International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(1), 108-120.

A Framework on Setting Strategies for Enhancing the Efficiency of State Power use in Thailand's Pursuit of a Green Economy

Pruethsan Sutthichaimethee*

Faculty of Political Science, Pitchayabundit College, Mueang, Nong Bua Lam Phu, Thailand. *Email: pruethsan.sut@gmail.com

Received: 17 September 2023 **Accepted:** 18 December 2023 **DOI:** https://doi.org/10.32479/ijeep.15202

ABSTRACT

The objectives of this study are to investigate the efficiency of state power use in governing the country towards a green economy and to examine proactive strategies to enhance the efficiency of state power use. This study employs a mixed-methods research approach, including quantitative research involving the construction of a model, Structural Equation Modeling-Latent Change Model with Vector Error Correction Model, to assess the above efficiency. Additionally, the findings from quantitative research are integrated into qualitative research to formulate proactive strategies for exercising state power to foster sustainable development. The findings indicate that the use of state power for the development of a green economy, in accordance with the 20-Year National Strategic Plan and various development strategies of Thailand, has proven to be inefficient. This inefficiency stems from continuous growth in the economic and social sectors, while the environmental sector has consistently deteriorated. The most significant contributing factor directly impacting the environment is the economic sector, followed by the social sector. Moreover, Thailand's adaptability towards sustainability has been notably slow and falls below the established standards. If the government continues to use state power and pursue policies in a manner similar to the past, it is likely to have severe adverse consequences for the environment. This is due to the fact that reactive measures, including civil measures, administrative measures, and criminal measures, cannot effectively facilitate the development of a green economy. Therefore, the guidelines for addressing and formulating proactive strategies are of paramount importance and highly necessary for achieving sustainability. Research findings suggest that the government must establish reactive measures alongside proactive measures in economic aspects. These measures include (1) taxation and revenue collection; (2) subsidies and tax incentives; (3) financial enforcement incentives; (4) deposit systems and refund mechanisms; and (5) ownership and market creation systems. The study also reveals that countries efficiently implementing these economic measures for sustainability include European nations and Asian countries such as South Korea and Japan. Consequently, Thailand should consider applying the research findings to appropriately and efficiently shape the use of state power before the nation causes further irreparable damage. It is imperative that these proactive measures are pursued diligently and continuously to promote green economy policies and ensure sustainability in both the present and future.

Keywords: State Power, State Power Use, Green Economy, Political Policy, Sustainability
JEL Classifications: P28, Q42, Q43, Q47, Q48

1. INTRODUCTION

In Thailand, the government has consistently exercised its administrative authority in managing the country, from the past to the present (2002–2022). In this regard, the government has actively promoted Thailand's transition towards a developed nation in various dimensions (The World Bank: Energy Use [Kg of Oil Equivalent Per Capita] Home Page, 2023). Notably, the government has taken comprehensive measures to ensure sustained economic growth, with the key indicator being the gross domestic product (GDP) (Office of the National Economic and Social Development Council [NESDC], 2023). This growth has been achieved through strategies such as increasing exports while reducing imports, attracting foreign investments, promoting continuous tourism, and offering incentives and exemptions for various tariffs to stimulate private sector investments, among others (National Statistic Office Ministry of Information and Communication Technology, 2023). It is evident that the

This Journal is licensed under a Creative Commons Attribution 4.0 International License

government's exercise of state power has been highly successful, leading to Thailand's escape from economic crises and realizing continuous growth as intended. Simultaneously, the government has employed state power and various policies to foster societal growth in all aspects. For instance, it has promoted and supported education to enhance literacy and access to higher education by implementing measures to provide comprehensive educational opportunities to the population. It has also focused on improving healthcare accessibility by establishing free and affordable healthcare, consistently increasing the number of state hospitals to accommodate the sick, and supporting wage rates and employment opportunities for citizens by continually reducing unemployment rates (NESDC, 2023). Additionally, the government has prioritized citizens' security, ensuring their overall well-being and national security by implementing extensive safety measures across the country. Moreover, it has strived to achieve income distribution that is fair and widespread, further emphasizing social and environmental responsibility by emphasizing environmental conservation and sustainability (Thailand greenhouse gas management organization [public organization], 2023). This has been realized through initiatives such as banning plastic bag usage, reducing carbon emissions, promoting green technology, and supporting renewable energy sources (Department of Alternative Energy Development and Efficiency, 2023; Pollution Control Department Ministry of Natural Resources and Environment. Navigation of Thai Waterways Act, B.E. 2546, 2023). Therefore, the use of state power, with the aim of promoting simultaneous and continuous growth in the three sectors mentioned, serves as a means to develop a green economy. This approach is expected to contribute to future sustainability (Pollution Control Department Ministry of Natural Resources and Environment. Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it, 2023).

The government's formulation of a 20-year national strategic plan is crucial for fostering sustainable development in the foreseeable future (NESDB, 2023). This approach encompasses continuous efforts under the purview of state power, including administrative measures, civil measures, and criminal measures, from the past to the present day (The World Bank: Energy Use [Kg of Oil Equivalent Per Capita] Home Page, 2023). Regardless, the government's commitment to accelerating economic and social growth has been evident since 2002 and continues to be effective as of 2022. It is apparent that this policy has resulted in consistent income growth among the population, an increase in per capita GDP (NESDB, 2023), and the establishment of socially desirable standards across the nation (Department of Alternative Energy Development and Efficiency, 2023). However, in terms of environmental considerations, there has been a corresponding rise in consumption patterns. Specifically, there has been an increase in energy consumption and a continuous growth in greenhouse gas emissions, particularly in the electronic, transportation, and industrial sectors. CO2 emissions have seen the highest growth rate, reaching 65.1% from 2002 to 2022 (Thailand greenhouse gas management organization [public organization], 2023). It is noteworthy that such increases have immediate and long-term consequences for the current and future environmental systems. Therefore, the government should thoroughly examine whether the use of state power in terms of governance measures, civil measures, and criminal measures in the past has been effective or not, in line with the goals of the green economy (NESDC, 2023). If it is found to be appropriate, it will contribute to the sustainability of Thailand in the future (Thailand greenhouse gas management organization [public organization], 2023). However, if the use of state power in the aforementioned manner does not align with the goals or goes in the opposite direction, it will undoubtedly have detrimental effects on Thailand's environmental system (United Nations Framework Convention on Climate Change, UNFCCC, Bonn, Germany, 2016). Ultimately, it may not be possible to rectify the situation, as environmental systems often take many years to restore to their original state and sometimes cannot be restored at all. Additionally, the government must have a key strategy for developing the country towards a green economy that is most suitable and comprehensive, leading Thailand toward a promising future in line with sustainability goals (Sutthichaimethee, Ariyasajjakorn, 2020; Pollution Control Department Ministry of Natural Resources and Environment. Enhancement and Conservation of National Environmental Quality Act, B.E. 2535, 2023).

Hence, an extensive review of research work both within the country and abroad was conducted and found that Thailand lacks research from the perspective of the research problem discussed. The few research efforts conducted within the country often take a narrow viewpoint on specific aspects, which may not contribute effectively to the formulation of national strategies. Consequently, this research project identified the aforementioned research gap and proceeded to conduct a quantitative study by creating a research model. This model was developed to investigate the efficiency of state power uses and their influence on shaping the green economy. In case the model proves unsuitable, the findings are intended to be utilized for further research through qualitative research endeavors, aiming to fill the research gaps and contribute to the ongoing development strategies of Thailand.

2. LITERATURE REVIEW

In the pursuit of a green economy, the enhancement of state power efficiency is a paramount consideration for nations worldwide. As Thailand endeavors to transition towards a sustainable and environmentally responsible future, it becomes imperative to explore the strategies and techniques that can optimize the allocation of resources and promote eco-friendly practices. This literature review section delves into a comprehensive analysis of various strategies employed to enhance state power efficiency in the context of Thailand's green economy agenda. We explore relevant qualitative studies that have delved into these strategies and present the results obtained from these studies, shedding light on the practical implications and effectiveness of these approaches. The importance of sustainability cannot be overstated, particularly in a world grappling with the consequences of climate change and environmental degradation. As Thailand seeks to align its development goals with global sustainability targets, understanding the strategies that drive state power efficiency is critical. This literature review aims to provide an insightful

overview of the current state of knowledge in this domain, offering a nuanced understanding of the techniques that can be harnessed to propel Thailand towards a more sustainable and environmentally conscious future.

In analyzing environmental sustainability models, several research studies have employed various methodologies to assess environmental sustainability across different contexts. Mahmood et al. (2022) used the Dynamic Ordinary Least Squares (DOLS) method to examine factors affecting environmental sustainability in South Asian economies. Harymawan et al. (2020) employed a multifaceted approach to assess sustainability disclosure in Indonesia. Nwobu et al. (2021) conducted a content analysis of sustainability disclosure in the Nigerian oil and gas industry. Al-Bazali and Al-Zuhair (2022) utilized fuzzy logic to comprehensively assess the sustainability of the oil and gas industry. Moreover, Rizki et al. (2022) combined green supply chain management (GSCM), enterprise resource planning (ERP), and environmental consciousness to enhance sustainability performance in manufacturing companies. In a more industry-specific context, Dally et al. (2020) examined the interplay between personal carbon trading and carbon knowledge management to assess their combined impact on environmental sustainability in Thailand. Ananda et al. (2023) assessed small-scale reservoir management's sustainability by considering ecological, social, and economic factors. Pramono et al. (2023) evaluated a company's commitment to long-term value creation by integrating environmental management accounting (EMA) and control system integration (CSI), with a focus on sectoral green economy (SGE). Kasayanond et al. (2019) highlighted the role of energy awards in promoting sustainability and environmental responsibility among high technology-based companies in Malaysia. In addition, Bhutta et al. (2022) employed statistical techniques to assess the contributions of green innovation, green energy production, financial development, and country governance to environmental sustainability. Pratama et al. (2022) examined sustainability disclosures in annual reports across Southeast Asia, emphasizing environmental, social, and governance (ESG) criteria. Pattiruhu (2020) quantitatively assessed the interplay between budget allocation for environmental development, government accountability mechanisms, renewable energy consumption, and environmental sustainability in Indonesia. Erna and Mutaqin (2023) used partial least squares structural equation modeling (PLS-SEM) to analyze the relationships between environmental regulations, public support, green public procurement, and green governance in the context of renewable energy implementation. The same model was used by Ratmono et al. (2022) in examining greenhouse gas emission disclosure in Indonesia, considering firm characteristics and corporate governance as determinants.

In the realm of sustainability research, a wealth of studies have explored various facets, offering unique insights into environmental responsibility and state power efficiency. This literature review delves into a selection of these studies, each contributing its own set of discoveries and implications, collectively enriching the discourse on building a greener, more sustainable future. In a comprehensive review of recent studies, we gain valuable insights into various facets of sustainability and environmental considerations across different domains. Wu et al. (2022) highlighted the monetary and health co-benefits arising from the implementation of carbon charges in Taiwan's industrial sector, demonstrating the substantial advantages of this approach. Cheng et al. (2022) drew attention to the evolution of Extended Producer Responsibility (EPR) in managing electronic waste, showcasing how environmental considerations in product design have led to improved ecological outcomes. Lam et al. (2018) emphasized the potential of a multifaceted strategy, including tax incentives and biofuel initiatives, in accelerating the adoption of electric vehicles in East Asia. Mfune et al. (2016) presented a case study in Eastern Zambia, demonstrating that initiatives like COMACO can align multifunctional agriculture with green economy objectives. Adeel et al. (2016) delved into sustainable dyeing practices using natural colorants, offering eco-friendly solutions for the textile industry. Yang et al. (2023) examined the complex relationship between urbanization and carbon emission efficiency in Western China, revealing patterns that inform sustainable urban development. Sezgin et al. (2023) underscored the role of economic factors in achieving educational attainment and, by extension, the Sustainable Development Goals. Guo, Wang, Xu, Li, and Wang (2023) explored the dynamic interplay between finance and economic growth, shedding light on regional variations in this relationship. Tasnim et al. (2023) recognized the power of stories in instilling sustainability values in children and shaping future mindsets. Premsagar and Kenworthy (2023) critically evaluated the feasibility of a hyperloop system in India, considering the broader implications for sustainable urban transport. Malatesta et al. (2023) investigated barriers to the adoption of renewable energy systems, highlighting the need to address societal norms and institutional resistance. Yang et al. (2021) delved into stakeholder attitudes towards fish welfare in China's aquaculture industry, shedding light on perceptions and knowledge gaps. Newman et al. (2021) introduced the concept of transit-activated corridors (TACs) to rejuvenate urban development around railway stations, linking transit and entrepreneurship theory. Lastly, Hiremath et al. (2021) analyzed the role of coal power and carbon capture and storage (CCS) in India's energy landscape, emphasizing the competitiveness of renewables in climate change mitigation. Dabeedooal et al. (2019) proposed a framework for transforming Port Louis, Mauritius, into a smart city through smart tourism, offering an alternative approach to urban development. Collectively, these studies contribute a diverse array of perspectives and strategies for advancing sustainability and environmental goals in various contexts.

In a comprehensive exploration of Australia's evolving landscape in various domains, a series of studies shed light on critical aspects of the country's sustainable development. Hargroves et al. (2023) examined the transition from centralized energy systems to decentralized ones, emphasizing the transformative potential driven by distributed energy resources (DER). Newman (2023) delved into the rapid acceleration of the net zero transition, highlighting its intersection with social, economic, and political transformations. Zaman et al. (2023) tackled construction and demolition (C&D) waste management, emphasizing the need for tailored guidelines in an era of circularity. Easton-Gomez et al. (2023) addressed climate change adversity, advocating systematic

approaches for support mechanisms. Wilkinson et al. (2021) scrutinized the adoption of rooftop solar photovoltaics (PV) and its implications for low-carbon electricity systems. Keegan and Breadsell (2021) explored food waste, emphasizing the role of meal preparation and storage practices. Sarker et al. (2019) focused on urban sustainability, particularly the integration of urban agriculture into Australia's urban planning, highlighting regulatory constraints. These studies collectively underscore the multifaceted nature of sustainability research and its profound impact across various domains, offering valuable insights into the pursuit of a more sustainable future.

In the course of conducting an extensive literature review on "Guidelines on Strategies and Settings for Enhancing State Power Efficiency in Thailand's Pursuit of a Green Economy," it has become evident that while there is a wealth of research addressing sustainability and environmental responsibility globally, there exists a notable research gap concerning the specific strategies required to enhance state power efficiency in the context of Thailand's green economy agenda. The examination of both domestic and international studies has revealed a scarcity of comprehensive investigations in this niche area. Most existing studies tend to be isolated, lacking a cohesive framework that aligns with Thailand's overarching sustainability objectives. This fragmentation of research findings may inadvertently lead to inconsistent policy directions and a lack of continuity in the government's efforts, potentially hindering the efficiency of state power utilization. Recognizing this critical gap, our research endeavors to provide a consolidated and comprehensive analysis, bridging the divide in the existing literature to offer practical insights that can guide Thailand towards a more efficient and sustainable future. By addressing this void in research, we aim to contribute valuable guidelines and recommendations that will facilitate the harmonization of state power efficiency strategies within the broader framework of Thailand's green economy agenda, ultimately fostering a more consistent and effective approach to sustainability.

After reviewing related research both domestically and internationally, it was found that there has been no prior research that has developed a model in this manner. Furthermore, analyses of this nature are scarce, particularly for Thailand, with very limited analysis conducted. The majority of previous analyses have not examined all components comprehensively but have instead focused on fragmented aspects. This fragmented approach has limited its suitability for forming various strategies effectively. Therefore, this study recognizes the research gap and conducts an analysis to provide beneficial insights to the government and other sectors. For this study, a quantitative approach has been chosen while utilizing secondary data from the period of 2002-2022. After obtaining quantitative research results, a qualitative research phase will follow, incorporating documentary policy analysis. The aim is to provide guidance for formulating strategies for state power uses. In the process of analysis and synthesis, the use of state power in various European and Asian countries is studied, including South Korea and Japan, to provide a framework for Thailand's future governance. The following outlines the steps of the research process: The researchers will need to undertake eight steps, as follows:

- Step 1: Model Specification (Dickey and Fuller, 1981)
- Step 2: Model Preparation
- Step 3: Model Identification (Johansen and Juselius, 1990; MacKinnon, 1991)
- Step 4: Model Estimation
- Step 5: Model Evaluation
- Step 6: Model Modification
- Step 7: Results Reporting
- Step 8: Integrating Quantitative Research Findings for Qualitative Research, whereby the researchers utilize the quantitative research results to analyze areas for qualitative research, specifically in the context of synthesizing state power for sustainable national development and the promotion of a green economy.

In Figure 1, a schematic representation of the steps involved in the Structural Equation Modeling-Latent Change Model with Vector Error Correction Model (SEM-LCM-VECM) analysis is presented. It is evident that at Step 3, cases may arise where the model cannot be feasibly executed. For instance, this could occur if statistical test results indicate negative or zero degrees of freedom due to an excessive number of parameters to be estimated, surpassing the Varian-Covariance count of observed variables. In such instances, model modifications are necessary, often entailing parameter reduction under specified conditions. Nevertheless, this research endeavor was devised to address and rectify these issues, ensuring that the estimated model yields a suitable level of validity.

Figure 1: Analytical steps in research procedures

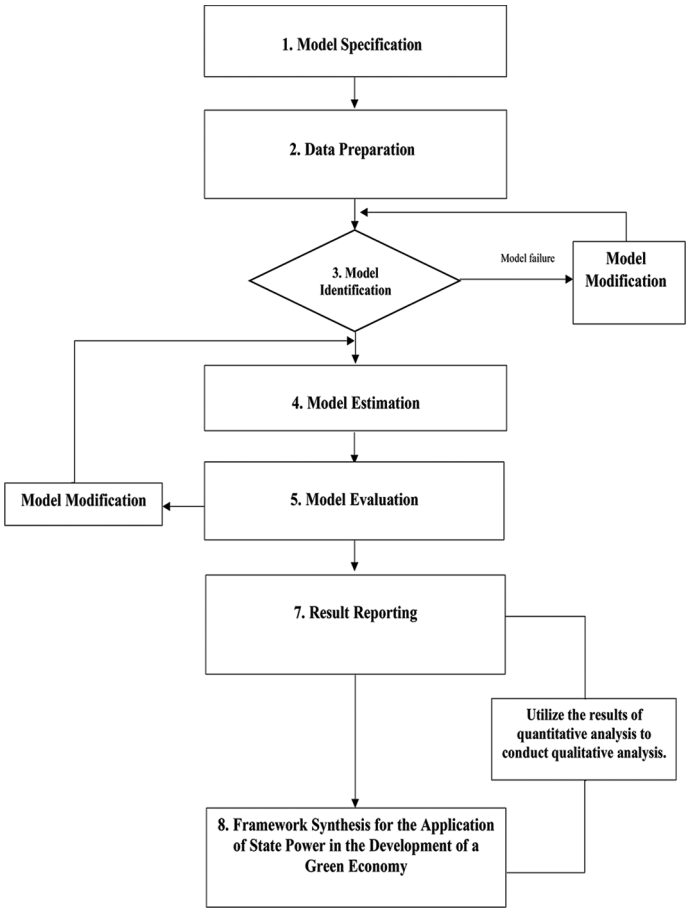


Figure 1 illustrates the research process steps, encompassing both quantitative research and the incorporation of quantitative research findings into qualitative research. This comprehensive approach is aimed at obtaining the most robust responses for application in the formulation of Thailand's green economic development strategy. For the quantitative research aspect, the following hypotheses have been established:

1. The economic sector has a direct impact on the social sector.
2. The economic sector has a direct impact on the environmental sector.
3. The social sector has a direct impact on the economic sector.
4. The social sector has a direct impact on the environmental sector.
5. The economic sector has an indirect impact on the environmental sector.

However, for this research endeavor, a meticulous examination of the quality of qualitative research has been conducted. This validation process ensures the accuracy and appropriateness of the results, focusing on aspects such as credibility, dependability, confirmability, and transferability.

3. MATERIALS AND METHODS

For this research study, the researchers have employed a model known as SEM-LCM-VECM. The details of this model are as follows:

3.1. Principles of Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a statistical data analysis technique employed in research to validate hypotheses derived from relevant theories or theoretical concepts in a causal framework. SEM facilitates the conversion of research hypotheses into mathematical models, and it can be described as a method that demonstrates the expected relationships based on the theories of a group of variables. These relationships can be visually represented in the form of a path diagram, which serves as the conceptual framework for research based on various relevant theories. SEM allows researchers to investigate both direct and indirect influences within the model, providing a comprehensive analysis of the interrelationships among variables in the research context (Sutthichaimethee and Ariyasajjakorn, 2017; Sutthichaimethee and Chatchorfa, Suyaprom, 2019).

SEM is, therefore, a technique utilized in data analysis that combines multiple analytical methods for the examination of multivariate data. The fundamental framework of SEM commonly incorporates techniques such as confirmatory factor analysis, path analysis, variance component analysis, and covariance structure analysis. These methods are employed collectively to perform comprehensive analyses. Furthermore, SEM can be applied to both experimental and non-experimental data, making it widely adopted across various academic disciplines, including biology, economics, education, marketing, medicine, and sociology. In addition to its versatility, there are numerous software programs available today that facilitate SEM analysis, including but not limited to AMOS, EQS, LISREL, Mplus, Mx, RAMONA, and SEPATH (Enders, 2010).

The principles for conducting the analysis of multi-step structural equation models in practical applications involve the sequential execution of various stages. Even in the utilization of pre-existing software programs such as AMOS, LISERL, Mplus, or EQS, there are multiple steps involved. Researchers must begin by framing the conceptual framework of their research, typically through the creation of a path diagram. This diagram serves to specify the types of variables and the relationships between them (Harvey, 1989).

3.2. Path Diagram

When the researchers have comprehensively reviewed relevant theories and literature, it becomes imperative to articulate the conceptual framework of the research project. In this regard, the researchers must craft a path diagram, employing symbols and arrows in accordance with the Structural Equation Modeling (SEM) methodology as prescribed by the technique (Enders, 2010).

3.3. Components of Structural Equation Modeling

Structural Equation Modeling (SEM) generally comprises two main components: the measurement model and the structural model.

3.3.1. Measurement Model

The measurement model is composed of observed variables, also referred to as indicator variables, and latent variables. This model is primarily based on the principles of factor analysis, often employing confirmatory factor analysis (CFA) to ascertain whether latent variables or factors can be effectively measured by observed variables. This concept is illustrated in Figure 2 (Sutthichaimethee and Ariyasajjakorn, 2017; Sutthichaimethee, 2018; Sutthichaimethee, 2017).

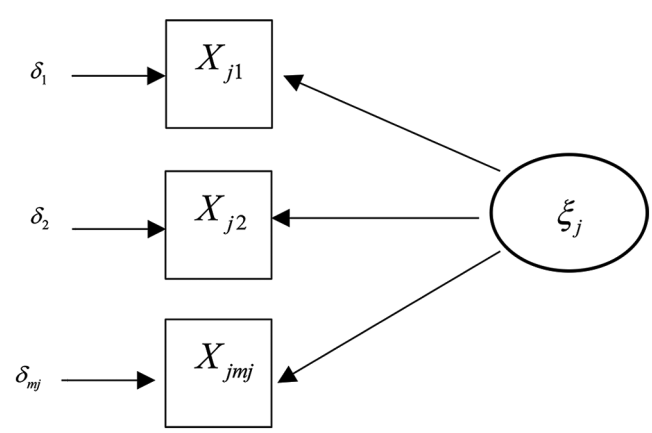
In Figure 2, a measurement model is depicted, which measures a latent variable (ξ_j) using three observed variables (X_{j1}, X_{j2}, X_{j3}).

3.3.2. Structural Model

The structural model is a causal model that can identify both the direct and indirect effects of latent variables. This analysis employs regression techniques, as illustrated in Figure 3, specifically highlighting the direct influence of ξ_j on η_j.

In Figure 3, there are two measurement models and one structural model. These models consist of observable variables, latent variables, and depict both exogenous variables (denoted as ξ_j) and

Figure 2: Illustrates a latent variable



endogenous variables (denoted as η_j) that capture both external and internal latent variables. The equation structure model in Figure 3 comprises the following components: Sutthichaimethee and Ariyasajjakorn, 2018

1. There are 6 observable variables, namely X_{j1}, X_{j2}, X_{j3} and Y_{j1}, Y_{j2}, Y_{j3}.
2. There are 2 latent variables, specifically ξ_j and η_j.
3. Measurement error is present in the observed variables.
4. The variability of the internal covariate η_j

In the context of measurement models, there are two confirmatory models, specifically characterized by:

1. The measurement model for the latent variable ξ_j, which comprises three indicator variables denoted as X_{j1}, X_{j2}, and X_{j3}. In this case, researchers aim to examine and confirm the suitability of employing ξ_j.

From Figure 4, it can be observed that the identical coefficients, denoted as λ_1 - λ_3, represent the regression coefficients, which are factor loadings for variables X_1 - X_3 with respect to the latent variable ξ_j. The error component, specific to this context, corresponds to measurement error.

2. Model validation of latent variable η_j comprises of three confirmatory factors, which are Y_1, Y_2, and Y_3. In this context, the researchers aim to ascertain whether variables Y_1, Y_2, and Y_3, in addition to η_j, are effectively verified (Sutthichaimethee and Kubaha, 2018; Sutthichaimethee and Ariyasajjakorn, 2018).

From Figure 5, it is evident that λ_1 - λ_3 represents the factor loadings of observed variables Y_1, Y_2, and Y_3 within the latent variable η_j. Meanwhile, the error terms signify the measurement errors associated with observed variables Y_1, Y_2, and Y_3, respectively.

3.4. The SEM-LCM IN this Research

In this research, the SEM-LCM-VECM was employed as the modeling technique. This approach is highly reliable and minimizes research-related issues, thereby yielding more accurate estimations compared to conventional methods.

The primary challenge in most research endeavors, as previously discussed, often involves utilizing cross-sectional data collected at a specific point in time. This is commonly encountered in social science research. However, it is noteworthy that contemporary research extends its focus beyond social sciences to encompass studies in social and behavioral sciences, as well as medical research, which is interested in examining the changes within the same group of individuals over time. This phenomenon is commonly referred to as repeated measures.

Repeated measurement is a research method aimed at investigating the changes in an individual, a group of individuals, or an organization over time. To facilitate this examination of change, longitudinal data must be collected, which involves gathering data from the same individuals or organizations on multiple occasions as time progresses.

Currently, repeated measurements find applications in research across various fields, including political science, economics, and business administration, among others. However, there are certain limitations associated with this approach:

- The duration of the study depends on the researcher and the appropriateness of the content, determining how long the study will last.
- The time intervals of long-term data may or may not be equal.
- Measurement repetition should occur more than twice.

3.5. Steps of SEM-LCM-VECM Analysis in this Research

The process of employing structural equation modeling (SEM) techniques in this research comprises six steps, as illustrated in Figure 6.

From Figure 6, it is evident that the steps involved in applying structural equation modeling (SEM) techniques in research are as follows:

- Step 1: Review and study theories relevant to the research, including a literature review.

Figure 3: Illustrates the measurement model and structural model

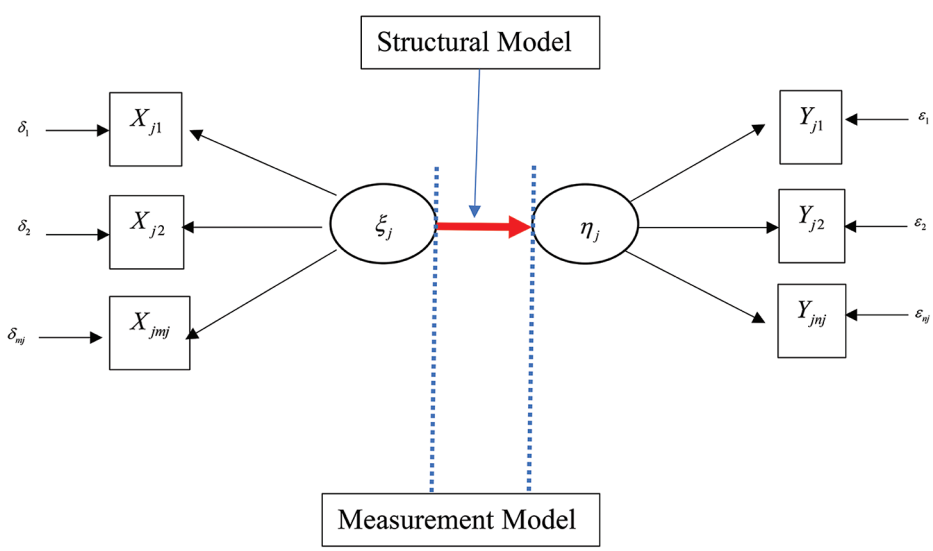


Figure 4: Illustrates the measurement model of latent variables, specifically for variable ξ_j

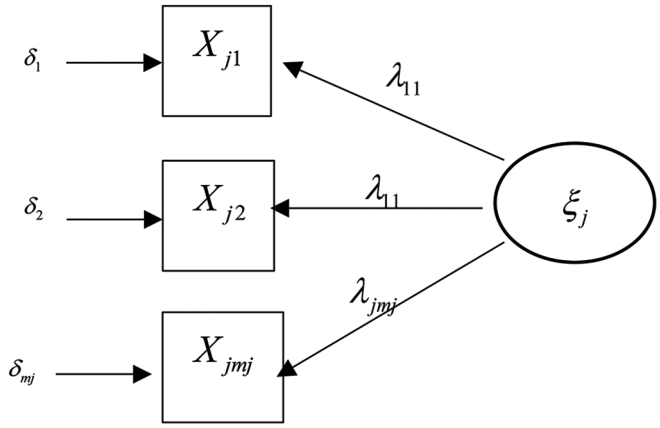
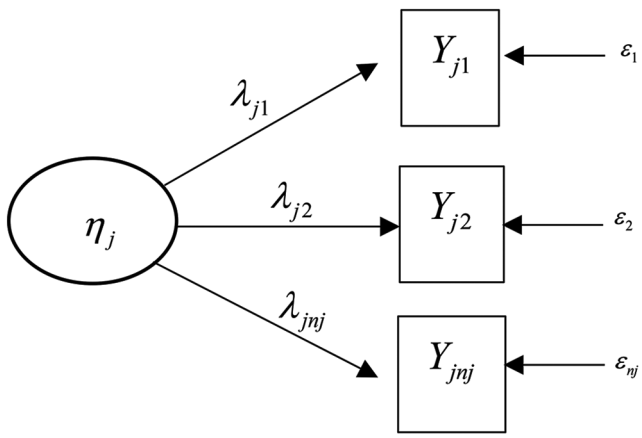


Figure 5: Illustrates the measurement model of the latent variable η_j

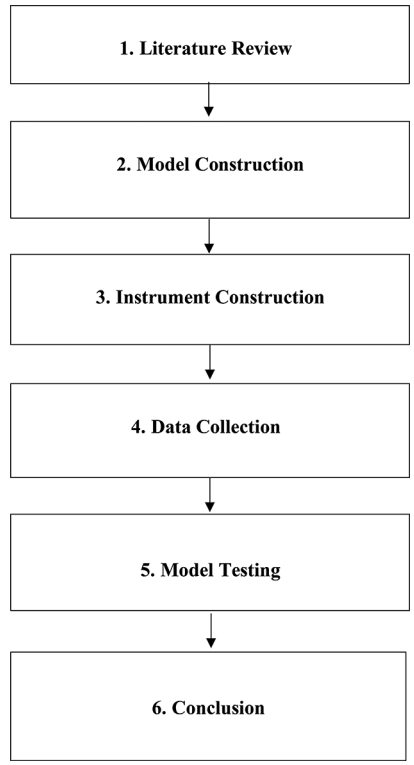


- Step 2: Construct a model in accordance with the research objectives, referencing the theories and literature reviewed in Step 1. This involves creating a Path Diagram of the research with assumptions that underpin the model.
- Step 3: Develop data collection tools. As mentioned earlier, SEM can be applied in various fields, and in social sciences, surveys are often used as data collection tools. Therefore, in this step, a questionnaire is designed, with questions and answers that correspond to observable or latent variables. In some disciplines like medicine or science, data may be collected through experiments or patient examinations.
- Step 4: Collect data using the tools created in Step 3.
- Step 5: Model validation, which entails verifying the consistency or alignment between the model or pathway diagrams outlined in Step 2 and the observational data collected in Step 4, as well as testing hypotheses regarding the parameters' values.
- Step 6: Prepare a report summarizing the findings from the analysis conducted in Step 5, highlighting its alignment with relevant theories and literature.

4. EMPIRICAL ANALYSIS

For this study, a mixed-methods research approach has been designed, incorporating quantitative research findings and utilizing them to conduct qualitative research. The aim is to develop proactive strategies to enhance the efficient use of state power in promoting a green economy in Thailand. The results of the analysis are presented as follows:

Figure 6: Illustrates the steps involved in utilizing structural equation modeling techniques in this research



4.1. Screening of Influencing Factors for Model Input

In this paper, the study employed the SEM-LCM-VECM model to assess the efficiency of the state power use in advancing the country towards a green economy. The model included latent variables, namely Economic (*Econ*) factor, Social (*Social*) factor, and Environmental (*Envi*) factor, together with a total of 13 observed variables. There variables are income (*Gdp*) urbanization rate (*Ur*), industrial structure (*Ins*), total exports (*Exp−m*), indirect foreign investment (*If*), expenditure government rate (*Gbl*), employment (*Epm*), health and illness (*H–i*), social security (*S–s*), consumer protection (*ecp*), total energy consumption (*eEe*), energy intensity (*eEi*), and Carbon Dioxide emission (eCO_2). The SEM-LCM-VECM model selected 13 factor variables for testing stationarity using Unit Root tests at levels I(0) and I(1), following the Augmented Dickey-Fuller theory (ADF-test). The results of the analysis are presented in Table 1.

From Table 1, it is evident that all factors exhibit non-stationary characteristics at level I(0). This renders the data unsuitable for model construction and analysis at this level. To address this issue, the data was transformed by taking the first difference to retest for stationarity. The results showed that all factors became stationary at the first difference level, as indicated by the tau-test values exceeding the MacKinnon critical value. This rejection of the null hypothesis occurred at the levels of $\alpha = 0.01$ and $\alpha = 0.05$. Consequently, it can be inferred that all 13 factors are suitable

for constructing a SEM-LCM-VECM model and possess the necessary properties for its application. Furthermore, they are also appropriate for co-integration analysis following the principles of the Johansen and Juselius theories, which can establish their capacity for long-term equilibrium adjustment as below.

4.2. Analysis of Co-Integration

In this part of the analysis, only stationary factors are selected at the same level, Level I (1). Especially in the analysis of co-integration, it adapts the theory of Johansen and Juselius to facilitate the analysis, and the analysis results are shown in Table 2.

From Table 2, it is evident that all factors exhibit cointegration at $\alpha = 0.01$. This is indicated by the trace statistic test values of 215.11 and 101.05, which exceed the MacKinnon critical values. Consequently, the null hypothesis is rejected. Therefore, these factors are used to analyze the error correction mechanism model using the SEM-LCM-VECM model.

4.3. Formation of Analysis and Modeling with the SEM-LCM-VECM Model

The above model has been constructed for the purpose of examining the relationships between economic, social, and environmental factors, aiming to assess the efficiency of state power use in advancing the country towards a green economy. Furthermore, the study investigates how adaptability toward sustainability is manifested. The SEM-LCM-VECM framework is employed to scrutinize the pathways of relationships, the influence of these relationships, and their adaptability towards sustainability. Within this framework, three latent variables, namely economic, social, and environmental, are considered, and a set of observed variables exhibiting appropriate properties at the first difference level across all 13 factors is incorporated into the model. The analytical results are presented as follows:

From Figure 7, it is evident that the latent variables exhibit both direct and indirect effects. The SEM-LCM-VECM model demonstrates high validity and a comprehensive goodness of fit, as indicated by the following statistics: χ^2/df is 1.45, RMSEA is 0.01, RMR is 0.000, GFI is 0.96, AGFI is 0.94, R-squared is 0.92, the F-statistic is 109.01 (with a probability of 0.00), the ARCH test results in 22.05 (with a probability of 0.1), and the LM test yields 1.25 (with a probability of 0.10). Furthermore, the SEM-LCM-VECM model can be effectively utilized for analyzing the use of state power in advancing a green economy. Detailed information regarding the relationship values mentioned above can be found in Table 3.

From Table 3, the results of the SEM-LCM-VECM model analysis indicate that there are no issues related to heteroskedasticity, multicollinearity, or autocorrelation. This suggests that this model is particularly suitable and exhibits white noise characteristics, thus ensuring the validity of using the estimated results for analyzing the efficiency of state power use in promoting the green economy. Furthermore, it proves highly beneficial when employed to assess the impact of various factors, providing insights into which areas the government should support or expedite its use of power to strategize and plan for sustainable national development in the future.

Therefore, the results of the analysis using the SEM-LCM-VECM

Table 1: Stationarity testing results

Tau Test				MacKinnon Critical Value		
Variables	Level I (0) Value	Variables	First Difference I (1) Value	1%	5%	10%
In (*Gdp*)	−4.20	ΔIn (*Gdp*)	−5.45***	−4.75	−3.49	−2.95
In (*Ur*)	−4.59	ΔIn (*Ur*)	−5.01***	−4.75	−3.49	−2.95
In (*Ins*)	−3.23	ΔIn (*Ins*)	−4.79***	−4.75	−3.49	−2.95
In (*Exp−m*)	−-3.72	ΔIn (*Exp−m*)	−5.35***	−4.75	−3.49	−2.95
In (*If*)	−4.52	ΔIn (*If*)	−4.77***	−4.75	−3.49	−2.95
In (*Gb1*)	−3.90	ΔIn (Gdl)	−4.79***	−4.75	−3.49	−2.95
In (*Epm*)	−3.75	ΔIn (*Epm*)	−4.78***	−4.75	−3.49	−2.95
In (*H−i*)	−3.99	ΔIn (*H−i*)	−4.97***	−4.75	−3.49	−2.95
In (*S−s*)	−-3.79	ΔIn (*S−s*)	−4.77***	−4.75	−3.49	−2.95
In (*ecp*)	−3.92	ΔIn (*ecp*)	−4.91***	−4.75	−3.49	−2.95
In (*eEe*)	−3.99	ΔIn (*eEe*)	−5.05***	−4.75	−3.49	−2.95
In (*eEi*)	−3.68	ΔIn (*eEi*)	−5.11***	−4.75	−3.49	−2.95
In (eCo_2)	−4.71	ΔIn (eCO_2)	−5.49***	−4.75	−3.49	−2.95

Gdp is the income, *Ur* is the urbanization rate, *Ins* is the industrial structure, *Exp−m* is the total exports, *If* is the indirect foreign investment, *Gbl* is the expenditure government rate, *Epm* is the employment, *H−i* is the health and illness, *S−s* is the social security, *ecp* is the consumer protection, *eEe* is the total energy consumption, *eEi* is the energy intensity, and eCO_2 is the Carbon Dioxide emission. ***denotes a significance, $\alpha = 0.01$, compared to the Tau test with the MacKinnon Critical Value, Δ is the first difference, and *In* is the natural logarithm

Table 2: Co-integration test

Variables	Hypothesized No. of CE (S)	Trace statistic test	Max-Eigen statistic test	MacKinnon critical value	
				1%	5%
ΔIn (*Gdp*), ΔIn (*Ur*), ΔIn (*Ins*), ΔIn (*Exp−m*), ΔIn (*If*), ΔIn (*Gbl*), ΔIn (*Epm*), ΔIn (*H−i*), ΔIn (*S−s*), ΔIn (*ecp*), ΔIn (*eEe*), ΔIn (*eEi*), ΔIn (eCO_2)	None***	215.11***	110.01***	15.95	12.65
	At Most 1***	101.05***	99.05***	11.05	9.05

***Denotes significance α = 0.01

Figure 7: The relationship analysis result of the structural equation Modeling-Latent change model with vector error correction model

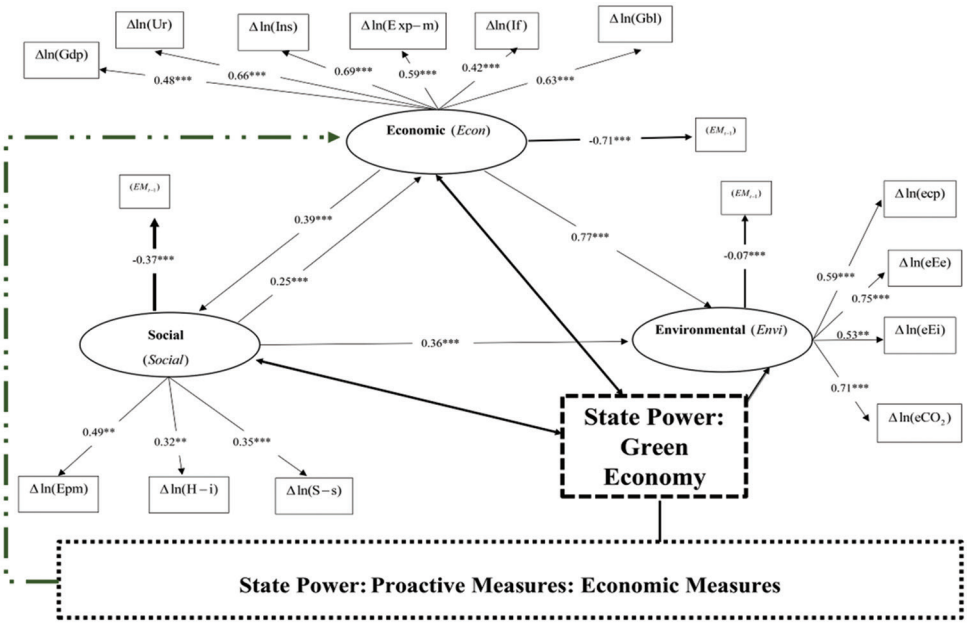


Table 3: Results of relationship size analysis of the SEM-LCM-VECM model

Dependent variables	Type of effect	Independent variables			
		Economic (*Econ*)	Social (*Social*)	Environmental (*Envi*)	Error Correction Mechanism (EM_{t-1})
Economic (*Econ*)	DE	-	0.25***	-	−0.71***
	IE	-	-	-	-
Social (*Social*)	DE	0.39***	-	-	−0.37***
	IE	-	-	-	-
Environmental (*Envi*)	DE	0.77***	0.36***	-	−0.07***
	IE	0.14***	-	-	-

In the above, ***denotes significance $\alpha = 0.01$, DE is direct effect and IE is indirect effect

model can be employed to examine the magnitude of the influence of causal factors, encompassing both direct and indirect effects. It was observed that the economic factor (*Econ*) exhibits the highest direct effect on the environmental factor (*Envi*), with a magnitude of 77% and a significant level of 1%. This indicates that a 1% change in the economic factor (*Econ*), leads to a corresponding 77% change in the environmental factor (*Envi*). Additionally, there is an indirect effect via the social factor (*Social*), which accounts for 14% of the total effect. Furthermore, the economic factor (*Econ*) also has a direct effect on the social factor (*Social*), amounting to 39% with a significant level of 1%. This implies that a 1% change in the economic factor (*Econ*) results in a 39% change in the social factor (*Social*). The social factor (*Social*), in turn, has a direct effect on the environmental factor (*Envi*), constituting 36% of the total effect, with a significant level of 1%. This signifies that a 1% change in the social factor (*Social*) leads to a 36% change in the environmental factor (*Envi*). Importantly, it should be noted that the environmental factor (*Envi*) does not possess the capacity to influence changes in the economic and social factors.

In this study, it has been found that the use of state power to promote the development of a green economy is highly inefficient. This inefficiency is primarily due to the failure to demonstrate simultaneous growth and development in all three sectors. However, when growth occurs, it is primarily concentrated in the economic and social sectors. The economic sector exhibits the most rapid growth rate and the highest adaptability to achieving equilibrium, with a magnitude of 71%. Moreover, it surpasses the established standard by 36%. In addition, the social sector experiences a slightly lower growth rate and a relatively quick adaptability to equilibrium, with a magnitude of 37%. It also slightly exceeds the prescribed standard. On the contrary, the environmental sector lags behind with the slowest growth rate and the slowest adaptability to equilibrium, registering a magnitude of only 7%. This sector falls significantly below the specified standard of 36%. Consequently, the analysis results from this study reveal a substantial lack of efficiency in the use of state power to foster a green economy. It is imperative to urgently seek remedies since the environmental sector's adaptability to equilibrium is remarkably low. Any damage to the ecosystem would result in a lengthy recovery period, more than what various environmental systems can manage. This would significantly impact the population and the nation, particularly concerning climate change, which could have irreversible consequences for Thailand. The quantitative analysis results in this study have provided valuable insights that have led to a clear direction for further qualitative research. This has assisted in the formulation of appropriate country-management strategies. The analysis has shed light on the inefficiency of past state power uses. Consequently, an investigation was conducted using documentary analysis as a research tool to identify new strategies based on these findings. This study has further revealed the necessity of establishing new standards for state power use,

with a primary focus on the economic sector. This emphasis is due to the fact that the economic sector is the single most influential sector, both in terms of direct and indirect effects. Furthermore, it has the ability to adapt to changes and achieve equilibrium more rapidly than other sectors. Importantly, it should not rely heavily on measures from the social sector, as it has a low impact on the environment and limited capacity to adapt to changes, nearly falling below the standard threshold. Therefore, if the government formulates incorrect strategies, it will significantly impact national management and may become irreparable. Consequently, an analysis of proactive economic measures instead of reactive measures that the government has implemented from the past to the present was conducted, yet they were proven to be inefficient. The results of this analysis are as follows:

4.4. Guidelines for Developing Strategies in Transitioning to a Green Economy

The Thai government has long utilized state power to address environmental issues. It has employed legal measures for environmental management through command measures, control measures, and civil measures, although the enforcement of environmental laws has not always been stringent. Legal enforcement plays a crucial role in the protection, prevention, and resolution of environmental issues in Thailand. The environmental laws in Thailand, including the Enhancement and Conservation of the National Environmental Quality Act, B.E. 2535 (1992), and subsequent legislation, are enforced selectively. For instance, the Factory Act, B.E. 2535 (1992), employs commands and controls as primary measures to ensure compliance with the law. Employing civil measures is expected to account for accountability and compensate for damages, while there are other supportive measures to complement law enforcement. Additionally, command and control measures consist of civil measures granting authorities, such as government officials, the power to manage environmental issues. These measures include issuing general or specific orders, exercising authority in administrative work to ensure compliance with the law, and imposing administrative penalties, which are significant measures employed to enforce the law rigorously. Furthermore, criminal measures have been established in Thai law to create a strict compliance environment. Key aspects of criminal measures include the imposition of imprisonment with specified durations and high fines, aimed at deterring violations and ensuring legal compliance. Civil measures have also been introduced to facilitate compensation for damage or indemnity for victims who suffer physical harm or property loss due to environmental misconduct. These measures have made it easier for victims to receive compensation or restitution by imposing strict civil liability.

However, the enforcement of environmental laws through the use of commands and control measures, as well as civil measures, has not been able to ensure strict compliance with the law. This is due to certain limitations and challenges, which can be summarized as follows:

1. Challenges in the execution of administrative measures: The nature of environmental law enforcement involves the expertise and competence of state officials and the readiness of state personnel to closely monitor and inspect compliance with the law. This results in high costs to the state for the execution of state officials' duties.
2. Challenges in criminal law enforcement: States often prefer to resort to high levels of fines and penalties rather than imprisonment, similar to administrative measures. Therefore, relying on inspections to ensure rigorous legal compliance falls short, as there is a lack of sufficient state personnel for this task, leading to the neglect of preventative actions until harm occurs. This does not align with effective environmental management.
3. Challenges in civil law enforcement: Applying strict liability principles in civil enforcement is problematic as the burden of proof rests on the victims to demonstrate that harm resulted from the actions of polluters. This is a challenging burden for victims, as polluters usually possess all the relevant information. Additionally, it requires the involvement of experts to prove the harm. Furthermore, the calculation of damages, often based on the principle of proving actual harm or estimating potential harm, does not align with the interdisciplinary nature of environmental law, which incorporates scientific expertise and relies on specialists to establish harm. Consequently, potential future harm may not be covered, and the researcher argues that the judicial process cannot guarantee clear compensation from polluters.

Therefore, this study has identified a way to address the aforementioned problem, which is to employ economic measures as a means to enhance the efficiency of legal environmental management. The utilization of economic measures for environmental management is rooted in the study of the relationship between the environment and the economic system, highlighting their significant interdependence. Environmental issues arise primarily from economic systems. In other words, the environment functions as a cost within the economic production system, and the environmental system often exceeds its capacity to absorb the waste generated by the economic production process. Consequently, economic tools were proposed to be used as measures for environmental management. These measures will control the economic system, considering the environment as a valuable cost and expenditure and aiming to integrate the environmental value into the production cost, following the Polluter-Pays principle. This approach will lead to more efficient use of the environmental system in terms of both benefits and environmental preservation, thus preventing and mitigating environmental problems from the source. Therefore, the economic measures include:

1) Revenue collection and taxation
2) Incentives and environmental tax rebates
3) Financial enforcement incentive
4) Deposit and refund systems
5) Ownership and market creation systems.

However, it is worth noting that the current utilization of economic measures for environmental management in Thailand, such as tax incentives to promote legal compliance and encourage producers to be environmentally friendly, as well as consumers choosing environmentally friendly products, represents only a fraction of the potential economic measures that can be employed. These measures have been implemented in developed countries and can be further developed and applied in Thailand for ongoing

environmental management improvement.

5. DISCUSSION AND CONCLUSIONS

This study conducted mixed-method research, incorporating both quantitative and qualitative research methods. It developed a model known as SEM-LCM-VECM, which stands for SEM-LCM-VECM, to analyze changes and growth. This model is well-suited for application in national development due to its high analytical quality, comprehensive validity, and absence of analysis-related issues. These factors contribute to the credibility of using the research results for future qualitative studies. From the quantitative research findings, it has been discovered that the government's policy measures from 1990 to 2022 in various legal dimensions, including criminal, civil, and administrative measures, were inefficient. This is evident from the increasing and continuous environmental degradation, which is anticipated to persist in the future. Consequently, the 20-year national development plan implemented by the government failed to promote a green economy. Furthermore, the study indicated that the economic sector has the highest direct and indirect influence on the environmental sector, followed by the social sector. As a result of these quantitative findings, a qualitative analysis was conducted to determine the strategies the government should adopt to transition towards a green economy. The findings revealed that the government's management practices have created various gaps, particularly concerning the use of state power to formulate national policies and strategies for Thailand's development. Two key observations emerged:

1. Lack of clarity in green economy development goals: There is no clear vision or explicit goal for green economic development, both domestically and internationally. A clear vision would encourage active engagement and compliance by the public sector, private sector, and civil society. This stands in contrast to countries like Germany and South Korea, which have diligently pursued such objectives.
2. Disconnection between economic, social, and environmental development: The government's use of state power does not harmonize actions across all three dimensions (economic, social, and environmental). Instead, it places significant emphasis on economic development, striving for continuous income growth, and integrating new innovations. In contrast, social initiatives focus on bridging income gaps among the population and redistributing wealth without a clear strategy for environmental sustainability. The government has not set forth a well-defined plan for environmental sustainability, including the responsible use of natural resources and environmental preservation. However, for the national strategy for the years 2018-2025, and specifically in 2019, the direction for achieving sustainable economic growth through a green economy has been emphasized. It places greater importance on conserving natural resources and the environment than on developing an economic model that can grow alongside environmental preservation. This is distinctly different from countries like Germany, Japan, and South Korea. Moreover, Thailand has found that there is a lack of direct responsibility-bearing agencies for the development of the green economy. There are no clear roles and defined powers, which results in inefficient governance. This differs significantly from South Korea, where dedicated agencies with substantial authority are established for green economy management and report directly to the presidential office. As a result, all organizations must align their operations with green economic policies and development objectives, which contrasts with Thailand's approach of adding green economy initiatives as an afterthought rather than integrating them into primary development goals.
3. Thailand has formulated numerous national strategies, plans, and measures, but clear and coordinated practical measures that are localized and regionalized are still lacking. This differs significantly from South Korea, where central laws mandate that all plans must align with national guidelines, ensuring clear and region-specific implementation plans.
4. The use of state power in promoting and supporting the widespread adoption of the green economy is inadequate. Green growth measures are not established as core policies, unlike Thailand's mainstream economic development policies. While green economy measures are utilized in some local government areas, changes in leadership can lead to discontinuity.
5. There is a lack of public involvement and private sector cooperation due to the absence of collaborative governance in the Thai government's initiatives. It is evident that South Korea employs a top-down approach to governance, while Germany employs a bottom-up approach. These governance styles result in sustainable development and active community involvement, which are currently lacking in Thailand.

For the recommendations arising from this study, it is evident that Thailand should revise its strategic plan to be comprehensive rather than fragmented. Clear objectives and indicators should be established, and they must be explicitly declared in the 20-Year National Strategy. Additionally, the government should invest in large-scale projects related to green economic development to transform production and consumption patterns. The government should address corruption in all sectors and seek cooperation from various stakeholders, including the public, private sector, and international trade organizations. It is imperative to fully integrate green technology into the production process, and the government should ensure the efficiency and effectiveness of fiscal and monetary policies.

The limitation of this research is that Thailand lacks research in the field of green economic development, and the government has not given it due importance or taken decisive actions to make it a pivotal measure for the country. Consequently, the transition towards a green economy in Thailand is extremely challenging. Furthermore, the green economy has not been the primary focus of the government's comprehensive management of the country, which has not been fully and appropriately aligned with this strategy.

6. CONFLICTS OF INTEREST

The authors declare no conflict of interest.

7. REFERENCES

Adeel, S., Zuber, M., Kınık, M., Zor, A., Büyükkol, S., Kahraman, A.D., Ozomay, M., Döl, A., Lehimler, Z., Khattak, S.P. (2016), Green application of isolated colorant from neem bark for mordant-coated wool: Optimization of dyeing and mordanting for shade development. Coatings, 13, 1639.

Ananda, F., Nofrizal, N., Yoswaty, D., Farida, L., Hamidy, R. (2023), Integrating environmentally friendly management of water resources toward ecological and socio-economic sustainability. International Journal of Energy Economics and Policy, 13(3), 73-79.

Al-Bazali, T.A., Al-Zuhair, M.A. (2022), The use of fuzzy logic to assess sustainability of oil and gas resources (R/P): Technical, economic and political perspectives. International Journal of Energy Economics and Policy, 12(1), 449-458.

Bhutta, A.I., Ullah, M.R., Sultan, J., Riaz, A., Sheikh, M.F. (2022), Impact of green energy production, green innovation, financial development on environment quality: A role of country governance in Pakistan. International Journal of Energy Economics and Policy, 12(1), 316-326.

Cheng, C.P., Lin, C.H., Wen, L.C., Chang, T.C. (2022), Determining environmental costs: A challenge in a governmental e-waste recycling scheme. Sustainability, 11, 5156.

Dabeedooal, Y.J., Dindoyal, V., Allam, Z., Jones, D.S. (2019), Smart tourism as a pillar for sustainable urban development: An alternate smart city strategy from Mauritius. Smart Cities, 2, 153-162.

Dally, D., Kurhayadi, K., Rohayati, Y., Kazemian, S. (2020), Personal carbon trading, carbon-knowledge management and their influence on environmental sustainability in Thailand. International Journal of Energy Economics and Policy, 10(6), 609-616.

Department of Alternative Energy Development and Efficiency. Available from: https://www.dede.go.th/ewtadmin/ewt/dede_web/ewt_news.php?nid=47140 [Last accessed on 2021 Jan 05].

Dickey, D.A., Fuller, W.A. (1981), Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49, 1057-1072.

Easton-Gomez, S.C., Mouritz, M., Breadsell, J.K. (2022), Enhancing emotional resilience in the face of climate change adversity: A systematic literature review. Sustainability, 14, 13966.

Enders, W. (2010), Applied Econometrics Time Series; Wiley Series in Probability and Statistics. Tuscaloosa, AL, USA: University of Alabama.

Erna, E., Mutaqin, Z. (2023), Greening public policy: The effects of environmentally friendly regulations, public support, sustainability orientation on green governance. International Journal of Energy Economics and Policy, 13(3), 552-559.

Hargroves, K., James, B., Lane, J., Newman, P. (2023), The role of distributed energy resources and associated business models in the decentralised energy transition: A review. Energies, 16, 4231.

Harvey, A.C. (1989), Forecasting, Structural Time Series Models and the Kalman Filter. Cambridge, UK: Cambridge University Press.

Harymawan, I., Putra, F.K.G., Agni, T.D.K., Kamarudin, K.A. (2020), Sustainability report practices in Indonesia: Context, policy, and readability. International Journal of Energy Economics and Policy, 10(3), 438-443.

Hiremath, M., Viebahn, P., Samadi, S. (2021), An integrated comparative assessment of coal-based carbon capture and storage (CCS) vis-à-vis renewable energies in India's low carbon electricity transition scenarios. Energies, 14, 262.

Johansen, S., Juselius, K. (1990), Maximum likelihood estimation and inference on cointegration with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52, 169-210.

Kasayanond, A., Umam, R., Jermsittiparsert, K. (2019), Environmental sustainability and its growth in Malaysia by elaborating the green economy and environmental efficiency. International Journal of Energy Economics and Policy, 9(5), 465-473.

Keegan, E., Breadsell, J.K. (2021), Food waste and social practices in Australian households. Sustainability, 13, 3377.

Lam, A., Lee, S., Mercure, J.F., Cho, Y., Lin, C.H., Pollitt, H., Chewpreecha, U., Billington, S. (2018), Policies and predictions for a low-carbon transition by 2050 in passenger vehicles in East Asia: Based on an analysis using the E3ME-FTT model. Sustainability, 10, 1612.

MacKinnon, J. (1991), Critical values for cointegration test. In: Engle, R., Granger, C., editors. Long-run Economic Relationships. Oxford, UK: Oxford University Press.

Mahmood, F., Riaz, A., Ateeq, A., Mahmood, S., Riaz, N. (2022), The nexus of human capital, information communication technologies and research and development expenditure in promoting environmental sustainability: Does financial development matter? International Journal of Energy Economics and Policy, 12(3), 497-504.

Malatesta, T., Morrison, G.M., Breadsell, J.K., Eon, C. (2023), A systematic literature review of the interplay between renewable energy systems and occupant practices. Sustainability, 15, 9172.

Mfune, O., Chisola, N.M., Ziba, I. (2016), How can multifunctional agriculture support a transition to a green economy in Africa? Lessons from the COMACO model in Zambia. Agriculture, 6, 48.

National Statistic Office Ministry of Information and Communication Technology. Available from: https://web.nso.go.th/index.htm [Last accessed on 2021 Jan 03].

Newman, P., Davies-Slate, S., Conley, D., Hargroves, K., Mouritz, M. (2021), From TOD to TAC: Why and how transport and urban policy needs to shift to regenerating main road corridors with new transit systems. Urban Science, 5, 52.

Newman, P.W.G. (2023), Net zero in the maelstrom: Professional practice for net zero in a time of turbulent change. Sustainability, 15, 4810.

Nwobu, O.A., Ngwakwe, C., Owolabi, A., Adeyemo, K. (2021), An assessment of sustainability disclosures in oil and gas listed companies in Nigeria. International Journal of Energy Economics and Policy, 11(4), 352-361.

Office of the National Economic and Social Development Council (NESDC). Available from: https://www.nesdb.go.th/nesdb_en/more_news.php?cid=154&filename=index [Last accessed on 2021 Jan 01].

Pattiruhu, J.R. (2020), The impact of budget, accountability mechanisms and renewable energy consumption on environmentally sustainable development: Evidence from Indonesia. International Journal of Energy Economics and Policy, 10(6), 697-703.

Pollution Control Department Ministry of Natural Resources and Environment. Enhancement and Conservation of National Environmental Quality Act, B.E. 2535. Available from: https://www.pcd.go.th/info_serv/reg_envi.html [Last accessed on 2021 Jan 07].

Pollution Control Department Ministry of Natural Resources and Environment. Navigation of Thai Waterways Act, B.E. 2546. Available from: https://www.pcd.go.th/info_serv/reg_envi.html [Last accessed on 2021 Jan 05].

Pollution Control Department Ministry of Natural Resources and Environment. Principle 4: In Order to Achieve Sustainable Development, Environmental Protection Shall Constitute an Integral Part of the Development Process and Cannot be Considered in Isolation from it. Available from: https://infofile.pcd.go.th/law/environmental%20law55_1.pdf?cfid=1741861&cftoken=322 74043 [Last accessed on 2021 Jan 12].

Pramono, A.J., Suwarno, S., Amyar, F., Friska, R. (2023), The effect of environmental management accounting and control system integration on sustainability orientation through sectoral green economy mediation. International Journal of Energy Economics and

Policy, 13(5), 348-354.

Pratama, A., Jaenudin, E., Anas, S. (2022), Environmental, social, governance-sustainability disclosure using international financial reporting sustainability standards S1 in Southeast Asian companies: A preliminary assessment. International Journal of Energy Economics and Policy, 12(6), 456-472.

Premsagar, S., Kenworthy, J.R. (2023), A critical review of the proposed hyperloop (ultra-high-speed rail) project between Mumbai and Pune and its broader implications for sustainable mobility in Indian cities. Future Transportation, 3, 931-969.

Ratmono, D., Darsono, D., Cahyonowati, N., Niza, C.T. (2022), Greenhouse gas emission accounting disclosure, corporate characteristics and governance: An empirical investigation on Indonesian firms. International Journal of Energy Economics and Policy, 12(6), 86-95.

Rizki, A.F., Murwaningsari, E., Sudibyo, Y.A. (2022), Does green supply chain management improve sustainable performance? International Journal of Energy Economics and Policy, 12(6), 323-331.

Sarker, A.H., Bornman, J.F., Marinova, D. (2019), A framework for integrating agriculture in urban sustainability in Australia. Urban Science, 3, 50.

Sezgin, F.H., Tekin Turhan, G., Sart, G., Danilina, M. (2023), Impact of financial development and remittances on educational attainment within the context of sustainable development: A panel evidence from emerging markets. Sustainability, 15, 12322.

Sutthichaimethee, P. (2017), Varimax model to forecast the emission of carbon dioxide from energy consumption in rubber and petroleum industries sectors in Thailand. Journal of Ecological Engineering, 18, 112-117.

Sutthichaimethee, P. (2018), Forecasting economic, social and environmental growth in the sanitary and service sector based on Thailand's sustainable development policy. Journal of Ecological Engineering, 19, 205-210.

Sutthichaimethee, P., Ariyasajjakorn, D. (2017), Forecasting model of GHG emission in manufacturing sectors of Thailand. Journal of Ecological Engineering, 18, 18-24.

Sutthichaimethee, P., Ariyasajjakorn, D. (2017), The revised input-output table to determine total energy content and total greenhouse gas emission factors in Thailand. Journal of Ecological Engineering, 18, 166-170.

Sutthichaimethee, P., Ariyasajjakorn, D. (2018), Forecast of carbon dioxide emissions from energy consumption in industry sectors in Thailand. Environmental and Climate Technologies, 22, 107-117.

Sutthichaimethee, P., Ariyasajjakorn, D.A. (2020), Forecasting model on carrying capacity for government's controlling measure under environmental law in Thailand: Adapting non-recursive autoregression based on the Var-X model. International Journal of Energy Economics and Policy, 10, 645-655.

Sutthichaimethee, P., Chatchorfa, A., Suyaprom, S. (2019), A forecasting model for economic growth and CO_2 emission based on industry 4.0 political policy under the government power: Adapting a second-order autoregressive-SEM. Journal of Open Innovation: Technology, Market, and Complexity, 5, 69.

Sutthichaimethee, P., Kubaha, K. (2018), A relational analysis model of the causal factors influencing CO_2 in Thailand's industrial sector under a sustainability policy adapting the VARIMAX-ECM model. Energies, 11, 1704.

Tasnim, S., Hossain, A., Marinova, D. (2023), How can stories in primary education support sustainable development in Bangladesh? Sustainability, 15, 12620.

Thailand Greenhouse Gas Management Organization (Public Organization). Available from: https://www.tgo.or.th/2015/thai/content.php?s1=7&s2=16&sub3=sub3 [Last accessed on 2021 Jan 10].

The World Bank: Energy Use (Kg of Oil Equivalent Per Capita). Available from: https://data.worldbank.org/indicator/eg.use.pcap.kg.oe [Last accessed on 2021 Jan 01].

United Nations Framework Convention on Climate Change, UNFCCC, Bonn, Germany. (2016), Global progress in environmental law. Environmental Policy and Law, 46, 23-27.

Wilkinson, S., John, M., Morrison, G.M. (2021), Rooftop PV and the renewable energy transition; a review of driving forces and analytical frameworks. Sustainability, 13, 5613.

Wu, P.I., Liou, J.L., Huang, T.K. (2022), Evaluation of benefits and health co-benefits of GHG reduction for Taiwan's industrial sector under a carbon charge in 2023-2030. International Journal of Environmental Research and Public Health, 19, 15385.

Yang, L., Liang, Z., Yao, W., Zhu, H., Zeng, L., Zhao, Z. (2023), What are the impacts of urbanisation on carbon emissions efficiency? Evidence from Western China. Land, 12, 1707.

Yang, Y., Wang, T., Phillips, C.J.C., Shao, Q., Narayan, E., Descovich, K. (2021), Knowledge of, and attitudes towards, live fish transport among aquaculture industry stakeholders in China: A qualitative study. Animals, 11, 2678.

Zaman, A., Caceres Ruiz, A.M., Shooshtarian, S., Ryley, T., Caldera, S., Maqsood, T. (2023), Development of the circular economy design guidelines for the Australian built environment sector. Sustainability, 15, 2500.