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PROMOTING OR HINDERING: THE RELATIONSHIP BETWEEN INDUSTRIALIZATION, URBANIZATION, AND HUMAN DEVELOPMENT IN VIETNAM

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ABSTRACT

Background: *Human beings are the ultimate beneficiaries of the achievements of economic activities. This study employs Wavelet analysis to investigate the relationship between industrialization, urbanization, and human development, measured by the Human Development Index (HDI, in Vietnam across both the time and frequency domains over the period 1986-2023. The results of the Wavelet Coherence analysis show that industrialization is strongly correlated with HDI at high-frequency scales, while the correlation becomes stronger at low-frequency scales, indicating a stronger long-run relationship, whereas urbanization exhibits a strong correlation across all time-frequency domains. The Partial Wavelet Coherence (PWC) analysis indicates that urbanization has a negligible effect on the relationship between HDI and industrialization, while the inclusion of industrialization strengthens the relationship between HDI and urbanization. The Multiple Wavelet Coherence (MWC) analysis further reveals that the relationship among HDI, industrialization, and urbanization is complementary. These insights into the interactions among the three variables across the time and frequency domains contribute to the theoretical foundation and provide empirical evidence for economic policymaking.*

Keywords: Human development; Industrialization; Urbanization; Vietnam.
JEL Codes: *C32, O14, R38*
Paper type: Research article

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INTRODUCTION

In 2000, with the commitment of 189 member states, the United Nations adopted the Millennium Declaration on human development, comprising eight goals that placed people at the center of development, building on the achievements of economic growth, reducing inequality, and pursuing sustainable development. Vietnam has made substantial progress in eradicating extreme poverty; however, its Human Development Index (HDI) reached only 0.766 in 2023. Although this figure was higher than the global average of 0.756, it remained relatively modest compared with neighboring countries such as China (0.797) and Singapore (0.946). This situation highlights the need for a comprehensive understanding of the factors that may influence human development in Vietnam. Among these factors, industrialization and urbanization have emerged as two of the most influential macroeconomic variables.

Industrialization (IND) refers to the fundamental and comprehensive transformation of production, business, service, and socio-economic management activities from the use of manual labor toward the use of labor combined with modern technologies, means, and methods, based on industrial development and advances in

science and technology (UNIDO, 2024). The relationship between industrialization and human development has attracted considerable attention from researchers because of its intertwined positive and negative effects. Szirmai (2012) pointed out that industrialization generates substantial benefits, including economies of scale, more consistent product quality, and higher labor productivity. Moreover, participation in the industrial sector requires workers not only to acquire basic skills but also to continuously engage in retraining and self-development, thereby enhancing their capabilities. However, Abbasi et al. (2021) argued that a more comprehensive assessment is needed, as industrialization can also generate considerable negative externalities, including waste, resource depletion, and environmental pollution. From a welfare perspective, when these adverse effects are deducted from the benefits, the contribution of industrialization to human development may be less substantial than commonly expected (Venkatraja, 2023).

Urbanization (URB) refers to the process whereby people increasingly concentrate in urban areas in search of employment opportunities and better access to social services, including healthcare and education (Pugh, 1995). Agglomeration theory suggests that when individuals and organizations interact within an environment populated by others who possess greater capabilities or expertise, they face greater competitive pressure but also gain opportunities to share knowledge, establish supply-chain linkages, reduce transportation costs, and maximize their own capabilities. Bildirici and Kayikçi (2024) identified a paradox in this process: urbanization promotes economic growth and HDI in the long run, but in the short run, it can generate environmental pollution and place additional pressure on public health.

The interactions between industrialization, urbanization, and human development have been examined in previous studies; however, several fundamental aspects of these relationships remain insufficiently understood. One such aspect concerns the interaction between the IND-HDI and URB-HDI pairs within the same time-frequency space, as well as the phase differences between these variables, which have not yet been adequately addressed. In other words, previous studies have not clearly identified which variable plays the role of the leading variable and which acts as the lagging variable. Furthermore, across the entire study period, it remains unclear during which periods the relationships between these pairs of variables are strong or weak. Given that industrialization and urbanization are increasingly regarded as “irreversible” trends, investigating the in-phase and out-of-phase dynamics between these pairs of variables can provide valuable policy implications for policymakers, particularly in Vietnam.

Literature review

Lewis's Dual-Sector Theory (Lewis, 1954) is regarded as a “foundational” theory for understanding the relationship between industrialization (IND) and human development (HDI). According to the theory, there is a clear tendency for labor to shift from the agricultural sector to the industrial sector, while economic growth is regarded as a key pillar of human development. Industrial production requires workers to undergo training and retraining; therefore, they need to invest in education and improve their skills and capabilities before and during this transition. Drawing on the theory of learning by doing, Arrow (1962) argued that people learned most effectively through their daily work. Industrial production requires concentration, precision, labor

intensity, and well-defined processes; therefore, participation in industrial production enables workers to develop their overall capabilities more comprehensively than in other sectors.

Agglomeration theory originated from Marshall's (1920) work and was later developed by Krugman (1991). According to this theory, when economic agents, including firms, workers, and suppliers, cluster within the same geographic area, the resulting concentration of economic activities, such as urban areas or industrial clusters, creates an "industrial atmosphere" in which knowledge, managerial experience, and ideas can be more easily disseminated among relevant actors. Agglomeration economies can generate three main benefits. First, they provide economies of scale and specialization. When economic agents are located close to one another, they create a larger consumer market, reduce transportation costs, and lower transaction costs associated with intermediaries. Second, they generate positive externalities, particularly through the sharing of a common labor market, which enables firms to optimize wage and compensation costs while facilitating labor mobility and cooperation during periods of peak production. Third, they generate linkage effects. Agglomeration economies create forward linkages with customers and backward linkages with suppliers. Through these interactions, firms can observe and learn from their partners about management practices and production organization, while also keeping up with the latest technological advances (Brueckner, 2011).

The Human Development Index (HDI) is calculated based on three dimensions: a long and healthy life, knowledge, and a decent standard of living. These dimensions are measured by life expectancy at birth, mean years of schooling and expected years of schooling, and gross national income (GNI) per capita, respectively (United Nations Development Programme, 2024). Empirical studies have primarily examined the effects of industrialization on the component indicators of HDI. Specifically, Li et al. (2025) employed a fixed-effects model to examine the impact of digital industrialization on green development across 31 Chinese provinces from 2008 to 2022. They found that digital industrialization significantly promoted green development through industrial structure upgrading, technological innovation, and financial decentralization, while also contributing to energy conservation, pollution reduction, and higher enterprise productivity. Chen (2025) argued that the long-term effects of environmental pollution on human capital were substantial. Using a difference-in-differences approach, the study found that early-life exposure to industrialization-related air pollution reduced children's learning ability. Specifically, increasing exposure from the 25th to the 75th percentile reduced children's years of schooling in China by 0.11 years. Fang et al. (2026) emphasized that China's industrialization campaign also generated positive effects when it reached less-developed inland regions. They found that industrialization significantly increased human capital accumulation in the long run. These effects were driven largely by improved access to education and healthcare, income effects, and the stronger positive effects of educational benefits relative to the negative effects of opportunity costs. Further analysis by Fang et al. (2026) suggested that children with greater exposure to industrialization were better integrated into the labor market, had lower fertility rates, and had smaller family sizes in adulthood.

Earlier, in *The Future of Industrialization: Building Future-ready Industries to Turn Challenges into Sustainable Solutions*, UNIDO (2024) argued that industrialization was essential for human development

because it promoted productivity, created employment opportunities, with each manufacturing job generating more than two additional jobs in other sectors, and reduced poverty. However, when industrialization was not sustainable, it could harm both people and the planet through pollution and resource depletion. By 2050, if governments failed to take practical action, approximately 450 million people would still live below the poverty line, with the majority concentrated in Africa. Earlier, Szirmai (2012) argued that industrialization was a "growth engine"; however, its effects differed between developed and developing countries. Ghosh and Paul (2024) developed and proposed a Sustainable Development Index (SDI) and examined the effects of industrialization on the SDI in developing countries in Asia and Europe from 1990 to 2022. Results from a dynamic panel estimation showed that industrialization had a positive long-run effect on the SDI, with a stronger effect in Asian countries, but a negative short-run effect. For European countries, Popescu et al. (2024) found that a 1% increase in industrial development increased the under-five mortality rate by 0.065%, while investment in education and healthcare helped offset these adverse effects.

In Vietnam, Ngô Thái Hưng et al. (2023) employed Wavelet analysis and found a positive bidirectional relationship between technological infrastructure, renewable energy, and improvements in human development in Vietnam. They suggested that investment in technological innovation should be prioritized in the government's economic development policies. Subsequently, Bùi Hoàng Ngọc (2024) and Bùi Hoàng Ngọc and Bùi Vũ Quỳnh Anh (2024) also argued that pursuing rapid, scale-driven economic growth could involve a trade-off between the well-being of the Vietnamese population and the quality of the living environment.

The evidence regarding the relationship between urbanization and human development remains mixed. Using life expectancy as a measure of the human development dimension, Ahmad et al. (2023) found that urbanization and income inequality reduced life expectancy among both men and women in South Asian countries, whereas healthcare expenditure had the opposite effect. In contrast, Wang et al. (2022) showed that urbanization had heterogeneous effects on reducing carbon intensity of human well-being (CIWB). More specifically, urbanization reduced CIWB in countries with low and moderate urbanization rates, whereas CIWB continued to increase in highly urbanized countries. Zhong and Chen (2022) classified urbanization into three dimensions: economic urbanization, social-service urbanization, and population urbanization. Their findings showed substantial regional differences in the well-being of residents across 28 provinces in China. Specifically, economic urbanization and social-service urbanization significantly enhanced residents' well-being, whereas population urbanization had the opposite effect. Social-service urbanization played a stronger role in improving well-being in eastern regions and cities of China, while economic urbanization had a more pronounced effect on residents in central and western regions and rural areas. From another perspective, both Bildirici and Kayikçi (2024) and Popescu et al. (2024) found that urbanization was a major driver of environmental degradation, including soil, water, air, and noise pollution, and exacerbated mortality among children aged 0-5 years, thereby hindering human development in the long run.

Overall, the relationship among human development, industrialization, and urbanization remains inconclusive. This lack of consensus demonstrates that findings from previous studies cannot simply be

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generalized to the Vietnamese context. In addition, fluctuations across the time and frequency domains, as well as the in-phase and out-of-phase relationships among these pairs of variables, remain insufficiently understood. These constitute the research gaps that the present study seeks to address.

METHODOLOGY

The human development variable is represented by the Human Development Index (HDI), which is calculated and published by the United Nations. The index ranges from 0 to 1, with higher values indicating higher levels of human development. Industrialization is measured by the share of industrial value added in GDP, while urbanization is measured by the proportion of the population living in urban areas. These two indicators are obtained from World Bank data (World Bank, 2026), while HDI data are obtained from the United Nations Development Programme (2024). The study covers the period from 1986 to 2023, corresponding to the latest year for which annual HDI data were available at the time of data collection To increase the number of observations for the application of Wavelet analysis, this study employs the Quadratic Match-Sum method to transform the annual data into quarterly data. Since the same interpolation method is applied to all variables, the temporal variation of the variables is preserved (Hung & Hieu, 2022).

Wavelet methodology was proposed in the mid-1980s (Goupillaud et al., 1984) and provided new insights into the relationships between variables at different time scales and frequencies. One of the advantages of wavelet analysis is its ability to provide a more comprehensive understanding of the relationships between variables, signifying short-, medium-, and long-term relationships. That means it extracts localized information in both the time and frequency domains, and therefore, it captures whether the interactions are negative or positive and which variable is leading or lagging at different time scales or frequencies (Olayeni, 2015). Moreover, it can be utilized to explore latent processes of evolving cyclic patterns, trends, and non-stationarity of economic variables in time series data analysis (Hung & Hieu, 2022). There are two techniques in Wavelet analysis, namely the Continuous Wavelet Transform and Wavelet Coherence.

In the first step, the Continuous Wavelet Transform (CWT) is employed to decompose the concerned series into wavelets, including time domains and frequency domains (see Figure 1).

The CWT of a given time series *x(t)* can be specified as follows:

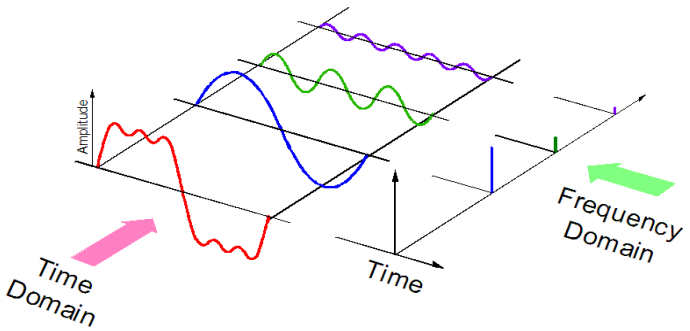


Figure 1. Time domain and frequency domain of a time series variable

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$$W_x(s) = \int_{-\infty}^{\infty} x(t) \frac{1}{\sqrt{s}} \psi^* \left(\frac{t}{s} \right) dt \qquad \text{(Equation 1)}$$

where * denotes the complex conjugate, while $\psi^* \left(\frac{t}{s} \right)$ reveals the complex conjugate function of $\psi \left(\frac{t}{s} \right)$, namely the so-called basis Wavelet function. And, *s* is the wavelet scale that controls how the mother wavelet is stretched.

Based on Equation 1, Torrence and Webster (1999) suggested that the Cross Wavelet Transform of two series *x(t)* and *y(t)* can be given as follows:

$$W_n^{XY}(u,s) = W_n^X(u,s) W_n^{Y*}(u,s) \qquad \text{(Equation 2)}$$

where, *u* present the positions. Therefore, the equation of the wavelet coherence can be given as:

$$R_n^2(u,s) = \frac{\left| S\left(s^{-1} W_n^{XY}(u,s) \right) \right|^2}{S\left(s^{-1} |W_X(u,s)|^2 \right) S\left(s^{-1} |W_Y(u,s)|^2 \right)} \qquad \text{(Equation 3)}$$

where, *S* connotes the smoothing process for time and frequency simultaneously, and *s* are scales. Torrence and Webster (1999) suggested that the 2- to 8-month scale represents the short-run horizon. Similarly, 8 to 32 months refers to the medium-term horizon, and the period above 32 months demonstrates the long-run horizon. Since Equation 3 is squared, Torrence and Webster (1999) proposed the technique of phase difference mechanism between *x(t)* and *y(t)* series to capture the causal association between positive or negative dependence. The equation of the phase difference can be specified as:

$$\phi_{XY}(u,s) = \tan^{-1} \left(\frac{\Im\{S(s^{-1} W_{XY}(u,s))\}}{\Re\{S(s^{-1} W_{XY}(u,s))\}} \right) \qquad \text{.....(Equation 4)}$$

where, $\Im$ and $\Re$ are the imaginary and real parts of the smooth power spectrum, respectively. The arrows indicate the direction of causality and correlation. Two time series will move simultaneously at a certain frequency when their phase difference is zero. If $\phi_{XY}(u,s) \in [-\pi/2; 0]$ and $\phi_{XY}(u,s) \in [0; \pi/2]$, then the two series are in phase. On the other hand, if $\phi_{XY}(u,s) \in [-\pi; \pi/2] \cup [-\pi/2; \pi]$, then the two series are anti-phase. The arrows point to the right (left), which means the correlation is positive (negative), and the arrows point down (up) by 90°, presenting the second (first) variable leading the first (second) variable (Grinsted et al., 2004).

In practice, an economic variable (Y) may be influenced by multiple other economic variables (X_1, X_2, …). Therefore, Hu and Si (2016) proposed two additional techniques: Partial Wavelet Coherence (PWC) and Multiple Wavelet Coherence (MWC). The PWC technique allows the effect of a third data series, $x_2(t)$, to be controlled for when examining the relationship between the series *y(t)* and $x_1(t)$, and is calculated using the following equation:

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$$RP^2(y,x_1,x_2)=\frac{\left|R(y,x_1)-R(y,x_2)R(y,x_1)^*\right|^2}{\left[1-R(y,x_2)\right]^2\left[1-R(y,x_2)\right]^2} \quad \text{(Equation 5)}$$

In contrast, the MWC technique allows the simultaneous effects of both $x_1(t)$ and $x_2(t)$ on the data series $y(t)$ to be analyzed according to the following equation:

$$RM^2(y,x_1,x_2)=\frac{R^2(y,x_1)+R^2(y,x_2)-2\,\mathrm{Re}[R(y,x_1)*R(y,x_2)*R(x_2,x_1)]}{1-R^2(x_2,x_1)} \quad \text{(Equation 6)}$$

A major advantage of the Wavelet framework is that it does not require a fixed structure for variable pairs, nor does it require the variables to be stationary or linear. In addition, compared with conventional estimation methods, Wavelet analysis allows the variations in two variables to be examined simultaneously across both the time and frequency domains and identifies changes in the relationships between variables across specific time periods (Grinsted et al., 2004). Given these advantages, the findings obtained from Wavelet techniques regarding the relationships among industrialization, urbanization, and human development in Vietnam provide important scientific evidence for formulating human development strategies in Vietnam.

Empirical results

Descriptive statistics

Human development has been a central priority throughout the development policies of the Vietnamese Government. However, Vietnam's low initial level of development and several structural constraints within the economy have limited its ability to make substantial progress in the global ranking of countries with high HDI scores. According to a report by the United Nations Development Programme (UNDP), in 2023, Vietnam ranked 93rd out of 193 countries and territories in terms of the HDI. Although the country achieved remarkable progress, with its HDI increasing from 0.499 in 1990 to 0.766 in 2023, its inequality-adjusted HDI stood at only 0.641. More concerningly, HDI growth has shown signs of stagnation in many regions of the world, including Vietnam (United Nations Development Programme, 2024). Amid growing global uncertainty, industrialization, together with advances in artificial intelligence, should be carefully considered as a means of reinvigorating human development and opening up new pathways and opportunities. Table 1 presents the descriptive statistics of HDI, IND, and URB over the study period.

Table 1. Descriptive statistics

Variable	Mean	Standard Dev.	Minimum	Maximum
HDI	0.62	0.08	0.45	0.76
IND	33.59	4.98	22.67	40.20
URB	27.83	6.28	19.62	39.48

Source: Authors' calculations, 2026

Cross-Wavelet Transform (CWT) Results

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Following the guidelines of Grinsted et al. (2004), the study first divided the frequency domain into wavelet scales (s = 2, 4, 8, 16, 32, ...). Smaller values of s (s = 2-4) corresponded to higher-frequency domains, reflecting short-term effects, while s = 4-8 and s = 8-16 represented medium- and long-term effects, respectively. The color spectrum in Figure 2 illustrated the CWT results, with colors indicating different levels of correlation strength according to the color scale. Figure 2 showed that, at higher-frequency domains (short-term), the correlations between the variable pairs (HDI-IND) and (HDI-URB) were both strong, as indicated by the red areas. At medium- and lower-frequency domains, the correlation between HDI and IND weakened, as indicated by the transition toward yellow-orange and green areas. The correlation between HDI and URB also weakened, but to a lesser extent.

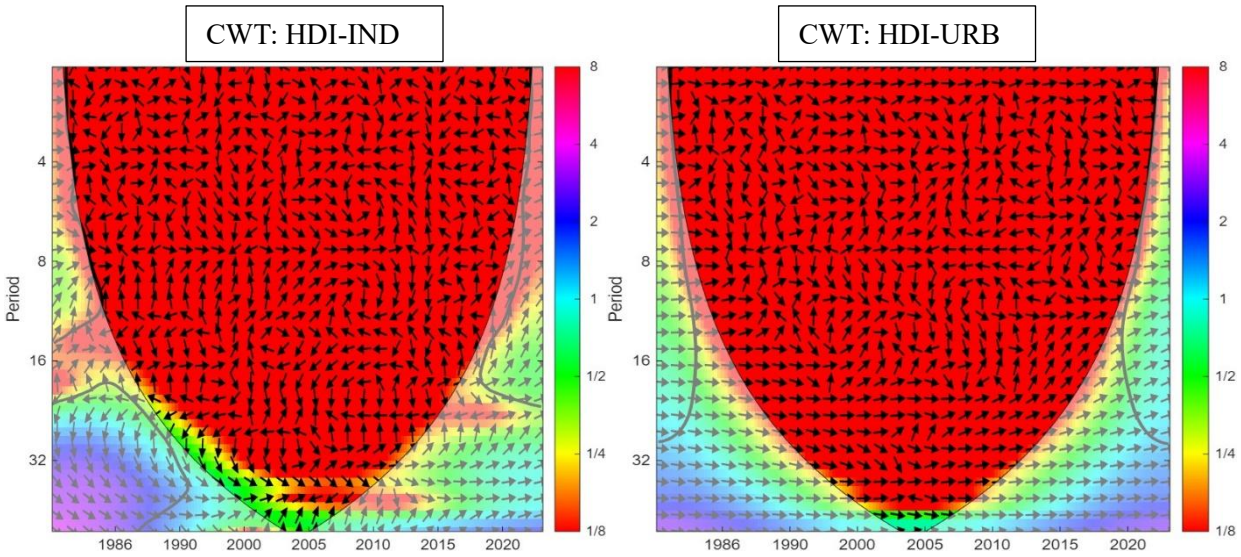


Figure 2. CWT results for the HDI-Industrialization and HDI-Urbanization

Note: The thick black contour shows the 5% significance level against red noise estimated from Monte Carlo simulation using phase randomized surrogate series, and the cone of influence where edge effects may distort the picture is indicated outside of the black line. The color code for power ranges from blue (low) to yellow (high). The Y-axis represents frequencies, and the X-axis measures the period.

Wavelet Coherence (XWT) Results

The Wavelet Coherence analysis provided a more detailed picture of the co-movement between the variable pairs across different time-frequency domains. More specifically, the left panel of Figure 3 showed that the correlation between HDI and IND was weak in the short and medium term, as indicated by the yellow-orange areas, but became slightly stronger in the long term, as indicated by the blue-purple areas. The period during which the two variables exhibited the strongest correlation was from 2002 to 2008. The arrows predominantly pointed to the right and downward (↘), indicating a positive correlation in which HDI was the leading variable and IND was the lagging variable. In other words, in the medium term, improvements in human development preceded and contributed to the development of the industrial sector in Vietnam. However, after 2015, this lead-lag relationship tended to reverse.

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The right panel of Figure 3 showed very strong correlations between HDI and URB in both the low- and high-frequency domains, with the two variables moving in the same direction. The strength of the correlation decreased slightly in the medium-frequency domain.

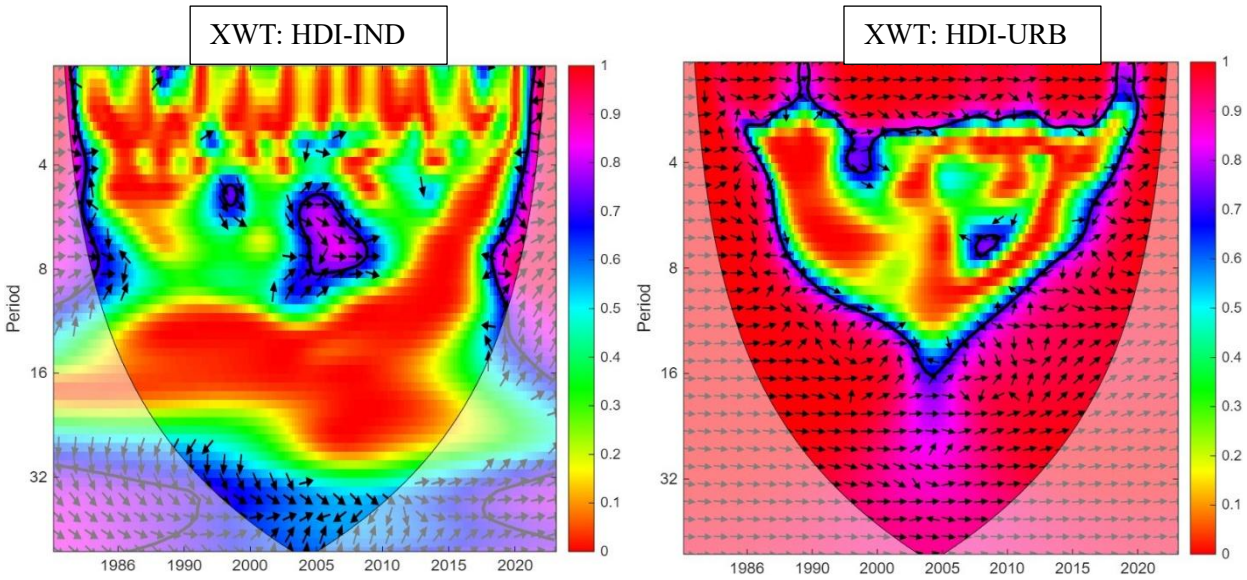


Figure 3. XWT results for the HDI–Industrialization and HDI–Urbanization

Note: The thick black contour shows the 5% significance level against red noise estimated from Monte Carlo simulation using phase randomized surrogate series, and the cone of influence where edge effects may distort the picture is indicated outside of the black line. The color code for power ranges from blue (low) to yellow (high). The Y-axis represents frequencies, and the X-axis measures the period.

The arrows predominantly pointed to the right and upward (↗), indicating that URB played the leading role in this relationship. In other words, increases in the urbanization rate had a positive effect on improvements in human development in Vietnam.

Partial Wavelet Coherence and Multiple Wavelet Coherence Results

The study additionally employed the Partial Wavelet Coherence (PWC) technique to control for the effect of a third variable and the Multiple Wavelet Coherence (MWC) technique to examine the simultaneous effects of multiple independent variables on a dependent variable.

The left panel of Figure 4 showed that, after controlling for the effect of urbanization (URB), the correlation between HDI and industrialization (IND) occurred primarily in the high-frequency domains (s = 2-8), while it was weak in the medium- and low-frequency domains, as indicated by the green areas. This finding suggested that changes in urbanization had a relatively limited influence on the relationship between human development and industrialization in Vietnam.

However, the right panel of Figure 4 presented a contrasting picture. When the effect of industrialization (IND) was controlled for in the relationship between HDI and urbanization (URB), the strength of the correlation increased substantially, as indicated by the dark-red areas. The arrow patterns remained largely unchanged compared with those obtained from the XWT analysis. This continued to indicate that, in the relationship between HDI and industrialization, IND played the role of the lagging variable, while HDI was

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the leading variable. Similarly, urbanization played a dominant role in shaping fluctuations in HDI across the time domain.

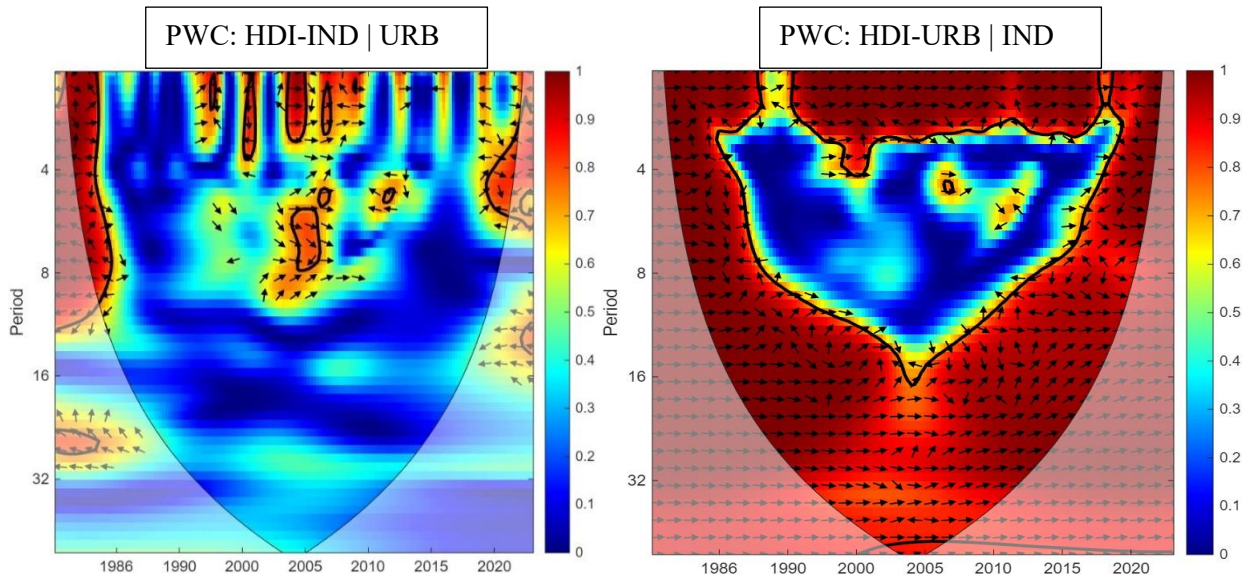


Figure 4. PWC results

Note: The color spectrum ranges from blue (weak correlation) to red (strong correlation). The vertical axis represents the frequency domain, while the horizontal axis represents the time domain.

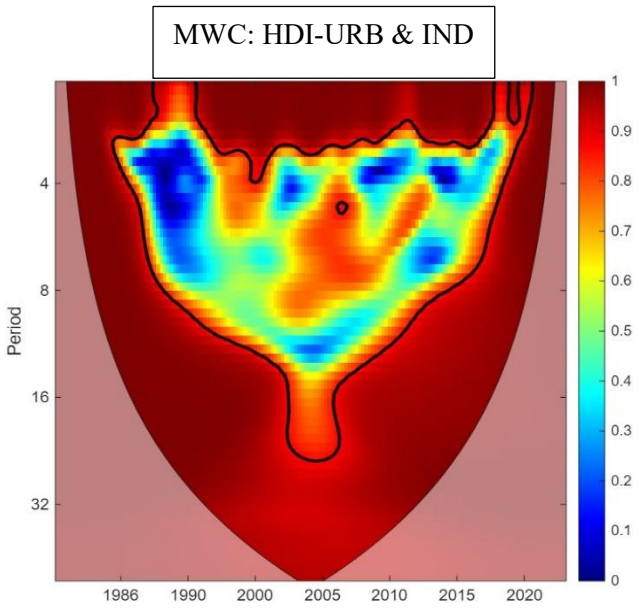


Figure 5. MWC results

Note: The horizontal axis represents time, the vertical axis represents wavelet scales, and the color scale indicates the strength of the multiple wavelet coherence, with blue representing weaker coherence and dark red representing stronger coherence.

Finally, Figure 5 showed that the relationship between industrialization and urbanization and human development was strong across the short-, medium-, and long-term scales, as indicated by the dark red areas. However, the relationship was relatively weaker in the medium term than in the short and long terms. This finding implied that policies promoting industrialization and urbanization simultaneously could accelerate improvements in human development in Vietnam.

DISCUSSION

The results obtained from the XWT and PWC analyses showed that the relationship between industrialization and human development in Vietnam over the period 1986-2023 was positive, with the relationship being particularly pronounced in the medium term. This finding was consistent with the conclusions of Szirmai (2012), Haraguchi et al. (2019), and UNIDO (2024). In addition, the leading role of industrialization became evident only after 2015 and has continued thereafter. Several arguments supported the plausibility of this finding. First, as Vietnam started from an agrarian economic base, it needed time to accumulate physical capital and shift toward industrial production. Second, for a long period, Vietnam pursued an extensive growth strategy based on low-cost labor and natural resource exploitation. This approach did not substantially contribute to the improvement of human capital (Bùi Hoàng Ngọc et al., 2024). Third, the widespread adoption of the Internet, artificial intelligence, automated robots, and other advanced technologies has accelerated only in recent years in Vietnam. These changes have created both challenges and necessary conditions for firms to make technological breakthroughs in production, engage in the transfer of scientific and technological advances, and for workers to become more aware of the need to continuously educate and retrain themselves (Vo et al., 2024).

The findings of this study also supported the benefits highlighted by agglomeration theory, showing that urbanization and human development in Vietnam had a strong positive correlation across all time-frequency domains. Moreover, with the contribution of industrialization, this relationship became even more pronounced. Compared with previous studies, this finding was consistent with Zhong and Chen (2022), but differed from the findings of Ahmad et al. (2023). In light of the Vietnamese context, the present study argued that this finding was plausible for several reasons. First, urbanization in Vietnam has been closely associated with infrastructure development, including shopping centers, office buildings, and concentrated urban areas, which has generated substantial demand for employment opportunities with higher incomes. When income and employment were relatively secure, people were more likely to invest in their health and education. Second, Vietnamese cities have been closely associated with high-quality education systems, as they are home to major universities, higher education institutions, and research institutes. Therefore, people's migration toward urban areas also created greater opportunities to access higher-quality education.

CONCLUSION AND POLICY IMPLICATIONS

Human development is the result of sustained efforts by individuals, but the state's role in providing strategic direction and effective governance is equally important. Industrialization and urbanization are widely regarded as irreversible trends; therefore, understanding their relationships with human development is essential. By decomposing the variables across the time and frequency domains over the period 1986-2023 and applying a comprehensive set of Wavelet analysis techniques, this study draws several conclusions. First, the relationship between industrialization and human development is positive and is most pronounced in the medium term, while it is relatively weak in both the short and long terms. Industrialization has played a leading role in human development only since 2015. In addition, urbanization strengthens this relationship. Second, urban

development provides favorable opportunities for human development across all frequency domains. When industrialization is considered jointly with urbanization, the relationship with human development becomes considerably stronger.

Based on these empirical findings, several policy implications should be considered.

First, different forms of urbanization should be clearly distinguished. Vietnam should avoid population urbanization driven primarily by net in-migration to particular geographic areas and instead place greater emphasis on economic urbanization and social-service urbanization. These forms of urbanization are associated with the reallocation of productive resources, including physical capital, technological capital, and highly skilled human resources.

Second, industrial development strategies at the regional and provincial or municipal levels should explicitly incorporate urbanization into the planning process. The implications of urbanization should be carefully assessed before industrial policies are formulated, rather than treating urbanization as an outcome that follows industrial development.

Human development is influenced by numerous other macroeconomic factors, such as the development of the national education system and policies aimed at attracting and retaining highly skilled workers. These factors were not examined in the present study. In addition, potential spillover effects from foreign residents to the Vietnamese population, as well as whether the educational attainment of neighboring countries influences human development in Vietnam, remain unclear. The authors acknowledge these limitations, which also provide promising directions for future research.

Conflict of interests: The authors declare no conflict of interest.

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