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SUSTAINABLE ENTREPRENEURSHIP AND ECONOMIC TRANSFORMATION: A PANEL DATA ANALYSIS OF ASIAN EMERGING MARKETS

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ABSTRACT

The economic transformation of Asian emerging markets depends heavily on sustainable entrepreneurship since rapid industrialization and policy changes are transforming business environments. The research project investigates the effects of sustainable entrepreneurship on economic expansion through eight emerging economies which include India, Indonesia, Vietnam, Thailand, Malaysia, the Philippines, Bangladesh, and Pakistan utilizing data from 2010 to 2025. Through Fixed Effects, Random Effects, and Generalized Method of Moments (GMM) analyses the researchers analyze how entrepreneurial sustainability works together with policy support features and how institutional quality affects GDP growth rates. The Entrepreneurial Sustainability Index demonstrates a significant relationship with GDP growth according to the study results (β = 2.01, p = 0.0047). The statistical analysis showed that Green Startups (β = 0.0003, p = 0.7042) and Policy Support (β = 0.0436, p = 0.6554) were statistically insignificant because policy initiatives need stronger financial incentives and infrastructure to drive economic transformation. Sustainable entrepreneurship growth is notable in Malaysia and Thailand through research findings yet Bangladesh and Pakistan show limitations from institutional and financial obstacles. The results support the requirement of extensive sustainability-based business operations together with strong financial systems and enhanced policy delivery frameworks. Future research must use Difference-in-Differences (DiD) as a quasi-experimental method to establish causal relationships. The study provides essential knowledge that helps policymakers investors and entrepreneurs who want to use sustainable entrepreneurship for enduring economic stability.

KEYWORDS: Sustainable Entrepreneurship, Economic Transformation, Panel Data, Emerging Markets, GDP Growth, Policy Support

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1. INTRODUCTION

Sustainable entrepreneurship serves as a main catalyst for economic change within developing economies and emerging markets. Sustainable entrepreneurship represents the search for business opportunities through combining environmental and social aspects and economic sustainability (Schaltegger & Wagner, 2011) which helps build enduring economic strength. The core principle of sustainable entrepreneurship differs from typical financial-driven entrepreneurship which adopts the Triple Bottom Line (TBL) system of people, planet, and profit to achieve value creation beyond money-oriented results (Elkington & Rowlands, 1999).

Literature establishes a clear connection between entrepreneurship and economic transformation since entrepreneurship acts as a driving force for employment generation technological progress and market development (Ács et al., 2017). Entrepreneurship stands as a vital mechanism in Asian emerging markets to reduce poverty levels while promoting financial accessibility and digital transformation according to Lu, Tsang, and Peng (2008). The potential of sustainable entrepreneurship remains limited because of institutional gaps together with inconsistent policies and funding obstacles (Alon & Rottig, 2013). Sustainable entrepreneurship needs a proper resolution of its current obstacles to achieve economic transformation.

1.2 Problem Statement

The study maintains importance for various stakeholders because it explores sustainable entrepreneurship together with economic transformation processes in Asian emerging markets. Academic research receives expansion through this study by showing empirical proof of how sustainable business models promote economic evolution in underdeveloped economies. The literature gap related to emerging economies receives resolution. The study provides essential recommendations to governments for ecosystem development which helps them implement sustainability-centric business-promoting policies. The study presents actionable findings that assist entrepreneurs and investors in conducting business alignment between sustainability initiatives and sustainable long-term growth objectives. Through its analysis of sustainable entrepreneurship and its market development effects the study demonstrates the complete advantages of environmental stewardship for economic transformation. This study supports the Sustainable Development Goals (SDGs) specifically SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry Innovation and Infrastructure) to demonstrate sustainable business operations create economic development and social welfare improvement (United Nations, 2023).

1.3 Research Objectives

This study aims to fill the research gap by systematically analyzing the impact of sustainable entrepreneurship on economic transformation in Asian emerging markets. The key objectives of the study are:

- To analyze the impact of sustainable entrepreneurship on economic transformation, focusing on employment, innovation, and market diversification.
- To evaluate the role of institutional and financial support mechanisms in promoting sustainable entrepreneurship.
- To provide empirical evidence using panel data analysis across selected Asian emerging markets.

1.4 Significance of the Study

The research findings have value for various stakeholders because they analyze sustainable entrepreneurship and economic transformation in Asian emerging markets. The research academically extends current knowledge by providing factual data about sustainability business models' impact on economic changes while addressing a literature deficiency regarding emerging economies. The study presents important policy guidelines for governments to develop their entrepreneurial environments while promoting sustainable business practices. The study presents actionable guidance that helps business visionaries together with financiers to structure their business frameworks that match sustainable operations with economic development goals. The study demonstrates how sustainability supports innovation and market expansion which enhances the comprehension of sustainable entrepreneurship benefits. The findings from this study support the Sustainable Development Goals particularly SDG 8 (Decent Work and Economic Growth) alongside SDG 9 (Industry Innovation and Infrastructure) which confirm sustainable practices enable economic development alongside social welfare (United Nations, 2023).

2. METHODOLOGY

2.1 Research Design

Sustainable entrepreneurship serves as a fundamental force that drives economic changes in

developing markets as well as emerging markets. Sustainable entrepreneurship represents the search for business opportunities through combining environmental and social aspects and economic sustainability (Schaltegger & Wagner, 2011) which helps build enduring economic strength. Thankfully sustainable entrepreneurships expand beyond monetary advantages to integrate people and planet and profit through the Triple Bottom Line (Elkington & Rowlands, 1999). Literature establishes a clear connection between entrepreneurship and economic transformation since entrepreneurship acts as a driving force for employment generation technological progress and market development (Ács et al., 2017). Entrepreneurship stands as a vital mechanism in Asian emerging markets to reduce poverty levels while promoting financial accessibility and digital transformation according to Lu, Tsang, and Peng (2008). The potential of sustainable entrepreneurship remains limited because of institutional gaps together with inconsistent policies and funding obstacles (Alon & Rottig, 2013). Sustainable entrepreneurship needs a proper resolution of its current obstacles to achieve economic transformation.

The analysis uses panel data from 2010 to 2025 to observe a sufficient period that shows sustainable entrepreneurship development alongside economic transformation. The selected research period provides sufficient time to study both long-term patterns and policy development effects on entrepreneurship ecosystems.

2.2 Data Sources

The study relies on secondary data from globally recognized established sources to ensure both accuracy and reliability and data comparison capability. This data provides vital insights regarding both entrepreneurial performance and the business regulatory environment alongside economic growth factors for observing entrepreneurship's effect on economic transformation. The reports about sustainability and economic development in emerging markets deliver extensive insights regarding the current state of sustainable businesses. The analysis incorporates macroeconomic factors that combine GDP growth rates with inflation rates as well as trade balance results to evaluate economic trends and policy effects. The evaluation gains depth through actionable entrepreneurship measurements and sustainability measurements since they track business environment changes throughout multiple regions. The evaluation of sustainable entrepreneurship development requires analysis of policy frameworks together with infrastructure development and support mechanisms for entrepreneurship to understand financial and institutional interventions. The research relies on multiple authoritative data sources that fulfill the research objectives by using globally recognized and relevant information.

2.3 Selection of Countries

Asian emerging markets were chosen for this research based on three specific evaluation criteria which focus on countries with high entrepreneurial activities and economic growth alongside supportive policies for sustainability businesses. The research focuses on countries where startup activity and small and medium enterprise (SME) growth remain high because such business environments promote entrepreneurial opportunities. The study includes countries with strong economic growth together with major structural changes because these economies provide important evidence about sustainable entrepreneurship's effects on economic development. The analysis adds government initiatives that create supportive structures for sustainable business development because they help environmentally and socially responsible businesses to grow. The analysis uses only countries with ten years or more of consistent panel data because of the need for robust analysis. The research analyzes India, Indonesia, Vietnam, Thailand, Malaysia, the Philippines, Bangladesh, and Pakistan because these countries possess distinct economic systems institutional maturity levels, and sustainable entrepreneurship promotion strategies.

2.4 Variables and Measurement

This study examines the relationship between sustainable entrepreneurship and economic transformation using the following variables:

2.4.1. Dependent Variable: Economic Transformation Indicators

Economic transformation is measured using three key indicators:

- GDP Growth Rate (%) – Measures overall economic expansion (IMF, 2023).
- Employment Rate (%) – Captures the labor market impact of entrepreneurship (World Bank, 2023).
- Innovation Index Score – Reflects technological advancements and business innovation (Global Innovation Index, 2023).

2.4.2. Independent Variables: Sustainable Entrepreneurship Metrics

Sustainable entrepreneurship is assessed through:

- Number of Green Startups – Measures the proportion of businesses adopting environmentally friendly practices (UNDP, 2023).
- Entrepreneurial Sustainability Index (ESI) – A composite measure of the social, environmental, and economic impact of businesses (GEM, 2023).
- Policy Support for Sustainable Enterprises – Evaluates government incentives and regulations promoting sustainability (ADB, 2023).

2.4.3. Control Variables

To ensure the model accounts for external factors affecting economic transformation, the following control variables are included:

- Institutional Quality – Governance and regulatory effectiveness (World Bank Governance Indicators, 2023).
- Infrastructure Development – Availability of logistics, digital connectivity, and utilities (IMF, 2023).
- Foreign Direct Investment (FDI) Inflows – Captures capital investment trends influencing entrepreneurship (UNCTAD, 2023).
- Market Conditions – Business environment and ease of doing business rankings (World Bank, 2023).

2.5 Statistical Methods

To analyze the impact of sustainable entrepreneurship on economic transformation, this study employs advanced panel data econometric techniques:

2.5.1. Panel Data Regression Analysis (Fixed vs. Random Effects)

- A Fixed Effects (FE) model is used to control for country-specific characteristics that do not change over time (Wooldridge, 2019).
- A Random Effects (RE) model is tested using the Hausman Specification Test to determine whether FE or RE is more appropriate for the dataset (Greene, 2020).

2.5.2. Generalized Method of Moments (GMM) for Endogeneity Control

- Given the potential endogeneity problem (i.e., reverse causality between entrepreneurship and economic transformation), the Arellano-Bond GMM Estimator is used for dynamic panel data modeling (Arellano & Bond, 1991).
- GMM helps in eliminating bias from unobserved variables and improving the robustness of the results.

2.5.3. Robustness Checks

To validate the consistency and reliability of the results, the study applies:

- Variance Inflation Factor (VIF) analysis to check for multicollinearity among variables.
- Heteroskedasticity-consistent standard errors to correct for potential heteroskedasticity in panel data.
- Alternative model specifications, such as interaction terms between policy support and sustainable entrepreneurship metrics, to verify the strength of the relationships.

By integrating these rigorous econometric methodologies, this study ensures the findings are robust, reliable, and empirically valid for understanding the role of sustainable entrepreneurship in economic transformation in Asian emerging markets.

3. RESULTS

3.1 Descriptive Statistics

The descriptive analysis of the dataset (2010–2025) highlights key trends in entrepreneurship and economic transformation across India, Indonesia, Vietnam, Thailand, Malaysia, the Philippines, Bangladesh, and Pakistan in Table 1.

- GDP Growth: Average GDP growth across these markets ranged between 3.5% and 6.8%, reflecting economic expansion despite fluctuations.
- Employment Rate: Employment rates varied significantly across markets, with an average of 62.5% and higher employment trends in Vietnam and Indonesia.
- Innovation Index: The Global Innovation Index score averaged around 40.3, with Malaysia and Thailand leading in technological innovation.
- Green Startups: The number of sustainable startups increased over time, particularly in India and Vietnam, where green entrepreneurship initiatives gained traction.
- Policy Support: The effectiveness of government policies promoting sustainable businesses varied, with Malaysia and Thailand scoring higher on policy effectiveness.

TABLE 1: Descriptive Statistics of Key Variables

Variable	Mean	Std Dev	Min	Max
GDP Growth (%)	4.86	0.89	3.2	6.8
Employment Rate (%)	62.5	5.3	50.1	75.4
Innovation Index	40.3	7.1	20.5	59.6
Green Startups	281.1	102.4	50	500
Entrepreneurial Sustainability Index	0.65	0.12	0.4	0.9
Policy Support (1-5 scale)	2.87	0.72	1.0	5.0
FDI Inflows (Billion USD)	5.4	2.1	1.0	9.8
Institutional Quality (0-1 scale)	0.56	0.14	0.3	0.8
Infrastructure Index (0-100 scale)	62.5	8.9	40.3	89.7

3.2 Regression Analysis Findings

The Fixed Effects (FE) and Random Effects (RE) models were used to examine how sustainable entrepreneurship metrics impact GDP growth in Table 2.

3.2.1. Fixed Effects Model

- Entrepreneurial Sustainability Index (β = 2.01, p = 0.0047) – Strongly significant, indicating that countries with higher sustainability-driven businesses experience higher GDP growth.
- Green Startups (β = 0.0003, p = 0.7042) – Statistically insignificant, suggesting that while the number of green startups is increasing, their economic impact is not yet significant. This aligns with prior findings in emerging economies, where scalability remains a challenge (Elkington & Rowlands, 1999).
- Policy Support (β = 0.0436, p = 0.6554) – Not statistically significant, suggesting that policy initiatives alone do not guarantee economic transformation unless backed by financial incentives and market accessibility.
- Employment Rate (β = 0.0010, p = 0.9457) – Insignificant, highlighting that employment improvements do not always translate directly into GDP gains, especially if jobs created are in low-productivity sectors.

TABLE 2: Fixed Effects Regression Results

Variable	Coefficient (β)	Std. Error	t-Statistic	P-Value	95% CI Lower	95% CI Upper
Intercept	4.5536	1.365	3.335	0.001	1.8498	7.2575
Entrepreneurial Sustainability Index	2.0100	0.698	2.880	0.0047	0.6277	3.3900
Green Startups	0.0003	0.0009	0.381	0.7042	-0.0014	0.0020
Policy Support	0.0436	0.0975	0.447	0.6554	-0.1494	0.2366
Employment Rate	0.0010	0.0145	0.068	0.9457	-0.0277	0.0297

3.2.2. Comparison with Random Effects Model

- The Entrepreneurial Sustainability Index remains a strong predictor of economic transformation across both FE and RE models in Table 3.
- Green startups and policy support have mixed effects, reinforcing the idea that entrepreneurial impact depends on scalability and institutional factors.
- Institutional Quality and Infrastructure were positively correlated with GDP growth, confirming that strong institutions and infrastructure improve the sustainability of entrepreneurship.

TABLE 3: Full Random Effects Regression Results

Variable	Coefficient	Std. Error	t-Statistic	P-Value	95% CI Lower	95% CI Upper
Intercept	4.4782	1.290	3.472	0.001	1.9705	6.9859
Green Startups	0.0004	0.0008	0.490	0.685	-0.0012	0.0022
Entrepreneurial Sustainability Index	1.8976	0.672	2.823	0.005	0.5802	3.2150
Policy Support	0.0384	0.0893	0.430	0.672	-0.1365	0.2133
Employment Rate	0.0008	0.0139	0.058	0.951	-0.0272	0.0288

3.3 Sector-Wise Analysis

3.3.1. Technology-Based Enterprises

- Found in India, Malaysia, and Indonesia, tech startups contribute significantly to economic transformation, particularly in fintech, ed-tech, and AI-driven solutions.
- The Innovation Index was highly correlated with economic performance in these countries,

reinforcing the role of technological entrepreneurship in sustainable growth.

3.3.2. Green Enterprises

- Vietnam and Thailand lead in green startups, but economic gains from these ventures are delayed due to scalability challenges.
- Access to financing and regulatory barriers were noted as key constraints.

3.3.3. Social Businesses

- More prominent in Bangladesh and the Philippines, where microfinance-backed social enterprises help improve employment and income generation.
- While employment rates are high, the GDP impact remains marginal, indicating that scaling remains a challenge.

3.4 Cross-Country Comparative Insights

3.4.1. Cross-Country Categorization Based on Data-Driven Clustering

The cross-country analysis classified countries into three categories based on the Entrepreneurial Sustainability Index, Policy Support, and GDP Growth in Table 4.

TABLE 4: Cross-country analysis classified countries

Country	GDP Growth (%)	Sustainability Index	Policy Support	Category
Malaysia	4.84	0.71	3.07	Strong Sustainable Entrepreneurship Growth
Thailand	5.12	0.74	3.12	Strong Sustainable Entrepreneurship Growth
India	4.90	0.62	2.35	Moderate Growth
Indonesia	4.58	0.70	2.38	Moderate Growth
Vietnam	4.79	0.68	2.55	Moderate Growth
Philippines	4.70	0.65	2.60	Moderate Growth
Bangladesh	4.41	0.62	2.92	Challenges in Sustainable Growth
Pakistan	5.53	0.70	2.76	Challenges in Sustainable Growth

Countries with Strong Sustainable Entrepreneurship Growth: Malaysia and Thailand have high policy effectiveness and strong institutional frameworks, leading to higher entrepreneurial success rates.

Countries with Moderate Growth: India, Indonesia, Vietnam, and the Philippines have moderate policy support and sustainability scores, indicating potential for growth but requiring stronger financial and infrastructure support.

Countries Facing Challenges: Bangladesh and Pakistan struggle due to lower institutional quality and infrastructure limitations, affecting their ability to fully leverage sustainable entrepreneurship for economic transformation.

The results indicate that policy effectiveness is not just about having sustainability frameworks in place but ensuring their proper execution (OECD, 2022). Countries with higher institutional quality tend to see better entrepreneurial outcomes, even if direct policy support is statistically weak.

4. DISCUSSION

The research analyzed sustainable entrepreneurship effects on economic transformation in Asian emerging markets through Fixed Effects and Random Effects and Generalized Method of Moments (GMM) panel data regression analysis. The research demonstrates that sustainability metrics in entrepreneurship drive substantial economic changes yet policy backing and green startup activities show different effects between nations and industries.

The Entrepreneurial Sustainability Index stands as a robust indicator ($\beta = 2.01$, $p = 0.0047$) that explains GDP growth because countries embracing sustainability-based business ventures demonstrate higher economic development. Sustainable entrepreneurship benefits economic durability because it promotes innovation and environmental preservation while creating social value (Elkington & Rowlands, 1999; Schaltegger & Wagner, 2011). Emerging market experts have acknowledged how sustainable entrepreneurship creates more work opportunities while advancing technological development as well as bringing in Foreign Direct Investment (FDI) (Alon & Rottig, 2013).

Green startup growth has shown no significant economic impact according to statistical analysis ($\beta = 0.0003$, $p = 0.7042$). The findings match previous studies about green businesses in emerging markets that experience difficulties with market penetration scalability and financial sustainability (Bocken et al., 2014). The results demonstrate a necessity to develop robust financial and policy frameworks that will boost green startups' ability to drive economic transformation (Hall et al., 2010).

The presence of policy frameworks alone fails to produce significant effects on GDP growth as indicated by the Policy Support variable ($\beta = 0.0436$, $p = 0.6554$). The literature indicates policy

effectiveness requires proper execution of regulations as well as financial resources and ease of business procedures (Acs et al., 2017; OECD, 2022). The results show particular importance for emerging markets because policy implementation gaps frequently reduce the expected benefits of entrepreneurial support initiatives (Lu, Tsang & Peng, 2008).

The policy effectiveness demonstrated by Malaysia and Thailand proved stronger yet their economic outcomes became visible only when institutional stability and financial access were present. According to the World Bank's (2023) Global Entrepreneurship Report governments demonstrating robust governance structures with strong institutional qualities report enhanced entrepreneurial performance.

The sustainable development of entrepreneurship together with its economic transformation depends mainly on institutional quality alongside infrastructure development. Empirical findings confirm earlier research which demonstrates how business owners in emerging markets must overcome institutional gaps as well as bureaucratic challenges and regulatory uncertainties during their push for sustainable business expansion (Alon & Rottig, 2013).

The research indicates that institutions with better quality and infrastructure spending (such as Malaysia and Thailand) achieve greater economic benefits through entrepreneurial activities. The United Nations Development Program (UNDP, 2023) confirms a well-developed institutional framework enables efficient business operations through improved investor trust which leads to economic growth (UNDP, 2023).

The study identifies several obstacles that prevent sustainable enterprises from achieving their full potential since sustainable startups and social businesses face difficulties in securing funding. Kuckertz & Wagner (2010) support the notion that financial constraints prevent sustainable ventures from expanding and competing effectively in emerging markets. The weak statistical evidence shows that financial barriers limit the ability of green startups to contribute to GDP growth. The research discovered that although green startup numbers are expanding their influence on economic transformation stays constrained. Research by Bocken et al. (2014) supports the notion that green and social businesses need sustainable financial models to create significant impact (2014). The economic performance of technology-based sustainable enterprises in India, Indonesia, and Malaysia exceeds other sustainable enterprises according to Global Innovation Index data (2023). Most emerging markets have policy frameworks but their implementation effectiveness differs substantially between them. Bangladesh and Pakistan face economic challenges because their regulatory systems are inefficient and their institutions lack support which reduces sustainable entrepreneurship benefits. Previous research confirmed that successful sustainable entrepreneurship requires policy support together with financial stimuli digital technology development and educational programs (OECD, 2022).

This research expands knowledge about sustainable entrepreneurship and economic transformation through the combination of Resource-Based View (RBV) and Triple Bottom Line Approach and Institutional Theory. The research outcome confirms that entrepreneurial success in emerging markets requires both individual business strategies and supportive institutional environments and financial ecosystems (Schaltegger & Wagner, 2011). The research demonstrates that sustainability-driven entrepreneurship requires alignment with economic policy development and infrastructure growth (Hall et al., 2010). This research demonstrates how entrepreneurship affects different geographic zones and industry groups so it reveals intricate connections between sustainable practices and effective policy development and economic change processes.

Sustainable businesses require better access to capital which governments and financial institutions should provide through grant programs low-interest loans and tax incentives. The implementation of such measures would enable green startups to expand their operations and deliver greater economic transformation results (Alon & Rottig, 2013). Governments should direct their efforts toward better implementation of current regulations instead of devoting all resources to policy development. The OECD (2022) recommends that governments should simplify administrative procedures while fighting corruption and strengthening their support for businesses. Successful entrepreneurs find their base where institutions have a strong infrastructure that delivers reliable performance and digital networks provide connectivity. The World Bank (2023) advocates for governmental institutions to invest their resources toward enhancing transportation systems and implementing digitalization platforms alongside energy-efficient solutions for business

growth expansion. Technology-based sustainable businesses possess superior scalability capabilities when compared to conventional green companies according to the research. Government leaders should use their power to promote innovation centers as well as research alliances and efficient digital sustainability methods to speed up economic growth (Global Innovation Index, 2023).

5. CONCLUSION

The research establishes empirical findings about sustainable entrepreneurship's economic transformation effects in Asian emerging markets during 2010–2025 through panel data regression models (Fixed Effects, Random Effects, and GMM estimations). The research shows sustainability-based entrepreneurship boosts GDP performance although governments need to strengthen policy measures and promote the growth of green startup businesses. The Entrepreneurial Sustainability Index ($\beta = 2.01$, $p = 0.0047$) showed statistical significance by proving that nations with robust sustainability-based businesses achieve greater economic expansion. The analysis showed that Green Startups demonstrated no statistical significance ($\beta = 0.0003$, $p = 0.7042$) because their economic impact is restricted by scalability issues. The analysis confirmed that Policy Support showed no statistical significance ($\beta = 0.0436$, $p = 0.6554$) indicating policy measures need financial and infrastructure support to be effective. The analysis showed that Malaysia and Thailand maintain efficient policy implementation together with high institutional quality but Bangladesh and Pakistan face strong barriers from regulatory inefficiencies and financial limitations. The research underlines that economic advantages from sustainable entrepreneurship demand better financial accessibility and increased infrastructure expenditure together with proper policy implementation. Future research needs to use Difference-in-Differences (DiD) and natural experiments as quasi-experimental methods to establish causal relationships. Economic sustainability through sustainable entrepreneurship depends heavily on solving scalability problems while making financial resources accessible and improving institutional reforms to maintain long-term economic growth in developing markets.

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