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THE IMPACT OF ECO-TOURISM BUSINESS TRANSFORMATION ON THE EFFECTIVENESS OF THAILAND'S FUTURE GREEN ECONOMY POLICY FORMULATION

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Abstract: This research aims to analyze the influence of changes in eco-tourism on the transformation of green economic policy. The analysis adopts a holistic and systematic approach. A mixed-methods research design was employed to ensure the completeness and appropriateness of the findings, with the objective of applying the results to formulate effective strategies for managing Thailand's tourism industry to achieve maximum efficiency in the future. The research findings indicate that the PAr-ARIMAX(1,1,1) model is the most appropriate model, demonstrating strong validity, the absence of spurious relationships, and comprehensive goodness-of-fit measures. This confirms its suitability for use in policy formulation and planning for Thailand, particularly in setting strategic directions for sustainable and continuous growth in the tourism industry. The results further reveal that eco-tourism entrepreneurship has the strongest direct effect on the environmental sector, accounting for 65% at a 1% significance level. This implies that a 1% change in eco-tourism entrepreneurship leads to a 65% change in the environmental sector in the same direction. At the same time, eco-tourism entrepreneurship exerts the greatest influence on changes in the green economy when compared with all other sectors. Moreover, changes in the social sector, especially community participation and cultural transformation, have a substantial impact on eco-tourism entrepreneurship, with an influence of up to 60%. Therefore, the government should consider the combined effects of changes in eco-tourism entrepreneurship and social dynamics, as their integration can maximize positive transformations in the green economy and contribute meaningfully to Thailand's sustainable national development in the future.

Keywords: eco-tourism, eco-entrepreneurship, green economy policy, social sector, community participation, social culture

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INTRODUCTION

Thailand has established a national strategic framework for long-term national development following its membership in the United Nations, particularly in relation to environmental governance (The World Bank: Energy Use (Kg of Oil Equivalent Per Capita) Home Page, 2025). Evidence indicates that from 1992 to the present (2025), Thailand has achieved continuous national development, especially in terms of economic and social growth (National Statistical Office Ministry of Information and Communication Technology, 2025). Urban expansion has increased significantly across regions, with urbanized areas expanding by approximately 65 percent (ONEP, 2025). This trend reflects Thailand's ongoing transition toward becoming a developed country (Office of Natural Resources and Environmental Policy and Planning (DEDE), 2025).

If Thailand is able to fully attain developed-country status, it would generate substantial positive impacts and enable accelerated development across all dimensions in the future (Thailand Greenhouse Gas Management Organization (Public Organization), 2025). For this reason, the government has played a crucial role in economic development by formulating long-term policies, such as modern industrial development plans, promoting both domestic and foreign investment, expanding and upgrading infrastructure to ensure nationwide coverage, and significantly advancing tourism development in all dimensions, particularly eco-tourism (Office of the National Economic and Social Development Council (NESDB), 2025). The government has also actively encouraged continuous growth among entrepreneurs across sectors (Hasanein & Ayad, 2025).

Tourism is a key industry within Thailand's economic system and represents a major source of revenue generated from both domestic and international tourists (Ahmed et al., 2025; Salama et al., 2025). It plays a vital role in economic stimulation, job creation, and local development (NESDB, 2025; Muna et al., 2025). Beyond its economic benefits, tourism also has strong potential to support environmental conservation and promote sustainable understanding of local cultures (OECD, 2025). The growth of Thailand's tourism industry in recent years has largely been driven by government policies aimed at promoting sustainable tourism to enhance national competitiveness (Junsiri et al., 2025).

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In recent years, eco-tourism has gained increasing popularity among tourists who prioritize nature-based experiences and adventure travel (Sutthichaimethee et al., 2025). These tourists typically seek close interaction with natural environments and wish to learn about the lifestyles of host communities rather than engaging in conventional forms of tourism (Energy Policy and Planning Office, 2025; Sutthichaimethee et al., 2025).

This trend has encouraged greater participation by local communities in the management and stewardship of tourist destinations, ensuring sustainability and minimizing negative impacts on natural resources. Regarding the role of tourism in Thailand's economy in 2025, the Tourism Authority of Thailand reported that during the first quarter of the year, the country welcomed approximately 9.98 million international tourists, representing a significant increase compared to the previous year (United Nations Framework Convention on Climate Change, UNFCCC, 2014). These visitors generated total revenue of 559,015 million baht, highlighting the critical importance of tourism to economic growth.

In addition to direct tourism revenue, the sector has produced positive spillover effects on local businesses, including restaurants, hotels, and related service industries, as well as supporting local and indigenous industries with unique cultural identities (United Nations Framework Convention on Climate Change, 2016; Sisriany & Furuya, 2024). Tourism, therefore, plays a crucial role in income distribution to remote and rural communities, improving quality of life and supporting local development. It also benefits communities seeking supplementary income through the production of distinctive local goods and services, such as handicrafts and souvenirs. This creates employment opportunities and enhances the well-being of communities actively involved in sustainable tourism development (Ministry of Natural Resources and Environment, 2025; Sutthichaimethee et al., 2024; Winyuchakrit et al., 2021; Sun et al., 2023).

At present, eco-tourism in Thailand has gained widespread popularity due to its emphasis on learning about nature while simultaneously conserving the environment and preserving local culture (NESDB, 2025). Eco-tourism activities in Thailand are diverse and include nature trekking, wildlife observation, coral reef diving, and immersive experiences within local communities (Waiyasusri et al., 2024). These activities not only bring tourists closer to nature but also foster long-term environmental awareness (Piedra-de-la-Cuadra & Ortega, 2024; Rahmawati et al., 2021).

Eco-tourism further creates economic opportunities for local communities by promoting sustainable use of natural resources and strengthening pride in traditional cultural heritage (Rasool et al., 2021). The connection between tourists and communities through environmentally friendly activities encourages sustainable relationships and serves as an important mechanism for conserving natural resources alongside local economic development (DEDE, 2025; Razzaq et al., 203; Salemi et al., 2019). As a tool for sustainable development, eco-tourism provides not only economic value but also serves as a critical mechanism for environmental education and awareness-building among tourists (ONEP, 2025; Sharif et al., 2020; Sharpley, 2020). This development model enables local communities to participate directly in managing tourism resources closely linked to their natural environments. Such participation not only increases income but also reduces resource-use conflicts and promotes environmentally and socially responsible development.

Moreover, eco-tourism enhances national tourism competitiveness and stimulates local economic growth efficiently. Community-based management contributes to equitable income distribution, reduces inequality, and strengthens economic security at the community level, supported by organizations such as the Thailand Ecotourism and Adventure Travel Association. Nevertheless, despite Thailand's demonstrated capacity to expand tourism and achieve effective economic and social growth over the long term, a critical challenge remains: environmental development has not progressed in parallel with economic and social advancement.

National-level data indicate that Thailand's environmental conditions have not significantly improved from the past to the present, despite the existence of major policies promoting eco-tourism.

This suggests that genuine sustainability has not yet been fully achieved. Between 1992 and 2025, overall tourism growth increased by 64.05 percent, while greenhouse gas emissions generated by the tourism sector rose by 59.72 percent. This increase in emissions has occurred at an accelerating rate, directly correlated with tourism growth. Although the government has introduced multiple tourism models across various dimensions, it has yet to conduct in-depth, integrated analyses of how changes in the eco-tourism industry affect the broader national sectoral system. Previous studies have largely examined individual sectors in isolation, lacking a comprehensive, holistic perspective. This research recognizes the necessity and value of such an integrated analysis. Its findings aim to provide concrete guidance for national governance and contribute meaningfully to Thailand's future development, enabling sustainable and genuine growth in the long term.

MATERIALS AND METHODS

A review of both domestic and international literature reveals that no previous study has constructed an analytical model of this nature or conducted a comprehensive, system-wide analysis comparable to the approach adopted in this research. Existing studies have primarily focused on individual dimensions or sectors in isolation, without integrating them into a holistic framework. As a result, such fragmented analyses have been insufficient for accurately formulating future strategic directions, as they fail to capture the true dynamics and interrelationships of transformational influences. This limitation may contribute to policy misalignment or errors, as evidenced by certain policies implemented in the past.

Accordingly, this research develops an integrated analytical model designed to support strategic decision-making and guide Thailand toward sustainable development. The study places particular emphasis on the eco-tourism industry, as it represents a major revenue-generating sector for Thailand and is among the leading contributors to rapidly increasing greenhouse gas emissions. For the quantitative component of the study, secondary data spanning the period from 1992 to 2025 were employed. The researcher developed a novel analytical framework referred to as Path Analysis with Correlation Based on the Autoregressive Moving Average (p) Model ($PAr - ARIMAX(p)$), the details of which are

presented as follows (Bentler & Chou, 1987; Kline, 2015). For the model used in this research, the researcher applied an integrated modeling approach by selecting a high-performance model while ensuring that the analytical results were appropriate. The model was developed based on its key strengths for application and is referred to as Path Analysis with Correlation based on the Autocorrelation Moving Average (p) model ($PAr - ARIMAX(p)$).

Path Analysis (PA) is a method for studying causal relationships among variables and is grounded in regression analysis. It relies on diagrams and structural equations derived primarily from hypotheses, conceptual frameworks, theories, and prior research to analyze and explain the relationships between independent variables and dependent variables, both in terms of magnitude and direction (Holbert & Stephenson, 2002).

These relationships can be explained as both direct and indirect effects. Correlation coefficients among variables are then analyzed using path analysis techniques. The results of path analysis serve as a test of the validity of the structure or model specified by the hypotheses, indicating whether the collected empirical data adequately support the existing theory or hypotheses. The researcher constructed diagrams or models illustrating influences based on theory and hypotheses.

The relationships among variables in the model (T) can be decomposed into the sum of parameters according to path coefficient theory. Specifically, the correlation coefficient between two variables in the model is equal to the sum of the Direct Effect (DE), Indirect Effect (IE), Spurious Relationship (SR), and Joint Effect (JE), as follows (Hayes, 2013):

$$r = DE + IE + SR + JE \quad (1)$$

Equation (1) illustrates the true structure of relationships in the causal factor influence analysis model, which consists of four key components: Direct Effect (DE), Indirect Effect (IE), Spurious Relationship (SR), and Joint Effect (JE). It eliminates the misconception or belief that conducting an analysis using path analysis necessarily results in **S**R and JE being equal to zero. Therefore, the equation used for the analysis can be written as follows (Holbert & Stephenson, 2002).

$$r = DE + IE \quad (2)$$

Equation (2) demonstrates that the previous conceptual understanding is incorrect, because in real analytical situations the analysis must follow the form specified in Equation (1) only. If, after implementation, **S**R and JE are found to be non-zero, this will adversely affect the validity of the model and may lead to substantial forecasting errors. Consequently, this study incorporates causal factors comprehensively, while carefully controlling critical issues arising from the analytical results, namely autocorrelation**,** multicollinearity**,** and heteroscedasticity**.** If any of these problems occur in a model, they can severely distort directional interpretation or lead to significant errors when applying the results for national policy formulation (Baltagi, 2021). Regarding the research procedure using the $PAr - ARIMAX(p)$ model**,** it is essential to consider the properties of the data used in constructing a complete and robust model, ensuring that spurious relationships do not occur. The data must exhibit **s**tationarity. Let Y_t be a stochastic time series variable. For the series to be stationary, it must satisfy the following three properties (Harvey, 1980).

$$\text{Mean :} \quad E(Y_t) = E(Y_{t-k}) = \mu \quad (3)$$

$$\text{Variance :} \quad \text{Var}(Y_t) = E(Y_t - \mu)^2 = E(Y_{t-k} - \mu)^2 = \sigma^2 \quad (4)$$

$$\text{Covariance :} \quad \text{E}[(Y_t - \mu)^2(Y_{t-k} - \mu)^2 = \gamma_k] \quad (5)$$

From Equations (3)–(5), it can be observed that the magnitude or spacing of the covariance remains constant; that is, the distance between two values of Y_t does not depend on time. When all three properties are satisfied, the data are considered stationary. This indicates that the time series has a constant mean or expected value, constant variance, and constant covariance over time. These properties do not depend on time itself but rather on the distance or lag between time periods (Baltagi, 2021). Transforming non-stationary data into stationary or weakly stationary data involves adjusting only the first and second moments. However, in the case of strict stationarity, consideration is not limited to the first and second moments; higher-order moments must also be examined. The consideration of moments involves two key principles. First, a stationary variable fluctuates within a narrow range around its mean, whereas a non-stationary variable exhibits increasing variability as the number of observations grows. Second, when an external shock occurs in the economic system, stationary data deviate from the mean only temporarily and return to equilibrium relatively quickly. In contrast, non-stationary data produce the opposite effect, influencing the model itself or affecting other variables within the model across different time periods. This indicates that non-stationary variables do not possess a long-run mean level, which can be represented by three populations as follows (Harvey, 1980).

$$Y_t = \delta Y_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta Y_t = \alpha_1 + \delta Y_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta Y_t = \alpha_1 + \alpha_2 T + \delta Y_{t-1} + \varepsilon_t \quad (8)$$

Equations (6)-(8) define Y_{t-1} as the variable under study in the lag period (t-1), while T represents the time variable. These equations indicate the formulation of the hypotheses: $H_0 : \delta = 0$, non–stationary, and $H_a : \delta < 1$, stationary. The differenced series ΔY_t exhibits non-stationary properties when H_0 is accepted, indicating that $\delta = 0$. In this case, the variance increases in an exponential or explosive manner as time increases. However, applying first differencing to a time series, or higher-order differencing, can transform the series into a stationary process. The procedure for difference-stationary transformation is shown as follows (Hoyle, 1995).

$$\Delta Y_t = \alpha_1 + \alpha_2 T - \delta Y_{t-1} + \varepsilon_t \quad (9)$$

From Equation (9), the relationship among the variables is specified in differential form as time increases at the level form. Rejecting H_a or accepting H_0 implies that the data are non-stationary, with the coefficient $\delta = 0$ being statistically significant. This result indicates that the absolute value of the tau statistic for the estimated coefficient is smaller than the critical value in absolute terms. Under this condition, the error term ε_t does not satisfy the white noise property, implying that the analyzed data exhibit autocorrelation. Therefore, the Augmented Dickey–Fuller (ADF) test must be employed. The ADF test modifies the original equation by including higher-order lagged values of the dependent variable in order to eliminate the autocorrelation problem. In this study, the selected specification is the Autoregressive Model of Order p: AR(p), denoted as AR(p)**,** which can be expressed as follows (Byrne, 2001).

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \varepsilon_t \quad (10)$$

From Equation (10), Y_{t-p} is defined as the variable under study in the lag period (t-p). Imposing the conditions $\beta_1 + \beta_2 < 1$, $\beta_2 - \beta_1 < 1$, and $|\beta_1| < 1$ indicates that the time series possesses stationarity. The Moving Average Model of Order q, denoted as **MA(q),** can be expressed as follows (MacKinnon, 1991).

$$Y_t = \delta + \varepsilon_t - \gamma_1 \varepsilon_{t-1} - \gamma_2 \varepsilon_{t-2}, \ldots, \gamma_q \varepsilon_{t-1} \quad (11)$$

From Equation (11), the condition $|\gamma_1| < 1$ indicates that the time series is invertible or stationary. Consequently, the Mixed Autoregressive and Moving – Average Model of Order p and q, denoted as ARMA(p, q)**,** can be expressed as follows (Dickey & Fuller, 1981; MacKinnon, 1991).

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \varepsilon_t - \gamma_1 \varepsilon_{t-1} - \gamma_2 \varepsilon_{t-2} - \ldots - \gamma_q \varepsilon_{t-q} \quad (12)$$

Equation (12) shows the relationship between Y_{t-p}, which is referred to as ARIMA, and ε_{t-q}, which is referred to as the Moving Average.

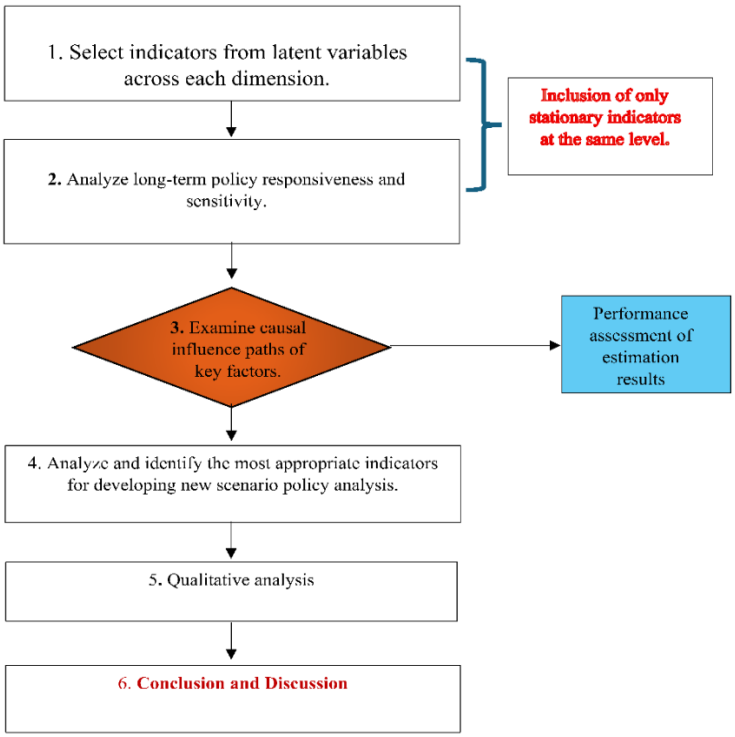

Figure 1. The research procedure based on the materials and methods used in this study

Based on the materials and methods described above, the researcher summarizes the research procedure as shown in Figure 1 into several main steps. First, indicators that possess stationarity properties at the same level are selected. Second, the ability of the variables to adjust toward equilibrium in both the short run and the long run is examined. Third, the appropriateness of the relationships among the latent variables is determined, along with testing the validity of the $PAr - ARIMAX(p)$ model.

RESULTS

In this study, the researcher developed the $PAr - ARIMAX(p)$ model and conducted rigorous validity testing. In addition, potential estimation problems associated with the $PAr - ARIMAX(p)$ model were systematically examined, including heteroskedasticity, multicollinearity, and autocorrelation. The model was also evaluated for its goodness-of-fit properties. Only models that satisfied these diagnostic criteria and demonstrated appropriate statistical performance were deemed suitable for subsequent analysis and interpretation of results. This research adopted a mixed-methods research design. The quantitative component involved constructing and estimating the $PAr - ARIMAX(p)$ model. Upon completion

of the quantitative analysis, the findings were complemented and enriched through qualitative research, incorporating insights from experts and key informants who possess direct responsibility and specialized expertise in Thailand's sustainable national development. Particular emphasis was placed on experts involved in the eco-tourism industry, given its critical role in Thailand's sustainable development framework. The detailed procedures and analytical steps are presented as follows.

Selection of Appropriate Indicators for Constructing the $PAr - ARIMAX(p)$ Model

The analysis involved the systematic selection of indicators to be incorporated into the $PAr - ARIMAX(p)$ model in order to examine the causal influences of eco-tourism–related factors on entrepreneurial performance and the transition of the tourism industry toward the green economy in the future. The model specifies several latent variables, namely the social sector, green economic sector, environmental sector, and eco-tourism entrepreneurship sector. These latent constructs are measured through a total of 15 observed variables, including green urbanization rate (E_1), green industrial structure rate (E_2), green total exports (E_3), expenditure government rate (E_4), green household rate E_5, employment rate (F_1), health and illness (F_2), social security (F_3), education rate (F_4), income distributions rate (F_5), Community Participation (F_6), Eco-tourism (G_1), total energy consumption (H_1), energy intensity (H_2), and Carbon dioxide emission (H_3).

The selected indicators were chosen to comprehensively capture the multidimensional interactions among sectors and to ensure the robustness and interpretability of the $PAr - ARIMAX(p)$ model in analyzing long-term structural changes and policy-relevant dynamics, as per the underlying results in Table 1. As shown in Table 1, all indicators satisfy the required statistical properties and are deemed appropriate for inclusion in the $PAr - ARIMAX(p)$ model.

The analysis indicates that each indicator is stationary at first difference at a statistical significance level of $\alpha = 0.01$. Consequently, all selected indicators are suitable for model construction and can be effectively utilized to analyze the impacts of structural and dynamic changes within the proposed analytical framework. Therefore, the researcher proceeds to incorporate all indicators into the estimation of the $PAr - ARIMAX(p)$ model in subsequent analyses.

Table 1. The results of the diagnostic analysis of the indicators used for constructing the $PAr - ARIMAX(p)$

Tau Test				MacKinnon Critical Value		
Variables	Level I(0) Value	Variables	First Difference I(1) Value	1%	5%	10%
$ln(E_1)$	−3.11	$\Delta\, ln(E_1)$	−4.39***	−4.10	−3.05	−2.50
$ln(E_2)$	−2.50	$\Delta ln(E_2)$	−4.57***	−4.10	−3.05	−2.50
$ln(E_3)$	−2.75	$\Delta ln(E_3)$	−4.68***	−4.10	−3.05	−2.50
$ln(E_4)$	−2.05	$\Delta ln(E_4)$	−5.10***	−4.10	−3.05	−2.50
$ln(E_5)$	−3.25	$\Delta ln(E_5)$	−5.01***	−4.10	−3.05	−2.50
$ln(F_1)$	−2.44	$\Delta ln(F_1)$	−4.95***	−4.10	−3.05	−2.50
$ln(F_2)$	−2.70	$\Delta ln(F_2)$	−5.58***	−4.10	−3.05	−2.50
$ln(F_3)$	−2.89	$\Delta ln(F_3)$	−5.03***	−4.10	−3.05	−2.50
$ln(F_4)$	−2.99	$\Delta ln(F_4)$	−5.11***	−4.10	−3.05	−2.50
$ln(F_5)$	−2.78	$\Delta ln(F_5)$	−5.58***	−4.10	−3.05	−2.50
$ln(F_6)$	−2.05	$\Delta ln(F_6)$	−4.89***	−4.10	−3.05	−2.50
$ln(G_1)$	−3.79	$\Delta ln(G_1)$	−6.02***	−4.10	−3.05	−2.50
$ln(H_1)$	−3.16	$\Delta ln(H_1)$	−4.76***	−4.10	−3.05	−2.50
$ln(H_2)$	−3.54	$\Delta ln(H_2)$	−4.79***	−4.10	−3.05	−2.50
$ln(H_3)$	−3.12	$\Delta ln(H_3)$	−4.25***	−4.10	−3.05	−2.50

Note: *** denotes significance α = 0.01

Table 2. The relational effects derived from the $PAr - ARIMAX(1,1,1)$ model

Dependent Variable	Type of effect	Independent Variable			
		Green economic sector	Environmental sector	Social sector	Ecotourism entrepreneurship sector
Green economic sector	DE	-	-	-	0.59***
	IE	-	-	0.11***	-
Environmental sector	DE	0.12***	-	0.58***	0.65***
	IE	0.10***	-	0.21***	0.19***
Social sector	DE	0.38***	0.35***	-	0.40***
	IE	0.11***	-	-	0.03***
Ecotourism entrepreneurship sector	DE	0.21***	-	0.60***	-
	IE	0.15***	-	-	-

Note: *** denotes significance α = 0.01, DE is direct effect and IE is indirect effect

Analysis of the Influence of Changes in Eco-Tourism Entrepreneurship

The analysis based on the $PAr - ARIMAX(p)$ model indicates that both latent variables and observed variables are interrelated through direct and indirect effects, as presented in Table 2.

The results shown in Table 2 indicate that the most appropriate specification of the $PAr - ARIMAX(p)$ model is $PAr - ARIMAX(1,1,1)$. This model represents the best-fitting and most robust specification, allowing for accurate estimation of the magnitude of relationships through both direct and indirect effects. The findings reveal that eco-tourism entrepreneurship exerts the strongest direct effect on the environmental sector, with an effect size of 65 percent, significant

at the 1 percent level. This result indicates that a 1 percent increase in eco-tourism entrepreneurship leads to a 65 percent change in the environmental sector in the same direction. Furthermore, eco-tourism entrepreneurship demonstrates the highest overall influence on changes in the green economy when compared to all other sectors included in the model.

These findings suggest that government policies and interventions aimed at stimulating change in eco-tourism entrepreneurship will generate corresponding positive transformations in the green economy, thereby promoting long-term sustainable growth. This strategy is more effective than interventions targeting other sectors in isolation. However, if policy actions are to be implemented across multiple sectors, it is essential to consider the intersectoral dynamics and relational influences identified in the model. The analysis further indicates that the social sector, particularly community participation and cultural transformation, has a substantial impact on eco-tourism entrepreneurship, with an influence level of up to 60 percent. This finding underscores the critical role of social factors in driving changes in eco-tourism entrepreneurship and, consequently, in shaping green economic outcomes. Therefore, when changes in eco-tourism entrepreneurship are combined with progressive transformations within the social sector, the resulting impact on the green economy is maximized compared with alternative policy approaches. Figure 2 illustrates the directional pathways and relational structure among the sectors within the $PAr - ARIMAX(1,1,1)$ model. The figure confirms that policy measures designed to stimulate eco-tourism entrepreneurship produce positive and aligned effects on green economic development and support sustainable long-term growth more effectively than interventions in other sectors alone.

Moreover, the figure highlights that change in the social sector, especially enhanced community participation and cultural adaptation, significantly influence eco-tourism entrepreneurship, with an impact magnitude of up to 60 percent. This reinforces the conclusion that social dynamics play a pivotal role in shaping entrepreneurial behavior within eco-tourism and are essential to achieving meaningful transformations in the green economy.

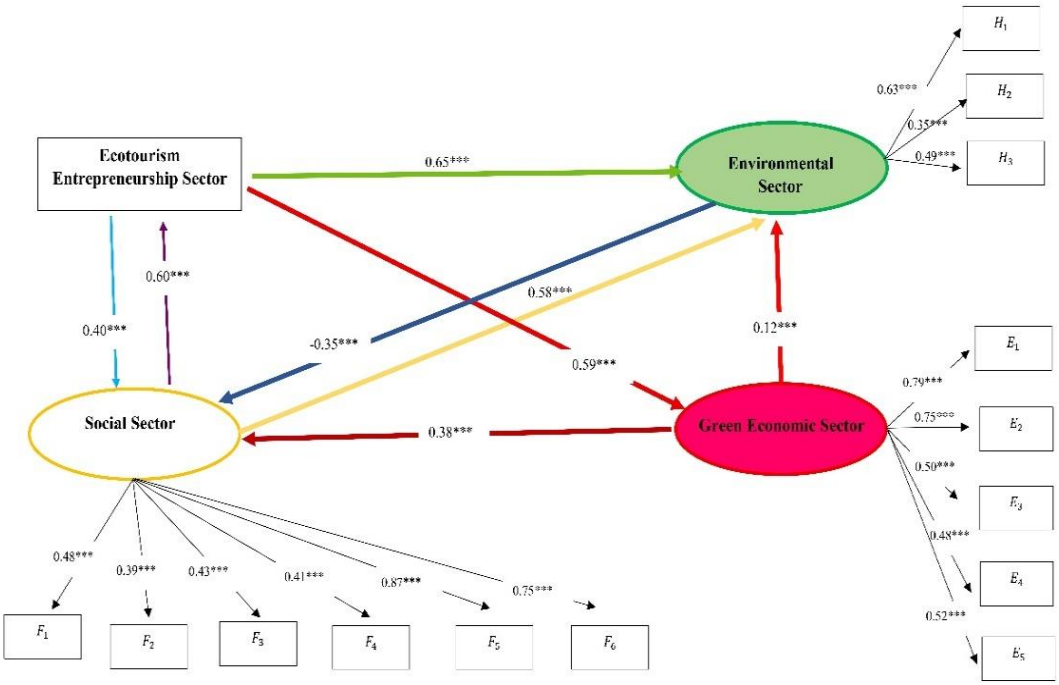

Figure 2. Direction of Intersectoral Relationships in the $PAr - ARIMAX(1,1,1)$ Model

Synthesis of Impacts on Various Sectors from Changes in Ecotourism Businesses and Operational Pathways toward the Green Economy

Based on qualitative research conducted through in-depth interviews with experts directly responsible for advancing Thailand toward the Green Economy goal, the impacts arising from changes in ecotourism were identified as follows.

1. Environmental Impacts: Ecotourism has strong potential to support environmental conservation by encouraging sustainable land use, protecting natural habitats, lowering carbon emissions, and preserving biodiversity. Studies show that it can generate funding for conservation and wildlife protection. However, its environmental outcomes depend heavily on management quality. Poorly managed activities, such as hiking or wildlife viewing, and unsustainable infrastructure development can degrade habitats and disturb ecosystems. In contrast, well-planned ecotourism generally produces lower environmental impacts than conventional tourism, particularly due to reduced carbon emissions from more sustainable transport and accommodation. Overall, the environmental effects of ecotourism are context-specific and influenced by activity types, infrastructure design, and ecosystem sensitivity; maximizing benefits requires careful planning, habitat protection, and low-carbon tourism practices.

2. Economic Impacts: Ecotourism can contribute to sustainable economic development by creating jobs, diversifying local economies, and supporting small and local enterprises. Evidence suggests it can make a meaningful contribution to GDP, particularly in developing countries, while generating income and employment at the community level. However, economic gains are not always evenly shared, as some communities benefit more than others, and economically

marginalized groups may receive limited returns. The scale of activities, community participation, and infrastructure quality strongly influence outcomes. Maximizing economic benefits therefore requires active local involvement in planning, fair benefit distribution, and investment in infrastructure that safeguards natural resources and cultural heritage.

3. Social Impact Mitigation: Protecting local communities and their cultural heritage is essential in ecotourism development to prevent social tension and conflict. Effective approaches include meaningful community participation, cultural sensitivity training for ecotourism operators, and the promotion of local cultural activities. Involving communities in planning, development, and management helps ensure that tourism respects local traditions and values, as demonstrated by community-led tourism initiatives offering cultural tours, craft workshops, and homestays. Training operators to understand and respect cultural norms further reduces conflict and improves the quality and appropriateness of tourism services. Promoting cultural events also supports heritage preservation while generating local economic benefits. Overall, these strategies help minimize negative social impacts and support ecotourism development that delivers long-term social benefits while safeguarding cultural heritage for future generations.

When it comes to monitoring and evaluation, they play a critical role in ensuring that ecotourism achieves sustainability goals and identifies areas for improvement. Ecotourism operators should systematically collect data on environmental, economic, and social impacts to assess the effectiveness of management practices and tourism policies. Environmental monitoring, such as waste generation, energy and water use, and greenhouse gas emissions, is essential for preventing ecological degradation and guiding operational improvements. Economic monitoring helps ensure that tourism activities generate local employment, support income distribution, and contribute to sustainable local development. Social monitoring focuses on cultural heritage protection, community participation, and the promotion of local products and services to ensure socially responsible tourism. Overall, integrated M&E supports long-term sustainability of ecotourism destinations, enhances community benefits, and safeguards natural and cultural resources for present and future generations. Achieving these outcomes requires coordinated collaboration among government agencies, destination managers, and local communities to promote responsible and sustainable ecotourism practices.

However, ecosystem conservation should remain the core focus of ecotourism, emphasizing biodiversity protection, reduced environmental impacts, and sustainable resource management. Active community participation in decision-making helps generate shared economic and social benefits, strengthens cultural understanding, and ensures fair benefit distribution. Capacity building through training and education for local communities, tourism operators, and guides enhances skills and informed participation in sustainable practices. Ecotourism infrastructure should prioritize sustainability by using eco-friendly materials, renewable energy, effective waste systems, and water-saving measures. Responsible visitor management, such as setting carrying capacities, promoting ethical travel behavior, and providing environmental education, helps minimize negative impacts on nature and communities.

Continuous monitoring and evaluation are essential to assess performance and refine management strategies. Strong partnerships among governments, local communities, NGOs, and businesses enable coordinated action and shared responsibility. Effective marketing can raise awareness of sustainable practices and attract environmentally conscious travelers by highlighting unique natural and cultural assets. Finally, certification and standards from recognized bodies help ensure compliance with sustainability principles and strengthen credibility.

DISCUSSION

This research developed a model with strong validity and conducted diagnostic tests on the $PAr - ARIMAX(p)$ estimation. The results indicate no problems of heteroskedasticity, multicollinearity, or autocorrelation, and the model also demonstrates satisfactory goodness of fit. These findings suggest that the model is appropriate for use in policy formulation and strategic planning in Thailand, particularly for guiding sustainable tourism management and supporting long-term growth, with a specific emphasis on the future development of ecotourism.

In selecting the indicators for the $PAr - ARIMAX(p)$ model, the analysis focused on examining the causal effects of ecotourism-related factors on entrepreneurial success and progress toward a green economy, while ensuring that carrying capacity can be maintained. The model incorporates latent variables representing the social sector, green economic sector, environmental sector, and ecotourism entrepreneurship sector. These latent constructs are measured through 15 observed variables, including green urbanization rate (E_1), green industrial structure rate (E_2), green total exports (E_3), expenditure government rate (E_4), green household rate E_5, employment rate (F_1), health and illness (F_2), social security (F_3), education rate (F_4), income distributions rate (F_5), Community Participation (F_6), Eco-tourism (G_1), total energy consumption (H_1), energy intensity (H_2), and Carbon dioxide emission (H_3). The results show that all indicators are appropriate for model construction and can be effectively used to analyze the impacts of change, as each variable is stationary at first difference at a statistical significance level of $\alpha = 0.01$.

Based on these findings, the researcher was able to develop the $PAr - ARIMAX(p)$ model as an optimal (best-fit) time-series model, enabling a reliable analysis of the magnitude of relationships in terms of both direct and indirect effects. The results indicate that ecotourism entrepreneurship has the strongest direct effect on the environmental sector, accounting for 65% at the 1% significance level. This implies that a 1% change in ecotourism entrepreneurship leads to a 65% change in the environmental sector in the same direction. At the same time, ecotourism entrepreneurship exerts the greatest influence on changes in the green economy compared with all other sectors included in the model.

Therefore, policy interventions or structural changes targeting ecotourism entrepreneurship are likely to generate corresponding positive changes in the green economy and deliver the highest benefits for long-term sustainability. In

addition, a key finding that warrants close attention is the role of the social sector, which influences changes in ecotourism entrepreneurship by as much as 60%. This highlights the critical importance of social dynamics in shaping ecotourism entrepreneurship and, consequently, in driving transformations toward a green economy.

When changes in ecotourism entrepreneurship are combined with social-sector transformation, the resulting impact on the green economy is maximized. This research approach and its findings have not been previously identified in the literature. The results further indicate that, in aligning with government policy objectives, the sector with the highest adaptive capacity is the social sector. Accordingly, government policy should urgently prioritize social-sector development, with particular emphasis on community participation and cultural transformation, and implement these measures in a concrete and systematic manner. Such coordinated change, aligned with the evolution of ecotourism entrepreneurship, is essential for achieving sustainable long-term development goals.

The development of ecotourism in Thailand can be strengthened through the following key approaches:

1. Promote public–private collaboration: Strong cooperation between government and the private sector is essential for effective ecotourism development. The public sector should support planning and infrastructure development, such as nature trails, sustainable resource management systems, and regulations encouraging the use of eco-friendly materials. The private sector can contribute by developing tourism services that prioritize sustainability, enhance visitor experiences, and promote conservation awareness.

2. Strengthen sustainable resource management: Sustainable resource management is central to the long-term success of ecotourism. Destinations should implement measures to prevent environmental degradation, including visitor limits, waste and pollution control, and the conservation of forests and key natural attractions. Clear management plans, supported by appropriate technologies, can improve efficiency and ensure sustainable destination development.

3. Enhance local community participation: Sustainable ecotourism should actively involve local communities as owners and stewards of tourism resources. Community-based activities can generate income while strengthening local economies and social cohesion. Government support is needed to build community capacity through guide training, resource management education, and assistance in developing distinctive local products for tourists.

4. Building integrated networks for systematic ecotourism development: Establishing networks among ecotourism destinations across different regions can promote coordinated and systematic tourism development. Such networks should involve public agencies, private sector actors, local communities, and other stakeholders, including researchers and conservation organizations. These networks facilitate knowledge sharing and the exchange of best practices for sustainable destination management, enhance the visibility of ecotourism sites, and support the creation of interconnected tourism routes that link multiple destinations.

As for the limitations of this study, it is subject to limitations arising from Thailand's relatively weak and outdated environmental legal framework. Environmental governance continues to rely primarily on the National Environmental Quality Promotion and Conservation Act B.E. 2535 (1992), with only limited amendments, alongside related legislation. As a result, legal mechanisms are often insufficient to effectively prevent or mitigate environmental impacts. Tourism development has significantly contributed to environmental degradation, particularly through the rapid growth of greenhouse gas emissions. Although tourism has been promoted as a national agenda, environmental protection has not progressed at a comparable pace. Consequently, this study could not fully incorporate legal and regulatory dimensions into the analysis or use them as a basis for defining comprehensive policy strategies.

CONCLUSIONS

This study investigates how transformations in ecotourism entrepreneurship shape Thailand's green economy policy, employing a holistic, systematic, and mixed-methods approach. Quantitative analysis was complemented by expert qualitative insights from sustainable development and ecotourism sectors.

The results identify the PAr-ARIMAX(1,1,1) model as the optimal analytical tool, demonstrating robust validity, no spurious associations, and excellent goodness-of-fit. This model thus provides a sound basis for policy formulation, strategic planning, and the sustainable management of Thailand's tourism sector. The result reveals that Ecotourism entrepreneurship exerts the strongest direct impact on the environmental sector, explaining 65% of the variance at a 1% significance level. A 1% increase in ecotourism entrepreneurship corresponds to a 65% rise in the environmental sector, underscoring its outsized influence relative to other modelled sectors. Accordingly, policies that promote ecotourism entrepreneurship can substantially advance environmental outcomes and accelerate the green economy transition.

At the same time, the social sector—especially community participation and cultural transformation—significantly affects ecotourism entrepreneurship, with an effect size of up to 60%. This suggests that green economy transformation requires more than shifts in entrepreneurship alone; government policy must address the interplay between ecotourism and social dynamics. Emphasizing community engagement, cultural adaptation, and active local stakeholder participation is therefore essential for effective ecotourism development.

In summary, integrating ecotourism entrepreneurship with progressive social sector change is the most effective strategy for advancing Thailand's green economy. Targeted government action to support entrepreneurs, build community capacity, and foster stakeholder collaboration is vital to ensure tourism aligns with both environmental and social sustainability, strengthening national development.

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