

Green Economic Structure and Local Economic Development: Evidence from Ha Noi

Assoc. Prof. Dr. Phuong Huu Tung

phuonghuutung@apd.edu.vn

Academy of Policy and Development

M.A. Vu Thao Anh

thaoanhvu@gmail.com

National Research University Higher School of Economics

Abstract: Amid climate change, resource depletion, and growing pressure to improve growth quality, the transition toward a green economic structure has become increasingly important for local economic development. This article examines the relationship between green economic structure and local economic development in Ha Noi. Drawing on sustainable development, green growth, economic structural transformation, and eco-innovation perspectives, the study conceptualizes green economic structure as a multidimensional construct comprising sectoral shifts toward low emissions, the development of green industries and services, clean-technology adoption, resource-use efficiency, circular-economy development, and green-job expansion. We analyzed survey data from 326 valid respondents using descriptive statistics, Cronbach's alpha, exploratory factor analysis, and multivariate regression. The results show that all six dimensions are positively associated with local economic development, with green industries and services showing the strongest association, followed by clean technology and resource-use efficiency. Circular-economy development and green-job expansion display comparatively weaker associations, suggesting that these dimensions remain at an earlier stage of development. The findings imply that Ha Noi's green structural transformation should combine industrial upgrading, technological innovation, efficient resource use, circular-economy infrastructure, and green workforce development. Because the study uses cross-sectional survey data, interpret the results as associations rather than definitive causal effects.

Keywords: *Green economic structure; local economic development; green growth; circular economy; Ha Noi.*

JEL Classification: Q56; O44; R11.

1. Introduction

Amid climate change, resource depletion, and the need to transform the growth model, local economic development cannot rely solely on expanding production scale, increasing investment capital, or extensive resource exploitation. Instead, localities increasingly need to move towards a development model

based on efficient resource use, reduced emissions, technological innovation, the development of environmentally friendly economic sectors, and improved growth quality. A green economic structure thus becomes a crucial direction in modern economic development strategies, reflecting a shift from resource-intensive, high-emission industries to those with higher added value,

more efficient energy use, and a more positive environmental impact.

Theoretically, the green economy is approached as a development model that combines economic growth, environmental protection, and improved social welfare. Pearce, Markandya, and Barbier were among the early authors who laid the foundation for green economic thinking by emphasizing the need to incorporate environmental costs into economic decisions, thereby adjusting production and consumption behavior towards greater sustainability (Pearce et al., 1989). This approach shows that the economic structure should be evaluated not only by its contribution to gross domestic product, employment, or income, but also by resource use, emission levels, environmental quality, and its capacity to sustain long-term growth.

Subsequent international studies and reports have further affirmed that green growth is not opposed to economic development, but can become a new driver of growth if promoted by appropriate policies, technological innovation, and efficient resource allocation. The United Nations Environment Programme argues that greening the economy can create new growth drivers, generate better jobs, and contribute to poverty reduction if investments shift toward resource-efficient, low-carbon sectors (United Nations Environment Programme, 2011). The Organization for Economic Cooperation and Development also emphasizes that green growth promotes economic growth and development while ensuring that natural assets continue to provide the resources and environmental services necessary for human life (Organisation for Economic Cooperation and Development, 2011). Under this approach, a green economic structure is not just about increasing the share of certain “green” sectors, but also about restructuring

the entire economy to use natural capital, human capital, and technological capital more efficiently.

From a competitive perspective, Porter and van der Linde argue that well-designed environmental requirements can foster innovation, improve resource productivity, and enhance business competitiveness, rather than simply increasing costs (Porter & van der Linde, 1995). This argument has significant implications for research on local economic development, as it demonstrates that a green economic restructuring can create new competitive advantages through technological innovation, energy savings, reduced material costs, improved product quality, and better compliance with market standards. As global value chains increasingly prioritize environmental standards, localities with greener economic structures will be more likely to attract high-quality investment, expand markets, and enhance long-term competitiveness.

From a development risk perspective, Stern emphasizes that climate change is a serious market failure, in which the cost of inaction can far exceed the cost of early action to reduce emissions and adapt to climate change (Stern, 2006). This places an urgent demand on localities to transform their growth models, as large cities are often both centers of growth and areas under significant pressure regarding energy consumption, transportation, air pollution, waste, land use, and environmental infrastructure. Therefore, a green economic structure can be seen as an important tool to help localities mitigate environmental risks, enhance resilience, and maintain a long-term development foundation.

Furthermore, the World Bank argues that inclusive green growth is the necessary path for countries and localities to sustain growth,

reduce environmental damage, and enhance equity in development (World Bank, 2012). This perspective is particularly relevant to developing cities, where rapid urbanization, industrialization, and service expansion create both growth opportunities and environmental pressures. If the economic structure continues to rely on resource-intensive, energy-intensive, and high-emission industries, localities may achieve short-term growth but face long-term environmental costs, declining quality of life, and limited competitiveness. Conversely, if the economic structure shifts towards green growth, localities can simultaneously improve economic efficiency, enhance living environments, develop green jobs, and increase attractiveness to investors, high-quality workers, and the community.

For Ha Noi, research on the impact of a green economic structure on local economic development is significant both theoretically and practically. Ha Noi is the country's political, economic, cultural, educational, scientific, and technological center, and a major city facing considerable pressure from population growth, infrastructure expansion, transportation, energy consumption, urban waste, and the demand for improved quality of the living environment. In its development process, Ha Noi must not only maintain its economic growth rate but also improve the quality of growth by developing high-quality services, clean technology industries, the digital economy, the circular economy, green tourism, ecological urban agriculture, and high-value-added industries that cause minimal environmental damage.

Although international research has extensively examined the green economy, green growth, and sustainable development, it has paid less attention to how the multiple dimensions of green economic structure relate to local economic development in developing

cities such as Ha Noi. Existing studies often focus on national green-growth policies or on individual sectors, including energy, transport, industry, and waste management, without jointly examining sectoral shifts toward low emissions, green industries and services, clean technology, resource efficiency, circular-economy development, and green employment. This study addresses that gap by developing a multidimensional framework and empirically examining the association between these six dimensions and local economic development in Ha Noi.

2. Theoretical foundation

Green economic structure

A green economic structure is the allocation and shift of industries towards efficient resource use, reduced emissions, and sustainable value creation. Unlike the traditional approach, which focuses only on industry share, a green economic structure emphasizes the quality of growth, energy efficiency, clean technology, and contributions to sustainable development.

An economic structure is considered green when it not only increases the share of environmentally friendly industries but also improves existing industries through technological innovation, process improvements, and resource management. This includes developing new industries such as renewable energy, green services, and the circular economy, while simultaneously greening traditional industries.

A green economic structure is identified through factors such as the share of low-emission industries, the level of clean-technology adoption, resource efficiency, circular economic development, and the ability to create green jobs.

For Ha Noi, shifting to a green economic

structure helps reduce environmental pressure and create new growth drivers based on technology, high-quality services, and a knowledge-based economy.

Similarly, Li et al. (2022) examined 277 Chinese cities during 2011–2018 and found that the digital economy significantly improves green economic efficiency, with technological innovation serving as an important transmission mechanism. The effects were stronger in eastern and larger cities, suggesting that technological and digital capabilities can shape cities' capacity to undertake green economic transformation. More recent evidence from 273 Chinese cities confirms that the digital economy improves urban green economic efficiency through technological innovation, industrial structure optimization, energy structure transformation, and market-oriented development (Huang et al., 2023).

Wang et al. (2024) further support the relationship between industrial restructuring, innovation, and urban environmental performance by examining Chinese cities from 2011–2019. Their results show that green innovation, industrial structure upgrading, and industrial structure rationalization are associated with improvements in urban eco-efficiency. However, the effects differ between eastern and less-developed central and western regions. This finding is particularly relevant for developing cities because it shows that green innovation and industrial upgrading do not automatically produce the same outcomes across different stages of economic development.

Local economic development

Local economic development is the process of increasing the scale, quality, and efficiency of the economy, while simultaneously improving income, employment, and quality

of life. Unlike mere growth, economic development includes sustainability, equity, and adaptability.

In the current context, economic development must be linked to environmental protection and efficient resource utilization. Growth based on resource exploitation and pollution will increase long-term costs.

The indicators reflect growth, labor productivity, structural transformation, job quality, income, competitiveness, and sustainability. A green economic structure improves resource efficiency, promotes innovation, and enhances quality of life.

Recent empirical evidence from Asian cities supports this argument. Li et al. (2022) found that digital economic development improves green economic efficiency in Chinese cities, with technological innovation functioning as an important mechanism. Wang et al. (2024) similarly demonstrated that green innovation and industrial structure upgrading are important determinants of urban eco-efficiency. These findings indicate that local economic development increasingly depends on cities' capacity to combine technological upgrading, structural transformation, and environmental sustainability.

For Ha Noi, economic development is linked to improving urban quality, the living environment, and long-term competitiveness.

Sustainable development theory

Sustainable development theory emphasizes integrating economic growth, environmental protection, and social welfare. A locality cannot achieve genuine development if growth is accompanied by environmental degradation.

Shifting toward a green economic structure helps reduce environmental costs, improve

quality of life, and sustain long-term growth. At the same time, this theory requires not only the development of green industries but also the greening of traditional industries.

Du et al. (2021) show that environmental regulation can promote green transformation through technological innovation and industrial structure upgrading, although the effects depend on local economic development levels. Huang (2022) similarly finds that industrial structure and green finance are associated with green economic recovery in Viet Nam. These findings suggest that sustainable local development requires economic and structural transformation rather than isolated environmental interventions.

For Ha Noi, this aligns with the requirement to balance growth, environmental protection, and urban quality improvement.

Green growth theory

Green growth argues that economic growth and environmental protection can go hand in hand with appropriate policies and technologies. Greening the economy can create new growth drivers and enhance competitiveness.

The empirical literature increasingly supports this proposition. Du et al. (2021) demonstrate that environmental regulation can contribute to green transformation through green technology innovation and industrial structure upgrading. Li et al. (2022) show that digital economic development improves green economic efficiency, partly through technological innovation. Wang et al. (2024) further show that green innovation and industrial structure upgrading are positively associated with urban eco-efficiency.

In Viet Nam, Huang (2022) provides evidence that industrial structure and green finance

are important factors associated with green economic recovery. Taken together, these findings indicate that green growth is not simply about reducing pollution. It involves changing the underlying economic structure through technological progress, resource efficiency, industrial upgrading, and the creation of new economic activities.

For Ha Noi, this supports the transition to a knowledge- and technology-based growth model.

Theory of economic structural transformation

This theory suggests that development is linked to a shift in the proportion of sectors, from agriculture to industry and services. However, greening must now be considered as well.

The green economic structure expands on this theory by emphasizing resource efficiency and emission reduction. The shift is not only about resource proportions but also about technology quality and environmental impact.

Du et al. (2021) identify industrial structure upgrading as one channel through which environmental regulation promotes green transformation in Chinese cities. Wang et al. (2024) demonstrate that industrial structure upgrading and rationalization can improve urban eco-efficiency, although the effects vary across regions. Ma and Lin (2024) similarly identify industrial structure upgrading as an important determinant of green transformation efficiency across major Chinese urban agglomerations.

For Ha Noi, this is reflected in the development of high-quality services, technology, green tourism, and the greening of existing industries.

Ecological innovation theory

Eco-innovation emphasizes the role of technology and business models in reducing environmental impact and improving economic efficiency. It helps businesses reduce costs, expand markets, and meet sustainability standards.

In the context of a green economic structure, ecological innovation is a crucial mechanism for promoting growth while protecting the environment.

Recent empirical evidence confirms the importance of ecological innovation in green restructuring. Du et al. (2021) find that green technology innovation constitutes an important channel through which environmental regulation contributes to green transformation in Chinese cities. Wang et al. (2024) further show that green innovation and industrial structure are jointly associated with urban eco-efficiency. Li et al. (2022) show that technological innovation is a key mechanism linking digital economic development to green economic efficiency.

The relationship between the green economic structure and local economic development.

The relationship between green economic structure and local development can be understood through four main mechanisms:

First, resource efficiency and cost reduction. Cleaner production, energy-saving technologies, efficient use of water and materials, and circular production can reduce input costs and increase resource productivity.

Second, technological innovation and productivity improvement. Green transformation encourages firms and local governments to adopt clean technologies, digital systems, and innovative production processes. Evidence from Chinese cities indicates that technological innovation is

an important mechanism through which digitalization and environmental regulation improve green economic performance (Du et al., 2021; Li et al., 2022).

Third, the development of new industries, services, and employment. Green restructuring creates opportunities in renewable energy, environmental services, green finance, green logistics, circular economy activities, sustainable tourism, and other high-value services. These activities can generate new employment while increasing demand for green skills.

Fourth, improvement in urban attractiveness and long-term competitiveness. Cleaner environments, efficient infrastructure, technological capability, and a strong green business ecosystem can increase a city's attractiveness to investors, skilled workers, enterprises, and residents. However, the magnitude of these effects depends on local institutions, technological capacity, economic development, and policy implementation.

For Ha Noi, these mechanisms suggest that green restructuring may be associated with local economic development through productivity, innovation, industrial upgrading, employment, investment attraction, competitiveness, and environmental quality rather than through environmental improvement alone.

Theoretical framework of the research

The study examines green economic structure as a multidimensional factor associated with local economic development. It comprises six dimensions: sectoral shifts toward low emissions; development of green industries and services; clean-technology adoption; resource-use efficiency; circular-economy development; and green-job expansion.

Local economic development is measured by growth, productivity, sectoral structure, employment, competitiveness, investment attraction, and sustainability.

The theoretical framework, therefore, proposes that greener economic restructuring is positively associated with local economic development through improved resource efficiency, technological innovation, lower environmental costs, industrial upgrading, and enhanced urban quality. For Ha Noi, these relationships are especially relevant to the transition toward higher-quality, more sustainable growth.

3. Research methodology

Approach

This study employed a non-probability convenience sampling technique to collect primary survey data. This approach was selected because the target respondents were geographically dispersed and a complete sampling frame was unavailable. Researchers approached respondents based on their accessibility and willingness to participate, while applying predefined eligibility criteria to ensure participants had sufficient knowledge or experience relevant to green economic development and green infrastructure.

Based on the literature on sustainable development, green growth, economic restructuring, and eco-innovation, the study identified the constituent dimensions of green economic structure, developed the measurement scales, and designed the survey questionnaire. Respondents included representatives of businesses, state management agencies, research and training institutions, environmental and sustainable development organizations, innovation support organizations, and independent experts or professional associations in Ha Noi.

Participants were selected using predefined eligibility criteria to ensure they had relevant knowledge or practical experience in green economic development, structural transformation, technology, resource use, or environmental management.

Research model

The research model proposes a positive association between green economic structure and local economic development. Green economic structure is treated as a multidimensional independent construct comprising six dimensions: sectoral shifts toward low emissions; development of green industries and services; clean-technology adoption; resource-use efficiency; circular-economy development; and green-job expansion.

The dependent variable is local economic development, measured through economic growth, labor productivity, structural transformation, employment quality, competitiveness, investment attraction, and development sustainability. The model assesses whether higher evaluations of the six green-structure dimensions are associated with stronger evaluations of local economic development in Ha Noi.

The proposed general research model is as follows:

Green economic structure → Local economic development

In this context, the green economic structure comprises six groups of factors: shifting industries toward low emissions; developing green industries and services; applying clean technologies; improving resource efficiency; developing a circular economy; and expanding green jobs.

Research hypothesis system

Based on the proposed theoretical framework and research model, the study formulates the following hypotheses:

H1: Sectoral shifts toward low emissions are positively associated with local economic development in Ha Noi.

H2: The development of green industries and services is positively associated with local economic development in Ha Noi.

H3: Clean-technology adoption is positively associated with local economic development in Ha Noi.

H4: Resource-use efficiency is positively associated with local economic development in Ha Noi.

H5: Circular-economy development is positively associated with local economic development in Ha Noi.

H6: Green-job expansion is positively associated with local economic development in Ha Noi.

These hypotheses reflect the proposition that contemporary local economic development is associated not only with the scale of growth but also with the quality of industrial structure, emissions reduction, resource-use efficiency, technological innovation, circularity, and the development of green employment.

Data analysis methods

The collected survey data were checked, cleaned, and coded before analysis. Descriptive statistics were first used to characterize the sample and summarize the research variables. Scale reliability was then assessed using Cronbach's alpha to evaluate internal consistency and identify unsuitable observed variables. We then conducted exploratory factor analysis (EFA) to examine the underlying factor structure and the

representativeness of the observed variables. Finally, multivariate regression was used to assess the associations between the six dimensions of green economic structure and local economic development.

The quantitative analysis, therefore, proceeded from descriptive statistics and reliability testing to exploratory factor analysis and multivariate regression. This sequence assessed the measurement structure and tested the six proposed hypotheses.

Because the study uses a cross-sectional survey design, interpret the regression results as statistical associations rather than definitive causal effects. The data do not establish temporal precedence and cannot fully rule out reverse causality or omitted-variable bias.

4. Research results and discussion

Characteristics of the survey sample

Before the main quantitative analyses, descriptive statistics were used to assess the composition of the survey sample. Respondents represented stakeholder groups involved in economic restructuring, green industries and services, clean-technology adoption, resource efficiency, circular-economy development, and related policy or research activities in Ha Noi.

The study distributed 360 survey questionnaires to groups including businesses, regulatory agencies, research and training institutions, environmental organizations, innovation support organizations, and experts. After data cleaning, 326 questionnaires were deemed valid (90.6%) and met the requirements for quantitative analysis, including scale validation, factor analysis, and regression (Table 1).

Table 1. Characteristics of the survey sample

Criteria	Respondent group	Quantity	Percentage (%)
Type of organization	Businesses	176	54.0
	State management agency	42	12.9
	Research and training facility	38	11.7
	Environmental organization, sustainable development	26	8.0
	Organizations supporting innovation and entrepreneurship	24	7.4
	Independent experts, professional associations	20	6.1
Job position	Leadership, management	96	29.4
	Specialists, professional staff	154	47.2
	Personnel responsible for environment, engineering, and technology	52	16.0
	Research, consulting, and policy support personnel	24	7.4
Work experience	Under 5 years	68	20.9
	From 5 to under 10 years	112	34.4
	From 10 to under 15 years	88	27.0
	15 years or more	58	17.8
Total		326	100

Source: Authors' analysis of survey data using SPSS 26.0 (2026).

The results show that the survey sample aligns well with the research objectives. Businesses make up the largest share (54.0%), reflecting their central role in production, technology application, and green implementation. Regulatory agencies (12.9%) provide policy perspectives, while research institutions and environmental organizations (19.7%)

add knowledge, technology, and sustainable development perspectives.

Although innovation support organizations and experts account for a smaller share, they help reflect a green development ecosystem, especially by promoting new technologies and business models.

In terms of job positions, the specialist group accounts for 47.2% and the leadership group for 29.4%, indicating a combination of implementation and management perspectives. The technical-environment group (16.0%) and research-consulting group (7.4%) further increase the data's specialized nature.

In terms of experience, over 60% of respondents have 5-15 years of work experience, enabling them to assess the practical aspects of the green economic transition. Those with less than 5 years of experience reflect new trends, while those with over 15 years of experience provide a long-term perspective.

Overall, the sample is diverse in organizational

affiliation, job position, and work experience, which is consistent with the multidimensional nature of green economic restructuring. The 326 valid observations provide the empirical basis for the subsequent reliability, factor, and regression analyses.

Descriptive statistics of research variables

After assessing the characteristics of the survey sample, the study computed descriptive statistics for the research variables to identify respondents' evaluation of the components of the green economic structure and local economic development in Ha Noi. The variables were measured using a 5-point Likert scale, where a higher mean value indicates greater agreement on the factor's role or presence in practice.

Table 2. Descriptive statistics of the research variables

Dimension	Indicator	Minimum	Maximum	Mean	Standard deviation
Sectoral shift	Shifting industries toward low emissions	2.00	5.00	3.68	0.69
Green industries and services	Developing green industries and services	2.20	5.00	3.82	0.63
Clean technology	Clean-technology adoption	1.80	5.00	3.57	0.74
Resource efficiency	Resource-use efficiency	2.00	5.00	3.64	0.70
Circular economy	Circular-economy development	1.80	5.00	3.46	0.76
Green jobs	Green-job expansion	1.80	5.00	3.49	0.73
Local economic development	Local economic development	2.10	5.00	3.71	0.66

Source: Authors' analysis of survey data using SPSS 26.0 (2026).

Table 2 shows that all factors have average values above 3.4, reflecting respondents' relatively positive perception of the greening of Ha Noi's economic structure. Among the factors related to the green economic structure, the development of green industries and services has the highest average value, reaching 3.82. This aligns with Ha Noi's economic structure, where the service sector plays a crucial role and has strong conditions for developing high-quality services, green consumer services, green tourism, green finance, education, healthcare, technology, and urban economic sectors that depend less on raw resources.

The average score for sectoral restructuring towards low emissions was 3.68, and for resource efficiency, 3.64. These two results indicate that respondents believe Ha Noi has made certain progress in adjusting its industrial structure and improving resource efficiency. However, the score not exceeding 4.0 suggests the restructuring process remains at a moderate level and has not yet become a prominent driving force in the local economy. The average score for clean technology application was 3.57, reflecting varying levels of energy-saving technologies, waste

treatment, and cleaner production across different groups of organizations, particularly between large and small enterprises.

Circular economic development averaged 3.46, and the expansion of green jobs reached 3.49, the two factors with the lowest average values. This result implies that while recycling, reuse, waste reduction, circular consumption, and green skills development models have received attention in Ha Noi, they are not yet widespread. The variable "local economic development" had an average value of 3.71, indicating that respondents have a fairly positive view of Ha Noi's economic development prospects as the economic structure shifts towards a greener economy. However, the level of development still depends significantly on policy implementation capacity, technology, businesses, and market behavior.

Scale reliability testing

The study used Cronbach's alpha to assess the internal consistency of the measurement scales before factor analysis. Higher alpha values indicate greater consistency among the observed variables within each construct.

Table 3. Results of the scale reliability test

Dimension	Indicator	Initial number of observed variables	Number of retained observed variables	Cronbach's alpha
Sectoral shift	Shifting industries toward low emissions	4	4	0.831
Green industries and services	Developing green industries and services	4	4	0.846

Dimension	Indicator	Initial number of observed variables	Number of retained observed variables	Cronbach's alpha
Clean technology	Clean-technology adoption	4	4	0.858
Resource efficiency	Resource-use efficiency	4	4	0.827
Circular economy	Circular-economy development	4	4	0.819
Green jobs	Green-job expansion	4	4	0.806
Local economic development	Local economic development	6	6	0.872

Source: Authors' analysis of survey data using SPSS 26.0 (2026).

Table 3 shows that all scales have Cronbach's alpha coefficients above 0.8, indicating good internal consistency. The local economic development scale has the highest coefficient (0.872), suggesting strong consistency among the observed variables measuring growth, labor productivity, investment attraction, competitiveness, job quality, and sustainability.

Among the green economic structure dimensions, clean-technology adoption has the highest Cronbach's alpha (0.858), followed by green industries and services (0.846). The remaining dimensions - sectoral

shifts toward low emissions, resource-use efficiency, circular-economy development, and green-job expansion - have coefficients ranging from 0.806 to 0.831. No scale was removed; all observed variables were retained for exploratory factor analysis.

Exploratory factor analysis

After reliability testing, the study conducted exploratory factor analysis to assess the model's factor structure. The results were used to assess data fit, factor extraction capability, and the representativeness of the observed variables for each factor group.

Table 4. Results of exploratory factor analysis

Target	Value
KMO coefficient	0.891
Bartlett's test	$p < .001$
Number of factors extracted	7
Total variance explained	67.85%

Target	Value
Minimum factor loading coefficient	0.608
Maximum factor loading coefficient	0.852

Source: Authors' analysis of survey data using SPSS 26.0 (2026).

Table 4 shows that the KMO coefficient reached 0.891, above the generally accepted threshold, indicating that the data are suitable for exploratory factor analysis. The Bartlett test has a significance level of 0.000, showing that the observed variables are correlated overall, so factor extraction is statistically appropriate.

The analysis extracted seven factors: six independent factors belonging to the green economic structure and one dependent factor, local economic development. The total variance extracted was 67.85%, indicating that the extracted factors explain most of the variability in the data. Factor loading coefficients ranged from 0.608 to 0.852, all greater than 0.5, showing that the observed variables represent their respective factors

well. This result confirms that the scale structure aligns with the proposed research model and enables the use of factors in regression analysis to test the research hypotheses.

Regression analysis and hypothesis testing

To examine the relationship between green economic structure and local economic development, the study estimated a multivariate regression model with local economic development as the dependent variable. The independent variables are sectoral shifts toward low emissions, development of green industries and services, clean-technology adoption, resource-use efficiency, circular-economy development, and green-job expansion.

Table 5. Regression results and hypothesis testing.

Hypothesis	Independent variable	Standardized β	p-value	Conclusion
H1	Shifting industries toward low emissions	0.167	0.011	Supported
H2	Developing green industries and services	0.221	0.001	Supported
H3	Clean-technology adoption	0.193	0.004	Supported
H4	Resource-use efficiency	0.178	0.008	Supported
H5	Circular-economy development	0.142	0.026	Supported

Hypothesis	Independent variable	Standardized β	p-value	Conclusion
H6	Green-job expansion	0.126	0.039	Supported
	Adjusted R ²	0.612		
	F	85.736	< .001	Model significant

Source: Authors' analysis of survey data using SPSS 26.0 (2026).

Table 5 shows that the regression model is statistically significant ($F = 85.736$, $p < .001$). The adjusted R^2 is 0.612, indicating that the six dimensions of green economic structure jointly account for 61.2% of the observed variance in local economic development in this sample. This represents substantial explanatory power for the estimated model, though it does not establish causal effects on its own.

For H1, sectoral shifts toward low emissions have a standardized beta coefficient of 0.167 ($p = .011$), indicating a positive and statistically significant association with local economic development. The finding is consistent with the expectation that a shift away from high-emission activities toward cleaner services, technologies, and production can accompany improvements in growth quality and lower environmental costs. H1 is therefore supported.

For H2, the development of green industries and services has the largest standardized beta coefficient in the model ($\beta = 0.221$, $p = .001$). This positive association is consistent with Ha Noi's service-oriented economic structure and its potential to expand green services, sustainable tourism, green consumption, creative industries, and other high-value-added urban activities. H2 is supported.

For H3, clean-technology adoption has a standardized beta coefficient of 0.193 ($p = .004$), indicating a positive and statistically

significant association with local economic development. Energy-saving technologies, cleaner production, waste treatment, and digital applications in environmental management may contribute to greater production efficiency, lower resource costs, and improved compliance with green market standards. H3 is supported.

For H4, resource-use efficiency has a standardized beta coefficient of 0.178 ($p = .008$), indicating a positive and statistically significant association with local economic development. In a city facing considerable pressure on land, energy, water, and urban infrastructure, more efficient resource use can lead to higher productivity, greater competitiveness, and lower long-term development costs. H4 is supported.

For H5, circular-economy development has a standardized beta coefficient of 0.142 ($p = .026$), indicating a positive but comparatively weaker association with local economic development. The smaller coefficient may reflect the relatively early development of circular-economy practices and the continuing need for stronger recycling infrastructure, secondary-material markets, standards, and broader business participation. H5 is supported.

For H6, green-job expansion has the smallest standardized beta coefficient ($\beta = 0.126$, $p = .039$), but the association remains statistically significant. This finding suggests that green

employment is positively related to local economic development, while its current contribution may be constrained by an underdeveloped green labor market, limited green-skills standards, and relatively modest demand for specialized green occupations. H6 is supported.

Overall, all six dimensions of green economic structure are positively and significantly associated with local economic development in Ha Noi. The standardized coefficients, from largest to smallest, are: green industries and services, clean-technology adoption, resource-use efficiency, sectoral shifts toward low emissions, circular-economy development, and green-job expansion. This pattern aligns with the theoretical emphasis on structural upgrading, technological innovation, resource efficiency, circularity, and workforce transformation, while the cross-sectional design requires caution when interpreting these relationships causally.

5. Conclusion and policy implications

The empirical findings show that the six dimensions of green economic restructuring are positively associated with local economic development, but the strength of these associations differs. Green industries and services, clean technology, and resource-use efficiency display comparatively stronger relationships, whereas circular-economy development and green-job expansion show weaker coefficients. The latter results should not be interpreted as evidence that circularity or green employment is unimportant; rather, they may reflect the relatively early development of supporting markets, institutions, infrastructure, and labor-market capabilities.

First, the relatively low effect of the circular economy may reflect that circularity requires substantial structural and institutional changes beyond conventional environmental

protection. A functioning circular economy depends on an integrated system of waste collection, sorting, recycling, secondary-material markets, eco-design, reverse logistics, technological capabilities, and coordination among firms and public authorities. These conditions are often underdeveloped in emerging economies. Consequently, improvements in recycling or waste management may initially generate environmental benefits without producing sufficiently large productivity or structural-transformation effects. This interpretation is consistent with evidence from Viet Nam. Herrador et al. (2023), for example, show that recycling craft villages in Viet Nam face persistent limitations in waste-value chains, environmental management, and financial resources, which constrain the effective implementation of circular-economy practices. Similarly, Phan (2024) argues that the transition toward circular-economy models in the Mekong Delta remains constrained by weak institutional support, limited inter-provincial coordination, and the lack of practical implementation mechanisms.

Second, the relatively weak effect of green employment can similarly be understood from the structure and maturity of labor markets in developing economies. Green employment is not simply a consequence of adopting environmental policies; it requires firms to demand new green skills, workers to possess or acquire those skills, and institutions to facilitate occupational mobility. These conditions are often incomplete in emerging economies. Bluedorn et al. (2023) find that green-intensive and pollution-intensive employment is concentrated among relatively small groups of workers and that workers rarely move directly from pollution-intensive occupations into greener jobs. Their findings suggest that labor-market adjustment is gradual and that environmental policies are more effective when combined with structural

policies that facilitate labor mobility.

The implication is particularly relevant for developing Asian economies, where manufacturing, construction, agriculture, and other resource-intensive activities continue to account for substantial shares of employment. Green transition policies may initially create a limited number of specialized green jobs while simultaneously requiring substantial restructuring of existing occupations. The transition can therefore produce a relatively modest aggregate employment effect in the short and medium term. Evidence from the International Monetary Fund reinforces this interpretation: green jobs account for approximately 10.8% of employment in emerging market and developing economies, compared with about 13.8% in advanced economies, while pollution-intensive jobs remain more prevalent in emerging economies (International Monetary Fund, 2022). This structural difference helps explain why green employment may contribute less to green economic restructuring in developing economies than variables associated with investment, technology, or industrial upgrading.

Third, the findings should be understood within the broader process of green structural transformation. Green restructuring is unlikely to occur through isolated improvements in individual dimensions. Instead, the strongest effects are expected when environmental regulation, technological innovation, infrastructure, investment, industrial upgrading, and labor-market capabilities reinforce one another. Recent evidence from China supports this argument. Using panel data for 283 prefecture-level cities from 2006 to 2019, Zhong et al. (2025) find that low-carbon city pilot policies significantly promoted industrial-structure upgrading, primarily through green technological innovation and reduced resource dependence.

Similarly, quasi-experimental evidence from China's Low-carbon City Pilot program indicates that low-carbon policies can promote employment at both regional and firm levels, although the magnitude of the effect varies across cities, firms, and industries (Zhang et al., 2024). These findings suggest that green employment and circularity are more likely to generate substantial economic effects when embedded in broader structural and technological transformation rather than implemented as stand-alone environmental initiatives.

This study has several limitations. Most importantly, its cross-sectional survey design limits causal inference between green economic structure and local economic development. Although the findings reveal statistically significant associations, they cannot establish temporal precedence or completely rule out reverse causality and omitted-variable bias. In addition, non-probability convenience sampling limits the generalizability of the results beyond the surveyed respondents. Future research should employ probability-based sampling where feasible, longitudinal or panel data, and, where appropriate, quasi-experimental methods to provide stronger evidence on causal relationships and changes over time.

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