. Overall, the study emphasizes that robust regulatory frameworks, combined with targeted incentives, can empower SMEs to innovate and generate both economic and environmental value through circular economy practices.*

Keywords: Agri-Food Innovation, Environmental Policy, Resource Efficiency, SME Competitiveness, Sustainability Adoption

1. Introduction

The shift towards a circular economy in agriculture is gaining momentum in numerous countries, particularly as the depletion of global natural resources becomes more pronounced. Consequently, transitioning to an economic model that tackles the challenge of harmonizing economic growth with environmental conservation (Nguyen *et al*., 2024) has become a central policy and research priority. In recent times, research has highlighted supply chains and closed-loop business models with the aim of transitioning to a Circular Economy. According to Nguyen *et al*. (2024), the Circular Economy (CE) is described as "an economic system that signifies a paradigm shift in the relationship between human society and nature, aiming to prevent resource depletion, close energy and material loops, and promote sustainable development through its application at the micro (enterprises and consumers), meso (economic agents in symbiosis), and macro (cities, regions, and governments) levels. It has been suggested that industries can achieve a circular economy through five stages: take, make, distribute, use, and recover, which involves transforming their linear business processes (take, make, and distribute) into circular ones (Prieto-Sandoval *et al*., 2018).

There are three key social processes: market, regulatory, and judicial mechanisms significantly influence how firms implement circular economy practices (Caswell *et al*., 1998). Market processes facilitate the coordination of firms' actions through voluntary cooperation driven by

market forces. For instance, in the agri-food sector, companies may adopt circular economic practices and customer-focused strategies either voluntarily or semi-voluntarily, often under the influence of government regulations or supportive policy frameworks, as well as recommendations from trade or industry bodies (Cahyadi *et al*., 2024). In this context, government processes play a distinct role by providing legal frameworks and enforcing compliance mechanisms that shape organizational behavior in different ways, particularly when comparing developing and developed country settings. In Sri Lanka, this is achieved through the statutory and regulatory requirements set by national, provincial, and municipal governments. Additionally, the judicial process aids in resolving disputes. This study is grounded in the theoretical frameworks proposed by Segerson (1999). However, prior studies seldom examine how these three social processes simultaneously influence CE adoption at the firm level, especially within small and medium-scale agri-food processors in developing economies, a gap this study addresses.

Small and medium-scale enterprises (SMEs) contribute largely to the economy in Sri Lanka. SMEs create opportunities across a wide range of geographical sectors and areas through employment and value creation, provide skills development opportunities, and drive innovation, contributing directly to inclusive growth and social goals. Climate change poses a major threat to humankind, driven largely by global warming resulting from greenhouse gas emissions and related anthropogenic activities. SMEs have the potential to become eco-innovators by enhancing their environmental performance through lean and green improvement measures (Rodríguez-Espíndola *et al*., 2022).

Additionally, prior research reveals the relationship between sustainability practices and performances, along with the impact of various enablers, drivers, and external and internal pressures on economic, environmental, and social (Dey *et al.*, 2022). However, there is a lack of a comprehensive approach that simultaneously captures the current state of CE adoption, the motives behind adoption, and the influence of social processes within resource-constrained SME contexts. The purpose of this empirical analysis is to identify the impact of social systems on agri-food processing SMEs in the North Western Province of Sri Lanka in adopting various CE actions to manage their operations

sustainably. Specifically, the study seeks to explain why some firms excel more than others in adopting CE practices, what drives these differences, and whether adoption is shaped primarily by judicial pressures, government regulations, or market-based incentives. By addressing these questions, the study fills a critical gap in understanding CE transitions among SMEs in developing-country agri-food sectors.

2. Literature Review

2.1. Fields of Action of CE

The circular economy (CE) model in the agri-food sector can be understood through five interconnected fields of action: Take, Make, Distribute, Use, and Recover. Each stage plays a vital role in reshaping traditional linear processes into sustainable, circular operations (Prieto-Sandoval *et al*., 2018). The effectiveness of CE systems depends heavily on the interconnectivity among these stages, where improvements in one stage, particularly in the Use and Recover phases, enhance resource efficiency, reduce waste generation, and enable continuous material loops across the value chain.

“Take” strategies focus on selecting raw materials and suppliers with established reputations for environmentally responsible practices. Key approaches for material selection in a CE include avoiding toxic substances, ensuring transparency in processes and products, adopting sustainable materials, and utilizing materials that are both sustainable and fully recoverable.

“Make” strategies involve training employees on sustainability issues, reducing environmental impact through resource optimization, using sustainable energy sources, preventing environmental harm, implementing eco-design, and achieving zero waste in production processes.

“Distribute” strategies aim to optimize inventory, logistics routes, and storage space through collaborative planning among all stakeholders, including suppliers and distributors.

" Use" strategies emphasize educating customers about eco-labeling and zero-waste certification, along with implementing green marketing strategies, market segmentation, and product system services.

"Recover" strategies focus on effective reuse, recycling, and resource recovery practices, requiring appropriate collaboration among all stakeholders in the supply chain, including policymakers (Prieto-Sandoval *et al*., 2018).

2.2. Social System Processes

We hypothesized that the managerial decisions on the adoption of circular economic practices were coupled with a system of economic incentives to which firms are expected to respond. This system is comprised of the market (private), regulatory (public), and liability (judiciary) incentives and is characterized by the direct and indirect "expected benefits" and "costs" to the firm arising from that decision. In other words, firms evaluate the potential gains and obligations arising from adopting CE practices, considering both voluntary market-driven incentives and externally imposed regulatory or legal pressures (Cahyadi *et al*., 2024).

2.3. Research Gap and Research Questions

Despite growing CE research, key gaps remain for SMEs in developing countries. Limited empirical evidence explains how market, regulatory, and judicial processes jointly influence firm-level adoption, with most studies centered on large firms or developed contexts. Research rarely addresses the resource constraints of agri-food SMEs or integrates how internal capabilities and external pressures shape adoption across the five CE fields—Take, Make, Distribute, Use, and Recover.

To address these gaps, this study formulates the following research questions:

RQ1. How do tangible and intangible resources affect the ability of agri-food SMEs in Sri Lanka to adopt circular economy practices?

RQ2. How do market, regulatory, and judicial processes individually and collectively influence the adoption of CE practices among these SMEs?
RQ3. What are the barriers and enabling factors that determine differences in CE adoption across SMEs in the Sri Lankan agri-food sector?

By addressing these questions, the study aims to provide a comprehensive understanding of the internal and external factors shaping CE adoption and offer practical insights for promoting sustainable business practices among SMEs in developing-country agri-food sectors.

3. Methodology

3.1. Data Collection and Analysis

This study employed a quantitative research approach to assess the influence of social system incentives on the adoption of CE practices. Using random sampling, 300 SMEs were contacted based on data obtained from the Provincial Environmental Authority-North Western Province (PEA-NWP). Due to time constraints, the final analysis included 50 fully completed responses.

Primary data were collected through a structured questionnaire representing agri-food SMEs. The questionnaire employed a 7-point Likert scale ranging from 1 ("Strongly Disagree") to 7 ("Strongly Agree"), ensuring a nuanced reflection of each firm's level of adoption with 20 different CE-related statements covering: Take, Make, Use, Distribute, and Recover. In addition, the questionnaire included items measuring perceptions of five selected social system incentives: Cost and other financial implications (CST), Sales and Revenue (SLR), Existing government Regulations (EGR), Anticipated government regulations (AGR), and Liability laws (LBL).

3.2. Developing Measurement Models

To assess the relationships among CE practices and influencing factors, Measurement Models (MM) were first developed for both dependent

and independent constructs using Structural Equation Modelling (SEM) in Analysis of Moment Structures (AMOS) software. Each latent variable CE practice (T, M, U, D, R), COST, SLR, EGR, AGR and LBL was measured using multiple Likert-scale items. The collected responses were analysed to assess the relationships between variables within the MM. Specifically, Cronbach's alpha values were calculated using IBM SPSS to validate construct reliability (Hussey & Eagan, 2007). All were found to be within acceptable limits, indicating satisfactory reliability and construct validity of the MM.

Table 1: Cronbach's Alpha Values of Latent Constructs

Construct	**Cronbach's alpha value**
Cost (CST)	0.73
Sales and Revenue (SLR)	0.74
Existing Government Regulations (EGR)	0.70
Anticipated Government Regulations (AGR)	0.69
Liability Laws (LBL)	0.71

After validating MMs, a full structural model was developed to test hypothesised relationships between independent variables and CE adoption practices. However, model fit indices GFI, RMSEA, and χ^2/df indicated a poor fit, suggesting the structural model required re-specification.

Table 2: Goodness of Fit Indices of MM

GOF Measures	**Value**
GFI	0.674
AGFI	0.564
PGFI	0.504

The Maximum Likelihood Estimation (MLE) techniques were used to determine whether the indicators chosen were adequate measures of the five incentives. However, MLE is sensitive to sample size and typically requires a large number of observations to produce reliable and stable estimates. In this study, the limited sample size poses challenges to obtaining acceptable model fit indices.

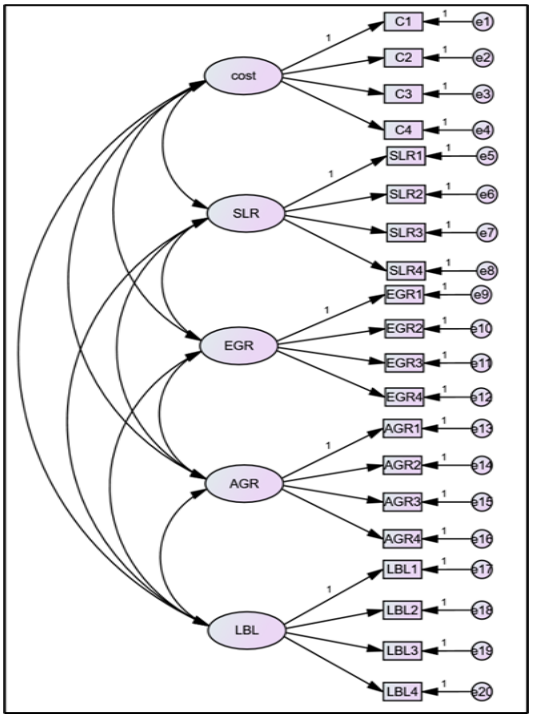

Figure 1: Measurement Model

3.3. Regression Analysis

Due to limitations in sample size and complexity of the structural model, the analysis shifted to Multiple Linear Regression (MLR). This allowed identification of the most influential drivers of CE practice adoption.

Because each incentive included multiple indicators, a single aggregate score wasn't initially available. To address this, the responses given by participants to each attitudinal statement related to an incentive were used to calculate an index value for that specific incentive (j = 1, 2...5). This value, known as the Incentive Index (Iji), was calculated by summing the respondent's scores for all relevant indicators of the incentive, each rated on a 7-point Likert scale, and dividing the total by the maximum potential score for that incentive. This approach provided a standardised measure of how strongly each respondent perceived the influence of each incentive (Jayasinghe-Mudalige U.K, & Udugama. M., 2014).

Iji = Aggregate Score (AGS)/ Maximum Potential Score (MPS) …….. (1)

The Maximum Potential Score (MPS) in Equation (1) was used to standardise the Incentive Index, allowing its final value to fall within a scale ranging from -1 to +1, where -1 represents the lowest possible perception of the incentive and +1 indicates the highest. Using these standardised indices as independent variables, the regression model in equation (2) was tested.

$$CE\_Total = \beta_0 + \beta_1(Cost) + \beta_2(SLR) + \beta_3(AGR) + \beta_4(EGR) + \beta_5(LBL) + \varepsilon \ldots. (2)$$

4. Results and Discussion

4.1. CE adoption by SMEs

To assess CE adoption among firms, a 7-point Likert scale was used across 20 items, each reflecting a key aspect of CE implementation. Responses were categorized into three levels of adoption based on the Likert score (Table 3).

Table 3: CE Adoption Levels and Relevant Likert Scores

Scale	Meaning	Points per Item
1–2	Not Adopted	0
3–5	Partially Adopted	3
6–7	Fully Adopted	6

A total adoption score was calculated for each respondent, with a maximum possible score of 120 across all 20 items. This total was then used to classify firms into three categories of adoption (Table 4).

Table 4: CE Adoption Levels and Total Scores

Total Score	Level	Justification
> 90	Fully Adopted	≥ 75% items fully adopted
60–90	Partially Adopted	Moderate adoption
<60	Not Adopted	Low adoption

Analysis of the 50 responses showed a generally positive but varied level of CE adoption: 54% of firms had high adoption, 30% moderate, and 16% low. These results offer early evidence of SMEs' capacity to

implement CE practices, highlighting the influence of both tangible and intangible resources (RQ1).

4.2. Evaluating the Impact of Social Systems on the CE Adoption

Regression analysis revealed a statistically significant model ($F(5, 44) = 5.178$, $p < 0.001$) that explains approximately 37% of the variance in the dependent variable. Among the five predictors, only existing government regulation (EGR) emerged as a statistically significant factor ($\beta = 0.541$, $^{***}p < 0.001$), suggesting that firms are primarily motivated to adopt CE practices due to current legal enforcement. All other variables, including COST, SLR, AGR, and LBL, were found to be statistically insignificant ($p > 0.05$), highlighting the limited role of market-based or internal drivers in influencing CE adoption within the studied context. These findings provide empirical insights into the regulatory dependence of environmental behaviour among agri-food SMEs in Sri Lanka and call for enhanced policy engagement to support broader adoption.

The results address RQ2 by showing that regulatory mechanisms are the strongest drivers of CE adoption, while market and judicial pressures have limited influence. They also inform RQ1, indicating that although SMEs possess tangible and intangible resources, these alone cannot ensure adoption without strong regulatory support, highlighting the interplay between internal capabilities and external pressures.

4.3. Practical Recommendations for Policymakers and SMEs

Based on the findings of this study, several practical recommendations can be made to support the adoption of circular economy practices among agri-food SMEs in Sri Lanka. Policymakers should strengthen regulations, provide financial incentives, raise awareness through capacity-building, and promote collaboration among key stakeholders. SMEs, in turn, need to build skills, adopt appropriate technologies, leverage available policy support, take gradual steps across all CE stages, and collaborate closely with suppliers, customers, and industry networks.

4.4. Limitations and Recommendations for Future Research

The study's main limitation is its small sample and low response rate, suggesting limited familiarity or interest among firms. Future research should use more participatory methods—such as on-site visits, workshops, and deeper industry engagement—to improve participation and capture a clearer picture of CE adoption. Incorporating qualitative insights would further enhance understanding of the motivations and contextual factors shaping firm behaviour.

5. Conclusion

This study examined CE adoption among SMEs in Sri Lanka's North Western Province, revealing generally positive but uneven uptake, with 54% showing high adoption. Environmental regulatory pressure emerged as the only significant driver, underscoring the importance of legal enforcement. Key barriers included limited resources, awareness, and managerial commitment, while enablers involved policy support and collaborative networks. The structural model showed weak fit, indicating that social pressures may influence CE adoption indirectly. Strengthening regulations, improving support systems, and enhancing SME capabilities can accelerate CE practices and advance sustainability in the agri-food sector.

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