

An Implementation Strategic of Environmental, Social and Governance of Waste Materials in the BCG Model from Tobacco, Tobacco Authority of Thailand

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Abstract

Implementing Environmental Social Governance principles for waste materials in the Bio-Circular-Green Economy Model from Tobacco at the Tobacco Authority of Thailand will boost sustainability, improve the organization's reputation, and favorably impact environmental and social welfare. By implementing waste reduction, recycling, and responsible governance, Tobacco Authority of Thailand can provide a more sustainable and ethical operational framework while promoting a culture of responsibility and accountability.

The research instrument was a questionnaire, and it was used for data collection. Key informants included the Deputy Director of the Tobacco Authority of Thailand (Production Division), the Director of Production Division, and the Head of the Bureau of Quality, Safety, and Environment. Descriptive statistics were mean, and standard deviation. The production supervisor must have a minimum of 7 years professional experience in waste material production and management, as well as maximum value addition. The outcomes derived from the SEM (Structural Equation Modeling) investigation are Chi-Square (CMIN) = 58.827, df = 44, p-value = 0.067, RMSEA = 0.028, GFI = 0.982, AGFI = 0.951. The purpose of the research was analyzing the ESG performance of waste materials based on the Bio-Circular-Green Economy concept and examine the correlation between ESG development and the performance of the TAOT. Summary of findings; Environmental: Mitigating waste and pollution from tobacco cultivation can alleviate environmental repercussions, including the diminishment of soil and water contamination, Social: Establishing accountability for communities and stakeholders by minimizing waste and pollution, which includes generating employment in the recycling sector or utilizing waste materials, Governance: Enhancing internal systems for transparency and reporting outcomes to stakeholders, so fostering confidence in sustainable operations. Minimizing waste from tobacco manufacturing through a sustainability strategy for waste materials can enhance firms' ESG outcomes and generate long-term value, encompassing environmental and social responsibility.

Keywords: ESG, BCG, Materials Waste of Tobacco



Introduction

The Tobacco Authority of Thailand (TOAT) is a government corporation that annually produces millions of baht in revenue for the state. The Tobacco Authority of Thailand currently holds 1,800 tons of waste materials from production, including tobacco dust, defective cigarettes, damaged filters, foil paper, and cigarette rolling paper. The Tobacco Authority of Thailand must engage external corporations for transportation and disposal, incurring substantial costs. It is underutilized and must incur expenses, specifically the Tobacco Authority's costs, for engaging external organizations to transport and dispose of them. Figure 1 depicts tobacco dust and damaged cigarettes.



Figure 1 Waste materials by products from tobacco production.

(United Nations, 1987) mentioned The BCG model consists of bioeconomy, circular economy, and green economy. The bioeconomy pursues to generate added value from biological resources. It is an economy that fosters knowledge and creativity. Biological sciences significantly contribute to ongoing advancement. Transform waste materials into products suitable for several industries, including agriculture, public health, and renewable energy, while maintaining equilibrium among economic, social, and environmental factors. The concept of sustainable development is named after the Brundtland report, which reported sustainable consumption in developed countries. Sustainable development is founded on three essential pillars: social, economic, and environmental. The Brundtland Report necessitated the formulation of policies to avert environmental deterioration and to examine how environmental constraints influence energy efficiency, the global economy, economic resources, and the overarching principles of sustainable industrialization and development grounded in social security.

(United Nations Environment Programme, 2024) A circular economy is a production and consumption paradigm that encompasses sharing, leasing, reusing, repairing, refurbishing, and recycling resources and products for extended durations. Circular Economy seeks to

address global issues including climate change, waste, biodiversity depletion, and pollution by prioritizing design principles. Furthermore, circular economy (CE) is crucial in mitigating climate change by tackling the climate problem, with material recovery playing a significant role. The United Nations' International Resource Panel determined that the extraction and exploitation of natural resources account for around fifty percent of global greenhouse gas emissions. The green economy (GE) is characterized by low carbon emissions, climate change mitigation, resource efficiency, and social equity. Green Economy (GE) should be integrated into employment and income growth, propelled by public and private investments in economic activities, infrastructure, and assets aimed at diminishing carbon emissions and pollution, improving energy and resource efficiency, and preventing biodiversity loss. The Green Economy (GE) is garnering increasing global attention, particularly following the financial crisis of 2008, which significantly exacerbated climate change due to the expansion of human economic activities reliant on the extensive use of fossil fuels. Green economics is acknowledged as the optimal strategy for business and industry implementation to achieve sustainable development at the United Nations Conference on Sustainable Development (UNCSD).

(Kumar, King and Ranta, 2024) strong and diverse corporate governance supports the integration of ESG activities into business strategies. Effective governance improves transparency, risk management, and helps create long-term value. Future research should explore how board characteristics influence ESG efforts and their impact on financial performance and sustainability. ESG is a framework employed to assess an organization's business policies and performance regarding diverse sustainability and ethical concerns. It also provides a method to assess business risks and opportunities in such domains. In capital markets, certain investors employ ESG criteria to assess companies and validate their investment strategies, a technique referred to as ESG investment (ASCO, 2023).

According to (Johnson, Martínez and Chen ,2024) although environmental sustainability, ethics, and corporate governance are often considered non-financial performance metrics, the primary objective of an ESG framework is to ensure organizational accountability through the establishment and execution of comprehensive systems and processes. These processes address a company's environmental impact, including carbon emissions and energy efficiency, as well as social factors such as the fair treatment of employees, suppliers, and stakeholders. ESG-oriented enterprises actively support broader business sustainability goals, positioning themselves for long-term success by integrating responsible governance practices with strategic management.

The primary dimension is the environmental dimension. Numerous enterprises across various sectors have implemented efficient systems and established policies aimed at diminishing carbon dioxide emissions, greenhouse gases, water recycling, waste reduction, and optimizing energy utilization, alongside energy conservation, to mitigate global warming and conserve resources. The second dimension is the social dimension, encompassing equitable human resource management through the organization of activities or projects that promote

the welfare of employees and the broader community, both within and outside the organization. According to (Thompson and Oliveira, 2024) the third pillar of ESG—governance—encompasses the implementation of sustainable practices in areas such as organizational safety, robust corporate governance structures, anti-corruption measures, and comprehensive risk management systems. These three ESG dimensions—environmental, social, and governance—are essential for many corporations, as they play a pivotal role in shaping investor behavior and are increasingly prioritized by stakeholders, partners, and regulatory bodies across global markets.

(Faculty of Providers, 2023) made a public post in fiscal year 2023, the Tobacco Board of Thailand implemented significant policies and guidelines aimed at enhancing operational efficiency and societal benefits for stakeholders. This includes the promotion and support of clean energy utilization and the reduction of greenhouse gas (GHG) emissions, accompanied by a sustained action plan. Thailand's Tobacco Authority planted additional forests to assist absorb carbon dioxide, culminating in an absorption of approximately 300,000 kilograms. The Tobacco Board of Thailand implements a fair management policy that seeks to harmonize sustainable organizational growth with accountability to the community, society, and the environment. This is achieved by leveraging organizational expertise to develop projects that augment community and societal benefits, optimizing resource utilization, and mitigating environmental impacts resulting from its operations (Brownstein, 2020). The Thai Tobacco Authority of Thailand utilizes a balanced management style that fosters sustainable organizational growth while fulfilling its responsibilities to the community, society, and environment by leveraging its expertise to generate projects that boost communal and societal advantages. Efficient resource management and the prevention and control of environmental impacts arising from the organization's operations are implemented through the following practices

Objective of Research

The objectives are:

1. To analyze the ESG performance of waste materials based on the Bio-Circular-Green Economy concept.

2. To examine the correlation between economic, social, and governance development and the strategy formulation in the management of the Tobacco Authority of Thailand.

Research Hypotheses

Hypothesis 1: The management of waste material sustainability strategies positively impacts performance.

Hypothesis 2: The management of waste material sustainability strategies positively influences sustainable business development.

Hypothesis 3: The management of waste material sustainability strategies positively affects the BCG Model.

Hypothesis 4: The BCG Model positively influences sustainable business development.

Hypothesis 5: The BCG Model positively impacts performance.

Hypothesis 6: Sustainable business development positively affects performance.

Hypothesis 7: The BCG Model indirectly enhances performance through sustainable business development.

Hypothesis 8: The management of waste material sustainability strategies indirectly improves performance through the Bio-Circular-Green Economy.

Literature Review

ESG

(Smith and Lee, 2024) The literature on ESG investing was systematically analyzed using the Antecedents, Decisions, and Outcomes (ADO) framework. The study revealed that ESG investments exhibit a strong alignment with the United Nations' Sustainable Development Goals (SDGs), particularly in domains such as green and social bonds. The review underscores the interrelated nature of ESG components and their critical contribution to advancing global sustainability objectives. ESG comprises three fundamental measures employed to assess a company's sustainability. The environmental criteria assess a company's performance regarding environmental issues, hence emphasizing accountability and monitoring of environmental impact. The social criteria assess the company's management of commercial relationships with suppliers, customers, and employees. (Rodrigues-Gomez et al., 2020) said the governance standards address the company's conduct regarding audits, internal controls, CEO compensation, and shareholder rights, encompassing the obligations, expectations, and privileges among corporate stakeholders. Asserts that a governance structure with robust attributes is an essential asset for a company's long-term objectives.

(Global Compact Network Thailand, 2022) mentioned Multiple research studies indicate that corporations can derive benefits from leading in social and environmental sustainability contend that financial performance is associated with the three domains of CSR sustainability. A company's commitment to CSR is likely influenced by stakeholder demands and the perspectives of individuals, as well as organizational, national, and international entities and agencies. In addition to these impacts, the dedication to CSR may hinge on the potential to evade possible penalties. Moreover, governmental entities significantly influence various facets of Corporate Social Responsibility, exemplified by the European Union Commission. Countries that have embraced the UN's Sustainable Development Goals (SDGs) must incorporate and enforce these objectives within public law, while also monitoring and holding corporations accountable for actions that contravene the SDGs. Figure 2 Provide an explanation regarding Economy Social Governance serves as a variable for Sustainable Organizational Development throughout the conceptual framework of this research.

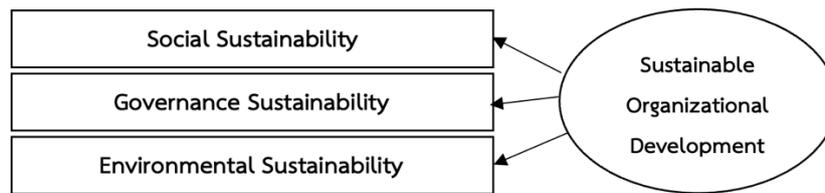


Figure 2 Components of ESG in Sustainable Organizational Development

BCG

Bio-Circular-Green Economy

The Bio-Circular-Green Economy is an economic framework for sustainable development. The approach involves employing science, technology, and innovation to improve the sustainable competitiveness of four targeted industries (S-curves): the agriculture and food sector, the energy and materials sector, the health and medical sector, and the tourism and service sector. Science, technology, and innovation will enhance the efficiency of primary producers, including farmers and communities, while also supporting entrepreneurs who create high-value-added products and services or innovations. The three BCG models must be integrated cohesively.

The Bio-Economy involves the utilization of knowledge, biological resources, and biological processes and principles for the sustainable provision of goods and services across all economic sectors. The bio-economy will transition from an agriculture-centric economy to an innovation-driven economy. The bioeconomy emphasizes the development of a value-added production chain through innovation; for instance, cassava and sugarcane can be sold for a nominal price per kilogram, but when transformed into biodegradable bioplastics, their value significantly increases, allowing for a more favorable market price. The bioeconomy aims to establish an economy based on sustainable biological resources, aligned with the United Nations' Sustainable Development Goals (SDGs) for 2030. These goals encompass objectives pertinent to the bioeconomy, including poverty eradication, food security enhancement, promotion of sustainable agriculture, health improvement, and the implementation of sustainable consumption and production strategies. Figure 3 A chart illustrating the expenses and volume of waste firms generate in waste removal, alongside the quantity of waste that remains unutilized.

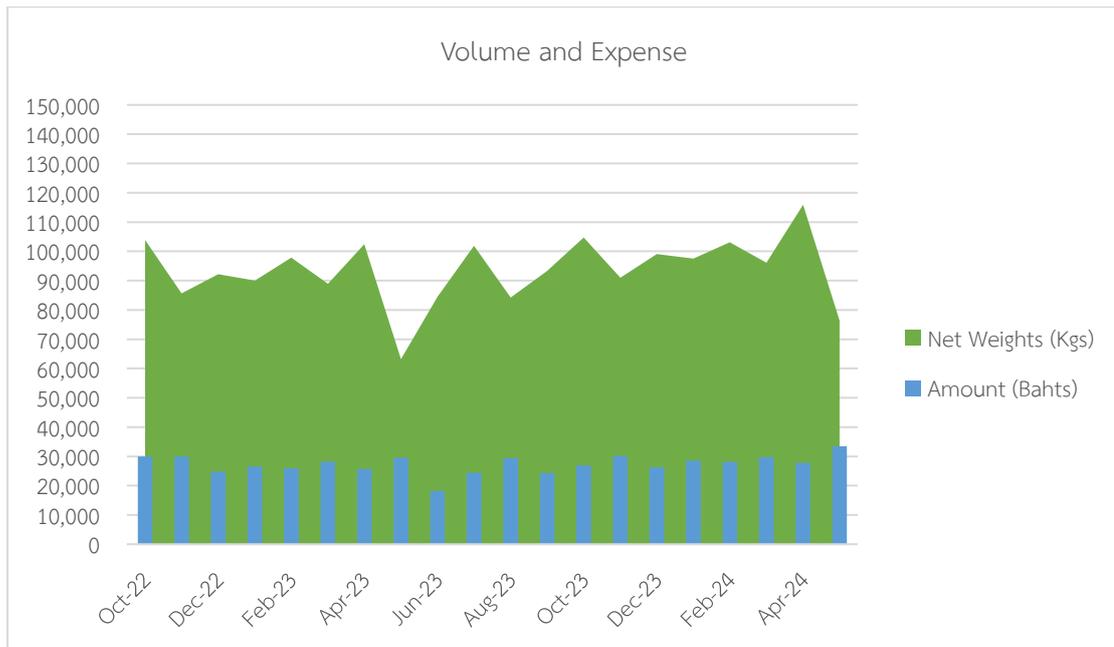


Figure 3 illustrating the volume and expense of waste materials generated from tobacco production

Propagation Measurements

This study utilizes a mixed methods approach, integrating quantitative research through Structural Equation Modeling (SEM) to examine causal relationships within the research model, followed by qualitative research involving in-depth interviews for content analysis, accordingly, validating the findings from the quantitative analysis. The findings will subsequently inform the creation of a model for managing tobacco production waste through the principles of the circular economy. Consequently, to achieve results that correspond with the objectives of this research, Research Conceptual Framework. Fig. 4 The study examines the Influence of Waste Sustainability Strategy Management, Sustainable Business Development, BCG Model, and Tobacco Performance, which has been modified (Adjusted Model) to align with empirical data at an acceptable level, as determined by the Fit Index. and Table. 1 Explain Conceptual Framework Variables employed in this study. Sample Selection

The Tobacco Authority of Thailand, located in the Rojana Industrial Estate, Uthai District, Phra Nakhon Si Ayutthaya Province, employs a total of 991 employees. A sample group of 597 employees were selected based on their positions. Personnel from the Bureau of Quality, Safety, and the Environment, in addition to the Procurement and Supplies Maintenance Division, Leaf Tobacco Production Division, and Finished Product Manufacturing Division, were there. The sample size was determined using, who all recommend a sample size of 10-20 times the number of observed variables. The normal data distribution and the reliability of structural equation modelling (SEM) analysis, which contributes to the study's completeness and dependability. The sample technique employed was stratified sampling, which depends on the characteristics of work roles relevant to the study. An allowance of uncertainty of 0.05 was used.

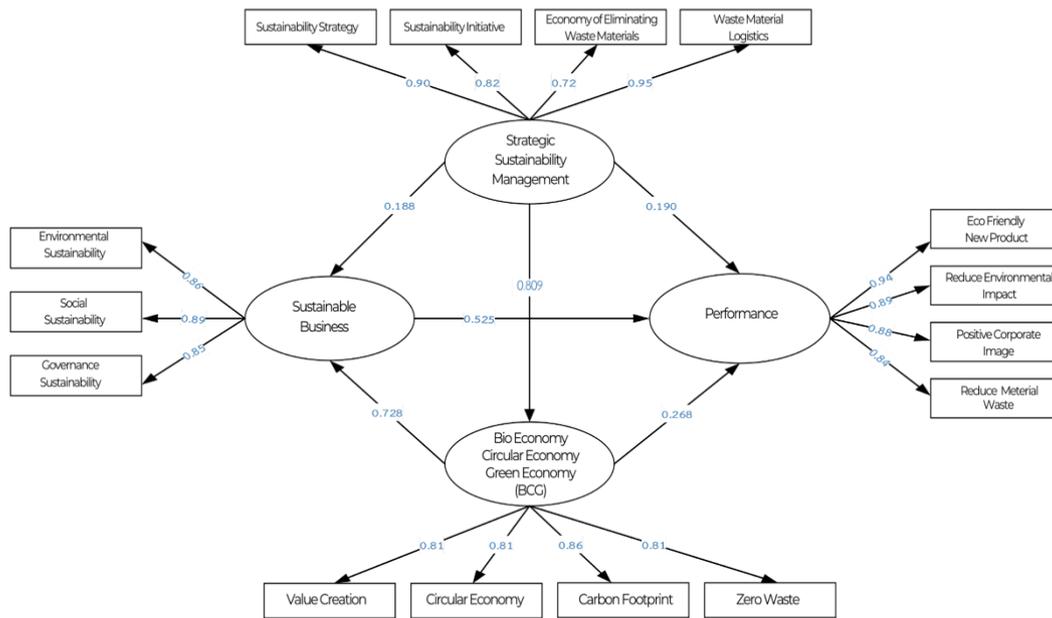


Figure 4 Framework for Understanding ESG

Research Methodology

Table 1 Explain Conceptual Framework

Initials	Types of variables	Identifier	Quantification
Strategic	Latent variables	Strategic Sustainability Management	Interval Scale
stra	Measurable variables	Sustainability Strategy	Interval Scale
plan		Sustainability Initiative	Interval Scale
econ		Economy of Eliminating Waste Materials	Interval Scale
logis		Waste Material Logistics	Interval Scale
Business	Latent variables	Sustainable Business	Interval Scale
envi	Measurable variables	Environmental Sustainability	Interval Scale
soci		Social Sustainability	Interval Scale
ecod		Governance Sustainability	Interval Scale
BCG	Latent variables	BCG (Bio-Circular-Green Economy)	Interval Scale
adv	Measurable variables	Value Creation	Interval Scale
cecon		Circular Economy	Interval Scale
carb		Carbon Footprint	Interval Scale
zero		Zero Waste	Interval Scale
Perform	Latent variables	Performance	Interval Scale
newp	Measurable variables	Eco Friendly New Product	Interval Scale
rede		Reduce Environment Impact	Interval Scale
cori		Positive Corporate Image	Interval Scale
redu		Reduce Material Waste	Interval Scale

1. The strategic management of waste material sustainability directly impacts performance, with an influence coefficient of 0.190, statistically significant at the 0.05 level.

2. Sustainable company development directly impacts performance, exhibiting an influence coefficient of 0.525, statistically significant at the 0.05 level.

3. The Bio-Circular-Green Economy directly impacts performance, with an influence coefficient of 0.268, which is statistically significant at the 0.05 level.

4. The strategic management of waste material sustainability directly impacts sustainable business development, with an influence coefficient of 0.188, statistically significant at the 0.05 level.

5. The Bio-Circular-Green Economy directly impacts sustainable business development. The coefficient of effect is 0.728, statistically significant at the 0.05 level.

6. The strategic management of waste material sustainability directly impacts the Bio-Circular-Green Economy, with an influence coefficient of 0.809, which is statistically significant at the 0.05 level.

7. The strategic management of waste material sustainability indirectly impacts sustainable business development via the Bio-Circular-Green Economy, with an influence coefficient of 0.589, statistically significant at the 0.05 level.

8. The strategic management of waste material sustainability exerts an indirect effect on performance via the Bio-Circular-Green Economy, with an influence coefficient of 0.625, statistically significant at the 0.05 level.

9. The Bio-Circular-Green Economy exerts an indirect effect on performance via sustainable business development, with an influence coefficient of 0.382, statistically significant at the 0.05 level.

Results

Fig. 5 The model was calibrated to align with the empirical data at an acceptable threshold, as indicated by the fit index as follows: $\chi^2 = 58.827$, $df = 44$, $p\text{-value} = 0.067$, $\chi^2/df = 1.337$, $RMSEA = 0.028$, $RMR = 0.014$, $GFI = 0.982$, $AGFI = 0.951$, $CFI = 0.998$.

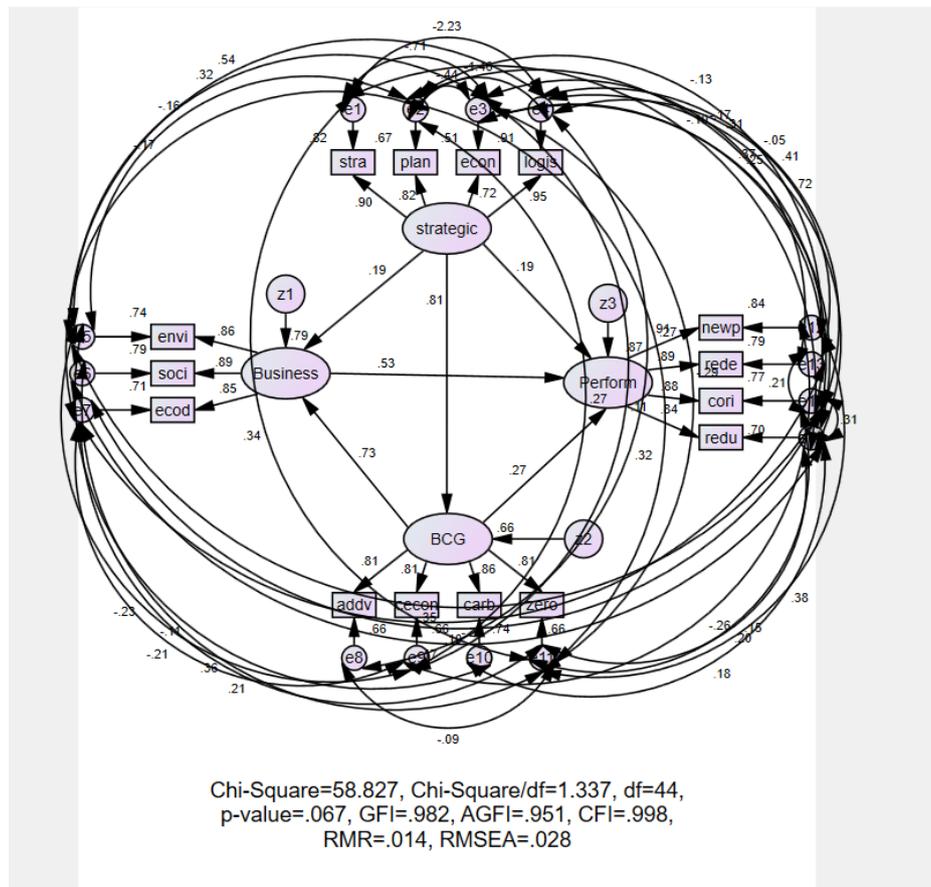


Figure 5 The impact of strategic management on sustainability Equation modeling

This research examines the strategic management of waste material sustainability, sustainable company development, the BCG Model, and performance metrics. The study will examine the concepts, theories, and research pertaining to the strategic management of sustainability, the BCG concept, waste products from tobacco production, the Tobacco Authority of Thailand, and Phra Nakhon Si Ayutthaya Province. The study population comprises personnel from departments associated with the production process, specifically the employees in the production department of the Tobacco Authority of Thailand, located in Uthai District, Phra Nakhon Si Ayutthaya Province, Population in 991 and Sample in 380 Individuals. The search conducted on May 31, 2024, is deemed a valid representative qualification for this research. These persons, being directly involved, can access the work process relevant to the context of this research project. The selection criteria stipulate that participants must have been involved in managing tobacco waste materials in Thailand for a minimum of five years. Table. 2 Results of structural equation model analysis An Implementation Strategic of Environmental, Social and Governance of Waste Materials in the BCG Model from Tobacco, Tobacco Authority of Thailand

Table 2 Results of structural equation modeling analysis

variable	b	β	S.E.	t (C.R.)	R ²	Factor Score
strategi					-	
stra	1.097	0.905	0.057	19.261***	0.819	0.474
plan	0.898	0.818	0.052	17.37***	0.669	0.277
econ	0.634	0.716	0.039	16.443***	0.513	0.136
logis	1.000	0.952	<- ->	<- ->	0.906	0.963
Business		0.845			0.786	
envi	1.003	0.886	0.044	22.637***	0.736	0.248
soci	0.958	0.858	0.039	24.603***	0.784	0.276
ecod	1.000	0.811	<- ->	<- ->	0.714	0.213
BCG		0.858			0.655	
zero	0.910	0.811	0.044	20.835***	0.658	0.146
carb	1.000	0.810	<- ->	<- ->	0.736	0.213
cecon	0.881	0.914	0.042	20.721***	0.658	0.201
addv	0.826	0.889	0.04	20.647***	0.656	0.165
Perform		0.876			0.869	
newp	0.924	0.836	0.033	27.666***	0.836	0.370
rede	0.868	0.905	0.029	29.567***	0.790	0.212
cori	1.000	0.818	<- ->	<- ->	0.767	0.106
redu	0.957	0.716	0.035	27.645***	0.698	0.120

Chi-Square (CMIN) = 58.827, df = 44, p-value = 0.067,

RMSEA = 0.028, GFI = 0.982, AGFI = 0.951

β denotes the weight of a standard component, R² Denotes the predictive coefficient, ***p < 0.001, designating <- -> Consequently, mandatory parameters are not documented. S.E. and t (C.R.)

Table 3 Basic statistical analysis was conducted on survey data regarding sustainability practices and industry performance, with results summarized in a table.

Variable	\bar{x}	S.D.
1. Strategic Sustainability Management		
1.1 Sustainability Strategy		
The organization effectively analyzes and eliminates tobacco production waste	3.57	.86
The firm possesses effective management, which impacts the proper storage procedure	3.14	.87



Variable	\bar{x}	S.D.
The group examines the issues of waste disposal and utilization and their effects on the environment	3.67	.90
Summary of the Sustainability Strategy	3.52	.78
1.2 Sustainability Initiative		
The organization respects to regulations, and waste management is thoroughly regulated to safeguard public health and the environment	3.30	.86
The organization has assessed and created suitable organizational development tools (Designing Interventions) and enhanced the organization using systematic management methods, according to the principles of a circular economy	3.32	.88
The organization considers social and environmental obligations across three domains: Environment, Social, and Governance	3.95	.77
Summary of the Sustainability Initiative	3.52	.71
1.3 Economy of Eliminating Waste Materials		
The company provides a system involving the collection and transportation of industrial waste to treatment or disposal facilities	4.10	.67
The organization reduces waste. Efficient strategies to minimize waste management expenses encompass the design of recyclable items and the advocacy of reusable packaging	4.06	.63
The organization oversees environmental and social expenditures, including habitat degradation, health hazards, and diminished quality of life for communities adjacent to waste sources	4.05	.66
Summary of the Economy of Eliminating Waste Materials	4.07	.57
1.4 Waste Material Logistics		
The organization retrieves products from downstream customers to either regenerate value or dispose of them properly	3.81	.79
The organization has actively endorsed the principles of green supply chain management, particularly in its significant contribution to the Zero Waste strategy, which seeks to minimize resource consumption and waste through product repair, remanufacture, or recycling	3.88	.78

Variable	\bar{x}	S.D.
Organizations attempting to mitigate the environmental impact of their supply chains concentrate on reverse logistics to retrieve recalled products for inspection, sorting, reconditioning, redistribution, or appropriate disposal	3.78	.78
Summary of the Waste Material Logistics	3.82	.69
The organization retrieves products from downstream customers to either regenerate value or dispose of them properly	3.81	.79
2. Strategic Sustainability Management		
2.1 Environmental Sustainability		
Organizations utilize natural resources in their business operations	4.23	.71
The organization implements strategies to minimize the consumption of natural resources	3.99	.81
The organization utilizes alternative energy sources	3.94	.95
The organization implements disposal techniques that comply with environmental regulations.	4.04	.79
Summary of the Environmental Sustainability	4.05	.71
2.2 Social Sustainability		
The group implements initiatives that promote community conservation.	3.92	.72
The organization endorses social initiatives pertaining to sustainable corporate development.	3.79	.69
The organization implements strategies to reduce emissions of pollutants to the community.	3.84	.71
Summary of the Social Sustainability	3.85	.65
2.3 Governance Sustainability		
The organization recognizes a potential for sustainable social development	3.90	.81
The organization utilizes technologies to minimize energy use	4.00	.74
The organization specializes in research or innovation for sustainable improvements in society	4.04	.73
Summary of the Governance Sustainability	3.98	.71
Summary of the Sustainable Business	3.96	.63
3. BCG (Bio-Circular-Green Economy)		
3.1 Value Creation		
The organization implements recycling and circular economy techniques. Investing in recycling infrastructure and	3.55	.82



Variable	\bar{x}	S.D.
advocating for circular economy models that facilitate the reuse and recycling of materials could decrease the trash directed to landfills or incinerators		
Public-private partnerships can stimulate innovation and investment in sustainable waste management strategies	3.60	.85
Organizations establish economic incentives. Utilizing economic processes like landfill taxes, pay-as-you-throw fees, and producer responsibility aligns incentives for waste reduction, recycling, and appropriate disposal with economic advantages and environmental objectives	3.99	.74
Summary of the Value Creation	3.71	.69
3.2 Circular Economy		
Business organizations interact with the environment both as contributors to its degradation and as entities impacted by it, as the raw materials utilized in manufacturing predominantly consist of finite natural resources	3.51	.83
The organization prioritizes waste and pollution management to prevent legal infractions and ensure the acquisition of operational licenses from impacted communities and society	3.48	.95
Organizations that diligently oversee greenhouse gas emissions by calculating an organization's carbon footprint and mitigate greenhouse gas emissions from diverse organizational activities Scope 1 and Scope 2 and Implement carbon offset initiatives to mitigate the effects of diverse corporate operations	3.99	.78
Summary of the Circular Economy	3.66	.74
3.3 Carbon Footprint		
The organization provides carbon footprint evaluations to inform the environmental policy of industrial facilities	3.70	.81
The organization implements management strategies across its operations to regulate greenhouse gas emissions in industrial facilities	3.71	.82
The organization provides a carbon footprint analysis and assessment to accurately manage emissions	3.67	.86
Summary of the Carbon Footprint	3.69	.79
3.4 Zero Waste		
The firm refrains from utilizing superfluous and useless things to mitigate waste	3.74	.84
The company minimizes the procurement and utilization of commodities that generate waste. If it is unavoidable to	3.75	.78

Variable	\bar{x}	S.D.
utilize or consume specific items, it endeavors to minimize their usage		
The organization repurposes or maximizes existing materials, including restoring functional items and reprocessing them for subsequent use after manufacture	3.67	.87
Summary of the Zero Waste	3.72	.75
4. Performance		
4.1 Eco Friendly New Product		
The organization is apprehensive that consumers will utilize products designed to safeguard the environment during production, thereby diminishing the consumption of wasteful resources and hazardous substances, which impacts public health and the environment overall, while also fostering societal values aimed at collective environmental conservation	3.87	.79
The organization is considerate of the producers. Environmentally friendly products and services lead to increased sales volume, resulting in long-term economic benefits through reduced production costs and enhanced product reputation	3.70	.84
The organization considers environmental advantages, mitigating production impacts that may directly or indirectly harm humans and the ecosystem, while also reducing emissions that contribute to global warming	3.99	.74
Summary of the Eco-Friendly New Product	3.85	.70
4.2 Reduce Environment Impact		
The firm administers garbage in an eco-friendly manner, beginning with strategies to minimize waste generation and promote reuse to prevent waste accumulation. Subsequently, it evaluates the recycling of items from community garbage or their composting. Non-recyclable garbage should undergo a conversion process to generate electricity	3.93	.73
The organization collects large-scale and hazardous garbage, segregates it for recycling by manufacturing or private entities, sorts it at the source, and further separates it for processing in a facility with higher purity standards for distribution	3.93	.73



Variable	\bar{x}	S.D.
The group evaluates and analyzes manufacturing and management processes, scrutinizing efficiency, sustainability, and waste reduction	4.00	.78
The organization concurrently oversees all facets of personnel, structure, and environment during the production process	3.96	.74
The residual organic waste will undergo treatment using a combination of mechanical and biological processes (MBT). The treatment residue will be disposed of at a landfill without producing biogas, thus diminishing greenhouse gas emissions	3.63	.85
The company has been enhancing the efficiency of its initial resource utilization and maximizing material recycling to minimize waste	3.84	.77
Summary of the Reduce Environment Impact	3.88	.68
4.3 Positive Corporate Image		
The organization possesses a favorable reputation among customers, society, and the community	4.20	.82
The organization demonstrates social and environmental responsibility	3.96	.80
The organization maintains transparent and straightforward communication with employees, customers, and stakeholders	3.73	1.03
Summary of the Positive Corporate Image	3.96	.80
4.4 Reduce Material Waste		
The organization oversees trash management in an eco-friendly manner, prioritizing waste reduction and reuse to minimize waste generation. Subsequently, it evaluates the recycling of items from community garbage or their composting. Non-recyclable garbage deserves a conversion process to generate electricity	3.72	.91
The organization collects large-scale and hazardous garbage, segregates it for recycle by manufacturers or individuals, sorts it at the source, and further separates it for processing at a facility with higher purity standards for distribution	3.89	.76
The organization evaluates and analyzes manufacturing and management processes, measuring efficiency, sustainability, and waste reduction	3.75	.91
Summary of the Reduce Material Waste	3.79	.80

Variable	\bar{x}	S.D.
Summary of the Performance	3.87	.68

Hypothesis 1: Strategic management of waste material sustainability exerts a direct positive impact on performance. The hypothesis testing results indicate that strategic management of waste material sustainability directly affects performance, with an influence coefficient of 0.190, statistically significant at the 0.05 level.

Hypothesis 2: Strategic management of waste material sustainability exerts a direct positive impact on sustainable business development. The hypothesis testing results indicate that waste material sustainability strategic management directly affects sustainable business development, with an influence coefficient of 0.188, statistically significant at the 0.05 level.

Hypothesis 3: Strategic management of waste material sustainability exerts a direct positive impact on the BCG Model. The hypothesis testing results indicated that strategic management of waste material sustainability directly affects the Bio-Circular-Green Economy, with an influence coefficient of 0.809, statistically significant at the 0.05 level.

Hypothesis 4: The BCG Model exerts a direct positive impact on Sustainable Business Development. The hypothesis testing results indicated that the Bio-Circular-Green Economy exerts a direct influence on sustainable business development, with an influence coefficient of 0.728, statistically significant at the 0.05 level.

Hypothesis 5: The BCG Model exerts a direct positive impact on performance. The hypothesis testing results indicated that the Bio-Circular-Green Economy directly affects performance, with an influence coefficient of 0.268, which is statistically significant at the 0.05 level.

Hypothesis 6: posits that Sustainable Business Development exerts a direct positive impact on performance. The hypothesis testing results indicated that sustainable business development directly affects performance, with an influence coefficient of 0.525, statistically significant at the 0.05 level.

Hypothesis 7: The BCG Model exerts a beneficial indirect influence on performance via sustainable business development. The hypothesis testing results indicated that the Bio-Circular-Green Economy exerts an indirect effect on performance via sustainable company development, with an influence coefficient of 0.382, statistically significant at the 0.05 level.

Hypothesis 8: The strategic management of waste material sustainability exerts an indirect influence on performance via the Bio-Circular-Green Economy. The hypothesis testing results indicated that the strategic management of waste sustainability indirectly influences sustainable company development via the Bio-Circular-Green Economy, with a statistically significant influence coefficient of 0.589 at the 0.05 level.

Discussions

The hypothesis testing results clearly highlight the strategic importance of sustainable waste material management in enhancing various dimensions of organizational development—particularly in terms of performance, sustainable business development, and alignment with the Bio-Circular-Green (BCG) Economy model.

1. Direct Impact of Strategic Waste Material Management on Business Performance

According to Hypothesis 1, sustainable waste management exerts a significant direct positive impact on business performance (coefficient = 0.190, $p < 0.05$). (Albitar et al., 2024) The study examines the impact of eco-innovation on corporate waste management, highlighting that firms demonstrating strong environmental, social, and governance (ESG) performance are well-positioned to strategically implement waste management practices to enhance overall business performance. The findings indicate that incorporating eco-innovative strategies into waste management not only leads to reduced operational costs but also strengthens financial outcomes by aligning corporate practices with long-term sustainability objectives

2. Contribution to Sustainable Business Development

Hypotheses 2 and 6 indicate that both sustainable waste management (coefficient = 0.188) and sustainable development itself (coefficient = 0.525) significantly contribute to enhanced performance. This study explores the relationship between organizational strategy and the Sustainable Development Goals (SDGs) by Sahbaz, R. (2024). It finds that organizations aligning their strategies with the SDGs can enhance long-term sustainability. Additionally, the study identifies both challenges and opportunities that arise from adjusting organizational strategies to be consistent with the SDGs. and Rodrigues-Gomez et al. (2020) that ESG and CSR can generate real economic value.

3. The BCG Model as a Strategic Mediator

Results from Hypotheses 3, 4, and 5 demonstrate that the BCG model has a strong direct influence on both sustainable business development (coefficient = 0.728) and performance (coefficient = 0.268). Furthermore, the model serves as a key mediator in the relationship between waste sustainability strategy and business outcomes, as shown in Hypotheses 7 and 8, with a notable indirect effect (coefficient = 0.589). This implies that integrating bio, circular, and green economy principles is a vital mechanism for achieving systemic sustainability. The literature review indicates that sustainable leadership is a pivotal factor in fostering sustainable entrepreneurship. Sustainable leaders motivate and empower entrepreneurs to implement sustainable practices within their business operations, thereby generating positive social and environmental outcomes while simultaneously enhancing the economic performance of their organizations by (Tuyet et al., 2024)

4. Implications for Strategy and Policy

These findings support the design of organizational and public policies that prioritize structured waste material management, especially in the industrial and manufacturing sectors where environmental impact is high (UNEP, 2024). If organizations effectively integrate this

strategy with the BCG model, it could serve as a catalyst for a truly sustainable economic transformation.

Result of the interview findings

Investigation of the sustainable management of the BCG framework Tobacco byproducts: The Tobacco Authority of Thailand, located in Phra Nakhon Si Ayutthaya Province, seeks to address the issue of waste management by developing strategies to eliminate and manage waste products, hence mitigating pollution levels. Numerous methodologies exist. One method employed in the research to enhance the commercial value of production waste is the adjustment of Downcycle, which optimizes resource utility and maximizes benefits through sustainability strategies aligned with the BCG concept (Bio-Circular-Green Economy). Waste materials are incorporated to produce new products. Product processing procedures enhance revenue, minimize waste, and achieve zero waste (Zero Waste). Generating added value from waste materials necessitates the selection of certain waste products for experimentation and testing. Systematically manage waste materials generated from production through sustainable ways while employing innovative thinking to develop intriguing items from tobacco production trash. The researcher has conducted experiments and evaluations on several waste materials, ultimately selecting those appropriate for the production of new items, including rolling papers, tobacco dust or leaves, and assorted waste papers. The design emphasizes functionality. The findings of the research about the strategic management of waste material sustainability, derived from interviews and questionnaires, are as follows: In alignment with the research objectives concerning strategic management of sustainability, the impact of strategies, sustainable business development, the BCG Model, and the proposal of a strategic management model for sustainability, the researchers and their team have formulated a sustainability strategy for the Tobacco Authority of Thailand. This strategy aims to innovate products from waste materials generated by tobacco production, minimize waste, enhance revenue, and foster a favorable environment. To attain the objective of sustainability management, it can be marketed and produce revenue for the community. The research has engaged with government entities, state enterprises, and retail outlets to establish distribution channels and earn revenue for the community from the Tobacco Authority of Thailand in the future. The strategic management framework for sustainability in enhancing the image of tobacco for social and environmental accountability comprises three approaches: 1) Enhancing the production process to be ecologically sustainable by employing technologies that mitigate pollutants in the air, water, and soil, such as implementing a standardized wastewater treatment system. Machinery that minimizes energy consumption, utilizes renewable energy, implements solar power systems or biomass energy within the factory, and employs waste materials from the production process, such as tobacco leaves, as biofuels, while also utilizing sustainable products by creating packaging from recycled or biodegradable materials, including the research and development of products that have a diminished impact on health and the environment. 2) Engaging and

fostering trust among consumers: The objective is to elucidate the advantages of the BCG Model by orchestrating a public relations campaign that underscores the dedication to responsible business practices, exemplified by the “Green Tobacco Factory” initiative, and disseminating an annual sustainability report that delineates environmental and social objectives and outcomes. 3) Engaging in national and international networks through collaboration with governmental and private entities, partaking in joint initiatives aimed at fostering sustainability, including the government's Circular Economy project, and executing environmental standard certifications, as well as pursuing international standard certifications such as ISO 14001 (Environmental Management) or Carbon Neutrality Certification.

Conclusion

The results of the research for Objective 1 indicated that the analysis of ESG (Environmental, Social, and Governance) performance in managing tobacco waste materials based on the Bio-Circular-Green (BCG) Economy concept revealed the following this could be attributed to The Tobacco Authority of Thailand previously implemented waste management strategies in a fragmented manner, lacking an integrated and coherent operational framework. Although operations were divided across organizational management, social responsibility, and environmental concerns, they shared a common objective of promoting organizational cohesion, with social responsibility serving as the foundation for initiating social actions. The social responsibility model aligned with empirical data, with the environmental aspect carrying slightly more weight than community participation and development. Among the evaluated models, the community engagement and development model emerged as the most significant, particularly due to its focus on income generation and waste reduction, which played a critical role in ESG performance.

The results of the research for Objective 2 indicated that The findings indicated that strategy formulation in managing tobacco waste was previously conducted in a fragmented and disjointed manner, with separate operational frameworks for organizational management, social responsibility, and environmental concerns this could be attributed to Despite this division, all strategies shared a common goal of promoting organizational cohesion, with social responsibility serving as the foundation for initiating actions. The social responsibility model was found to align with empirical data, where environmental factors held slightly more weight than community participation and development. Among the evaluated models, the community engagement and development model stood out as the most significant, primarily due to its emphasis on income generation and waste reduction, which strongly contributed to economic and social development.

Suggestions

Prospective Research, Integration of Sustainable Strategies in Tobacco Waste Management: Future study may investigate how the Tobacco Authority of Thailand might more effectively integrate environmental sustainability into its strategy framework. Research could

examine the integration of waste reduction initiatives with long-term sustainability objectives within a unified operational framework, harmonizing community growth and environmental conservation.

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