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Connecting Environmental Health Quality And Regional Competitiveness: A Conceptual Review

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Abstract: *This study explores the critical relationship between environmental health quality and regional competitiveness, aiming to clarify how ecological conditions shape economic resilience, innovation, and regional development. A qualitative systematic literature review was conducted, synthesizing 127 peer-reviewed articles from the past 10–15 years, selected based on relevance to regional competitiveness, environmental health, and productivity. Using deductive reasoning and structured data tabulation, the study examined theoretical frameworks, empirical evidence, and policy implications. The findings indicate that improved environmental health such as reduced pollution and enhanced public health outcomes significantly enhances workforce productivity, reduces healthcare burdens, and increases regional attractiveness to investment. Furthermore, the integration of environmental health indicators into competitiveness frameworks enables more holistic regional planning, aligning economic growth with sustainability goals. Evidence from multiple sectors (tourism, manufacturing, agriculture, and health) illustrates that environmental quality influences innovation capacity, labor market dynamics, and regional branding. Governance models emphasizing sustainability, multi-sectoral collaboration, and stakeholder engagement are shown to be essential for successful integration. The study concludes that environmental health should be viewed as a foundational component of regional competitiveness and recommends developing multidimensional indicators, adaptive strategies, and inclusive governance frameworks for future research and policy innovation.*
Keyword: *Competitiveness, Environment Health, Regional Competitiveness, Productivity*

INTRODUCTION

Current global and regional trends in environmental health quality reflect a concerning interplay of increasing environmental risks and health disparities, particularly among vulnerable populations. Approximately 22% of the global disease burden is attributed to environmental health risks, with marginalized groups being disproportionately affected (McAlister et al., 2022). The Sustainable Development Goals (SDGs) establish critical indicators for monitoring these environmental health challenges, emphasizing the necessity for inter-sectoral approaches to improve health outcomes (Jung et al., 2018). Moreover, the integration of environmental health metrics into policy frameworks, such as those for antimicrobial resistance (AMR) and environmental sustainability, underscores the relevance of coordinated action across healthcare and environmental sectors (Kaiser et al., 2022). The healthcare industry's substantial environmental footprint highlights urgent needs for reductions in pollution, which are pivotal for both health and sustainability (Lenzen et al., 2020). Effective measurement strategies, including risk assessments and health impact assessments, are being developed to address these interconnected challenges (Grout et al., 2018; Desye, 2024; Wójcik et al., 2023).

Regional competitiveness is defined as the ability of regions to attract and retain firms and skilled labor while enhancing the standard of living for their residents. This concept encompasses various dimensions, including economic performance, innovation capacity, and institutional framework, which are crucial for sustainable growth (Gagarina et al., 2016; Gumar et al., 2024). The literature emphasizes measuring regional competitiveness through various composite indicators that consider socio-economic elements, such as human capital, infrastructure, and institutional quality (Gumar et al., 2024; López & Castro, 2025). Functional methodologies for assessment include indices like the Global Competitiveness Index

and regional adaptations, such as the EU Regional Competitiveness Index and others outlined in recent studies (Moirangthem & Nag, 2022; Wojtasiak-Terech, 2019). These indices aggregate multiple qualitative and quantitative variables, enabling stakeholders to identify competitive advantages and areas for improvement (Budd & Hirmis, 2004). Furthermore, emerging frameworks incorporate environmental sustainability indicators, reflecting the growing recognition of ecological factors in regional economic strategies (Bilbao-Terol et al., 2017; Kouskoura et al., 2024). As such, the multi-dimensional nature of regional competitiveness assessments necessitates a blend of traditional economic analysis and innovative approaches tailored to regional contexts and objectives (Castro et al., 2023; Koišová et al., 2019).The linkage between environmental health and regional economic performance is often explained through various theoretical frameworks that highlight the interplay between ecological systems, economic structures, and governance. One prominent framework is the "sustainable competitiveness" theory, which posits that regions can achieve economic prosperity without compromising environmental integrity. This perspective emphasizes the need for strong institutional foundations and normative behaviors that support sustainable development (Doyle & Alaniz, 2020). In addition, the input-output model provides a robust analytical lens, allowing researchers to observe how economic activities impact environmental quality and vice versa. This model facilitates an understanding of the dynamic interactions between economic growth and environmental degradation, aiding in the formulation of policies that promote both economic advancement and environmental sustainability (Bùi & Quang, 2021). Another approach integrates regional resilience frameworks, which underline the capacity of regional economies to recover from environmental shocks while fostering sustainable growth. This perspective considers the systemic and holistic interactions among economic, social, and environmental factors (Rizzi et al., 2017). Additionally, regulatory competition theories suggest that local governments may weaken environmental regulations during economic downturns, which can lead to deteriorated environmental health and ultimately constrain long-term economic performance (Konisky, 2007). These frameworks collectively provide a comprehensive understanding of how environmental health and regional economic performance are interlinked, emphasizing the necessity for sustainable development strategies that balance economic growth with ecological preservation.Environmental degradation significantly affects regional economic attractiveness and productivity through various mechanisms. Firstly, the deterioration of air and water quality leads to increased public health risks, which subsequently heighten health care expenditures and undermine economic productivity. Research has demonstrated that air pollution is associated with increased health expenditures, indicating how environmental factors necessitate more public health spending, thereby diverting resources from other productive investments (Usman et al., 2019). For instance, regions experiencing severe environmental decline often witness a reduced labor force participation rate due to health-related issues, which directly affects economic output (Zhao et al., 2022). Moreover, environmental policies that do not adequately address public health outcomes can lead to an unsustainable economic trajectory. Studies indicate that effective environmental regulation improves public health and can also act as a catalyst for economic development by fostering a healthier workforce (Xu et al., 2022). When regions prioritize environmental health, they enhance their economic appeal by attracting investments that seek sustainable and healthy living conditions (Raghupathi & Raghupathi, 2020). Thus, the intricate relationship between a region's environmental quality and its economic performance underlines the importance of integrated approaches that consider environmental health as a foundation for long-term economic sustainability. Environmental sustainability and public health outcomes significantly shape investment decisions and drive regional growth by influencing economic attractiveness, workforce productivity, and overall community well-being. Regions that prioritize environmentally sustainable practices tend to create healthier living conditions, which can attract businesses and skilled labor. Research indicates that improved environmental quality can enhance public health, leading to decreased healthcare costs and increased economic productivity (Hlafa et al., 2019). Thus, investments in environmental sustainability can contribute to a more robust economy by maximizing individual well-being and collective productivity (Yang et al., 2021). Furthermore, public health investments play a vital role in enhancing regional economic performance. Areas that allocate resources toward health services often see substantial returns in the form of reduced healthcare expenditures and improved labor efficiency. Findings suggest that a 10% increase in local public health

spending correlates with a decrease in preventable deaths, thus enhancing the labor pool (Mays & Smith, 2011). Additionally, regions that support effective health systems can leverage spillover effects to stimulate growth in various sectors through increased private investments (Chen et al., 2022). Moreover, integrating public health considerations into local governance and planning decisions is crucial for long-term sustainability. Policymakers who incorporate evidence-based practices into investment strategies tend to create environments conducive to innovation and economic resilience (Marks et al., 2015). Consequently, the dynamic interplay between environmental sustainability, public health outcomes, and investment decisions is essential for shaping the trajectory of regional growth.

Integrating environmental health indicators into regional development and competitiveness strategies is increasingly crucial for various reasons. Firstly, evidence suggests that improved environmental health significantly contributes to public health outcomes, which in turn enhances workforce productivity and economic performance. Regulatory measures that enhance environmental standards can reduce public health risks, leading to lower healthcare costs and a healthier labor force (Pei et al., 2023). Regions that prioritize environmental health are more likely to experience increased economic attractiveness, as healthier populations tend to be more productive, thereby attracting investments. Moreover, aligning regional development with sustainability objectives fosters resilience against environmental challenges and climate change, which can disrupt economic activities (Hu, 2015). By embedding environmental health measures into strategic frameworks, policymakers can facilitate better long-term economic planning and regional competitiveness. This integrated approach allows for synergistic benefits across economic, social, and environmental dimensions, ensuring that development initiatives contribute to overall sustainability (Strand et al., 2010). Additionally, stakeholder engagement in these processes is critical for achieving comprehensive and effective strategies. Involving local populations in decision-making can lead to more tailored and accepted policies that enhance both environmental quality and public health outcomes, ultimately supporting sustained regional growth (Polyakova & Gorina, 2021). As such, integrating environmental health indicators is essential for creating holistic development strategies that emphasize both economic prosperity and community well-being.

LITERATURE REVIEW

Pivotal Empirical evidence consistently suggests a significant link between environmental quality and economic growth, often illustrated through the Environmental Kuznets Curve (EKC), which posits that economic growth initially leads to environmental degradation, followed by improvement as income rises (Li et al., 2022; Chen et al., 2019). Studies have shown that strategic investments in green technologies and environmental protection frameworks can foster sustainable economic development (Sinaga, 2024; Adanma & Ogunbiyi, 2024). For instance, sustainable management of natural resources not only enhances environmental quality but also stimulates job creation and regional economic prosperity (Harsono et al., 2023). Additionally, research indicates that integrating economic policies with eco-friendliness can yield substantial benefits, promoting a holistic approach towards regional development while simultaneously addressing critical issues like climate change and resource depletion (Hutajulu et al., 2024; Anwarya, 2022). Therefore, a multifaceted approach that includes cooperation among stakeholders is essential for maximizing both economic advantages and environmental sustainability (Yue et al., 2023; Amirova et al., 2021). Studies have utilized various methodologies to measure the impacts of air, water, and soil pollution on human health and economic performance. The cost-of-illness approach is widely adopted, quantifying healthcare costs associated with pollution-related diseases, such as respiratory illnesses resulting from air pollution, which can lead to significant national economic losses. For instance, in Thailand, air pollution was responsible for about 50,000 deaths and incurred approximately USD 60.9 billion in economic costs, equating to nearly 15% of the country's GDP in 2016 (Syuhada et al., 2023). Additionally, analyses of disability-adjusted life years (DALYs) quantify the broader impacts of pollution on public health (Wang et al., 2020). Research suggests that air pollution contributes to over a million premature deaths annually in China, and this has been linked to substantial economic losses due to decreased labor productivity. Furthermore, evidence indicates that pollution disproportionately affects vulnerable demographics, intensifying health disparities and consequently impeding economic growth due to lost productivity (Li et al., 2025). This evidence underscores the

interconnectedness of environmental quality, public health, and economic performance in achieving sustainable development. The existing literature on the synergistic role of environmental health in enhancing regional competitiveness reveals several gaps that merit further investigation. One notable gap is the insufficient integration of environmental health metrics in evaluating overall regional competitiveness. While studies like those by Hu et al. have established the connection between environmental regulations and technological innovation related to the Porter Hypothesis Hu et al. (2020), they often overlook the broader implications of environmental health on long-term economic resilience and competitiveness. Moreover, many analyses focus primarily on direct economic indicators without adequately addressing the multifaceted interactions between environmental health, public policy, and economic outcomes (Liu et al., 2023). Another significant gap exists in the understanding of how specific environmental health initiatives impact diverse sectors and demographics within regions. Insights from tourism and manufacturing contexts demonstrate the importance of integrating environmental practices into competitive strategies, as highlighted by Grimstad and Burgess, who discusses how environmental sustainability can lead to competitive advantage in tourism clusters (Grimstad & Burgess, 2014). However, empirical evidence examining these intersections across various economic sectors remains sparse. For instance, while the Porter Hypothesis supports the notion that stricter environmental regulations can drive innovation (Vries & Withagen, 2005), the resulting benefits on regional competitiveness have not been extensively quantified or regionally contextualized. Lastly, there is a limited exploration of the temporal dynamics between environmental health improvements and economic growth. Although numerous studies establish correlations between sustainable practices and competitive advantages (Darbani, 2023; Agyabeng-Mensah et al., 2020), the longitudinal effects of enhanced environmental health on regional competitiveness after implementing strategic environmental policies have yet to be comprehensively analyzed. Evaluating the relationship between environmental health and competitiveness involves a variety of indicators drawn from both fields. Commonly used environmental health indicators include pollution indices, such as the Pollution Load Index (PLI), which quantifies the level of contamination in soil and water by assessing the concentration of heavy metals (Silver et al., 2024). Additionally, metrics derived from biological assessments, like fish assemblage indicators, are utilized to evaluate environmental degradation in aquatic systems (Ávila et al., 2018). On the side of economic competitiveness, studies such as those by Cvelbar et al. highlight the need for robust environmental indicators within tourism competitiveness frameworks, emphasizing that limited secondary data skews evaluations (Cvelbar et al., 2016). Natural capital indices are also critical, as they measure the environmental assets that contribute to regional competitiveness (Kasztelan, 2015). Integrating these indicators, researchers like Karman et al. emphasize the relevance of a comprehensive regional competitiveness index that incorporates environmental quality metrics alongside traditional economic metrics to achieve a holistic assessment of regional health and competitiveness (Karman et al., 2021). This interplay of indicators underscores the necessity of recognizing the dual role that environmental health plays in influencing economic outcomes. Governance and environmental policy play a crucial role in shaping the relationship between ecological health and regional competitiveness. Effective governance structures, as highlighted by Bukanov, facilitate the implementation of ecological policies that align economic development with sustainability, thereby enhancing the productive capacities of regions (Bukanov, 2020). Policies that prioritize environmental health are increasingly recognized as integral components of national strategies, guiding regional decision-making in line with sustainable development goals. Additionally, research by Song emphasizes that corporate governance frameworks focusing on sustainability drive ethical management practices, which can significantly mitigate environmental impacts (Song, 2025). The incorporation of sustainability into governance models not only enhances corporate transparency but also fosters stakeholder engagement, which can lead to improved ecological performance. Similarly, Sancha et al. indicates that effective operations management within firms shaped by governance practices results in enhanced sustainability outcomes, thereby strengthening competitive advantages (Sancha et al., 2022). Moreover, Bashir's analysis reveals that institutional quality and governance significantly influence the efficacy of green innovations, which enhance both ecological health and regional competitiveness in the context of sustainable development (Bashir, 2025). Policy frameworks that integrate environmental considerations into governance ensure the sustainable utilization of natural

resources, essential for long-term economic viability. In summary, strong governance and environmental policies are instrumental in shaping the interplay between ecological health and competitiveness. They encourage investments in sustainable practices, uphold regulatory standards, and ultimately foster a competitive edge in the global economy.

METHODS

This research was conducted using a qualitative method with a systematic literature review approach that focused on the conceptual construction of the relationship between environmental health quality and provincial competitiveness. This study used data in the form of research articles and reviews relevant to the theme and discussion points raised in this study. In the literature selection process, several exclusion criteria were used to limit data sources that were too broad and could lead to bias and deviation from the constructed main problem. Some of the exclusion criteria are as follows:

1. The article is a research or review article
2. The article is published within 10-15 years
3. The article main topic is regional competitiveness, environmental health, and productivity
4. The article was search using the following keyword (Competitiveness, Environmental Health, Regional Competitiveness, Productivity).

The collected data will be tabulated first to highlight the information contained in the selected articles. To formulate and compile the research results, the collected data will be processed using deductive reasoning to obtain relevant information and extract accurate information from the data sources. After going through the selection and exclusion stages, there are 127 articles relevant to the topic of discussion in this study. These articles are used to compile the conceptual framework, up to the research results in this study. The data that has been obtained is not only used in formulating the research results but also will be analyzed to provide comprehensive implications for research with similar themes and for research in the same scope.

RESULT

Environmental Health Indicators

Environmental health indicators (EHIs) play a significant role in correlating with regional economic performance, demonstrating the intertwined nature of environmental quality and economic growth. Specifically, research shows that areas with lower environmental pollution levels reflected through indicators such as air and water quality tend to have better public health outcomes, which are positively associated with economic performance (Zhao et al., 2022). Significant regional disparities in health effects due to pollution in China, underscoring how environmental degradation can hinder economic growth and public health. Moreover, Brereton et al. discuss how improving children's environmental health can correlate with broader economic development, emphasizing that economic progress can exacerbate health inequalities based on environmental conditions if not managed properly (Brereton et al., 2018). Finally, frameworks for developing EHIs across varying contexts can assist in highlighting these correlations, thereby supporting targeted public health and economic policies (Tisch et al., 2014; Hambling et al., 2011). Changes in pollution levels directly affect workforce productivity and healthcare burdens through various mechanisms. Elevated air pollution, particularly particulate matter (PM) and nitrogen oxides, diminish cognitive function and physical health, leading to increased absenteeism and reduced productivity in workplaces. Kriit et al. reported that lower healthcare costs are associated with decreased air pollution exposure, illustrating a direct economic benefit from improving air quality among commuters (Kriit et al., 2019). Furthermore, studies indicate that even pollution levels below regulatory thresholds can exacerbate asthma-related healthcare utilization, burdening health systems with increased hospital admissions. For example, Lee et al. found that increased levels of air pollution below the U.S. standard thresholds can lead to more frequent hospital admissions among individuals with asthma (Lee et al., 2025). Moreover, the economic impact of air pollution is significant; Yin et al. highlighted that the healthcare costs associated with pollution-related diseases are substantial, placing a disproportionate burden on aging populations (Yin et al., 2020). Research by Kumbhakar et al. demonstrated that higher air pollution levels correlate with rising healthcare expenditures, emphasizing the economic ramifications

of environmental degradation (Kumbhakar et al., 2021). These findings underscore the interdependence between clean air initiatives, workforce health, productivity, and healthcare costs, advocating for comprehensive policies aimed at pollution reduction to bolster economic performance and public health. Evidence suggests that environmental health interventions can lead to measurable economic gains at the regional level by improving public health outcomes and thereby reducing healthcare costs. For instance, environmental policies aimed at reducing air and water pollution have been linked to significant public health benefits, including decreased morbidity and mortality rates from pollution-related diseases. Adanma and Ogunbiyi highlight that the implementation of such policies correlates with lower healthcare burdens, which ultimately contributes to economic savings for regions due to reduced healthcare spending (Adanma & Ogunbiyi, 2024). Furthermore, Rentschler and Leonova discuss the economic implications of air pollution exposure, emphasizing that improving air quality can elevate productivity levels and foster better health among workers, which in turn drives economic growth (Rentschler & Leonova, 2023). Research by Tang et al. also indicates that robust environmental regulations significantly enhance public health and contribute to high-quality environmental development, resulting in further economic benefits (Tang et al., 2020). This indicates a significant interplay between environmental interventions and regional economic performance, reinforcing the necessity for integrated policies that consider both health and economic outcomes in environmental planning. Spatial and temporal patterns in environmental health significantly influence the competitiveness rankings of regions through their impact on public health and economic performance. Bacoş and Gabor assert that air quality is an essential factor for establishing a competitive edge in the tourism industry, where cleaner environments enhance destination attractiveness and, consequently, drive economic growth (Bacoş & Gabor, 2021). Improved air quality can elevate living standards and health outcomes, contributing to increased labor productivity and reduced healthcare costs, which are critical for maintaining a competitive economy. Moreover, Ngami and Ventelou emphasize that environmental quality directly affects healthcare performance and life expectancy, resulting in notable re-ranking among OECD countries when factoring in environmental conditions (Ngami & Ventelou, 2023). These health outcomes correlate with regional competitiveness; areas with better public health are often more attractive for investment and workforce retention. The findings from Li et al. also suggest that regions focusing on improving environmental quality and health standards can enhance economic prospects, linking environmental health interventions to improved competitiveness (Li et al., 2025). Thus, the evidence illustrates that proactive management of environmental quality fosters public health and is integral to enhancing economic competitiveness on both local and global scales.

Regional Competitiveness Outcomes

Environmental health conditions have a profound impact on several economic sectors, particularly those that rely heavily on public health and environmental quality. The tourism sector is among the most sensitive, as it directly correlates with clean air, water quality, and overall environmental aesthetics. This is supported by insights from Casado-Aranda et al., who discuss how environmental factors influence tourist behavior and the viability of tourism-dependent regions, particularly in the context of post-COVID-19 recovery (Casado-Aranda et al., 2021). Additionally, the agriculture sector is significantly affected, as environmental health issues like pollution and climate change can lead to reduced crop yields and livestock health, ultimately impacting food supply chains and economic stability. This connection is highlighted in research focusing on the broader implications of health on economic activity due to changing environmental conditions (Pratiwi et al., 2022). The manufacturing and construction industries also face pressures from environmental health changes, as stricter regulations often arise in response to environmental degradation. Research indicates that increases in environmental standards can negatively affect economic growth within these sectors (Görüş, 2023). Furthermore, the healthcare sector itself is indirectly influenced; as environmental health declines, there is often an increase in healthcare costs due to higher morbidity and mortality rates associated with pollution and climate impacts, which puts a strain on public resources. This illustrates the integral relationship between environmental health and public health expenditures (Mohammadpour et al., 2024). In summary, sectors such as tourism, agriculture, manufacturing, and healthcare are intricately linked to environmental health conditions, making them particularly vulnerable to changes in environmental quality. Environmental quality metrics significantly

influence regional innovation capacity, labor market dynamics, and business attraction through a variety of mechanisms. Higher environmental quality often fosters innovation by creating incentives for businesses to adopt sustainable practices and invest in clean technologies. López-Gamero et al. discuss how stringent environmental regulations can lead to improved environmental management practices that boost competitiveness and encourage innovation among firms, although they also note that the competitive benefits from such regulations can be industry-specific (López-Gamero et al., 2010). This innovation is critical for maintaining competitive advantages in an increasingly eco-conscious market. Labor market dynamics are closely tied to environmental health conditions. Research by Li et al. indicates that labor market distortions, often exacerbated by poor environmental conditions, can impede the allocation of skills and labor across regions, diminishing economic efficiency and innovation potential (Li et al., 2023). Moreover, Deschênes highlights that while environmental regulations may have negative effects on employment and productivity, they can also yield significant social benefits, such as improved health outcomes (Deschênes, 2018). Finally, regions with higher environmental quality tend to attract more businesses, as firms increasingly seek locations with sustainable practices and healthy workforces. Environmental quality can thus be a decisive factor for businesses when considering relocation or expansion affecting decisions that influence the overall economic vitality of a region (Pautrel, 2017). This interplay underscores the importance of promoting environmental health as a strategy for regional economic development and competitiveness. Healthier environments play a critical role in enhancing human capital and strengthening regional branding. Improved environmental quality positively influences public health outcomes, thereby fostering a more productive workforce. For example, healthier populations demonstrate increased cognitive performance and lower absenteeism rates, which enhance overall productivity and innovation within the labor market (Munawaroh & Fajri, 2023). This is particularly vital for regions aiming to develop their human capital, as a skilled and healthy workforce is essential for attracting and retaining businesses that require high levels of innovation and quality. Moreover, the link between environmental quality and regional branding is significant. Sustainable practices and environmental health contribute to a region's brand identity, making it more appealing to potential investors and residents. Munawaroh and Fajri highlight that effective regional branding strategies can promote sustainable environments, which in turn enhances the perception of the region as a desirable place to live and work (Munawaroh & Fajri, 2023). Better environmental conditions enhance the quality of life, which has been shown to be a crucial factor in place branding, thereby attracting businesses and talent seeking sustainable locales (Makarov & Illarionov, 2020). In conclusion, healthier environments enrich human capital by improving public health and productivity, while also enhancing regional brands that prioritize sustainability and well-being, thus creating a competitive advantage for regions involved in these efforts. Several regional case studies illustrate the connection between improved environmental health and enhanced competitiveness. A case study in China by Zhou et al. emphasizes that effective environmental regulations can stimulate urban innovation capacity. The research indicates that cities with better environmental regulation performance may experience positive spillover effects that enhance neighboring cities' innovation capabilities, highlighting a relationship between environmental management and regional economic vitality Zhou et al. (2021). Similarly, findings from Deng et al. suggest that local government competition and stringent environmental regulations in Chinese provinces lead to improved regional innovation performance. The study shows that local governments are motivated to enhance environmental regulations to attract foreign direct investment (FDI), which, in turn, can drive regional competitiveness (Deng et al., 2019). Additionally, the research by Liu et al. indicates that local government competition influences environmental regulation intensity, ultimately impacting green development and industrial competitiveness in China, although some studies suggest that this competition may distort environmental priorities. This underscores the complex role of competitive environmental governance in fostering sustainable economic growth (Liu et al., 2023). Moreover, the work of Hu et al. demonstrates that green innovations can significantly improve regional environmental carrying capacity, contributing to sustainable economic advantages (Hu et al., 2022). These studies collectively suggest that prioritizing environmental health not only mitigates ecological degradation but also serves as a catalyst for innovation and economic resilience in various regions.

Policy and Institutional Dynamics

Regional policies increasingly aim to integrate environmental health targets into development planning to address the interconnectedness of health, economic vitality, and ecological sustainability. For instance, the Seoul Metropolitan Government created an environmental health department in 2012 and enacted an Environmental Health Ordinance. In 2013, it established the "Seoul Metropolitan Government's Environmental Health Policy Road Map (2013-2017)" to systematically address environmental health challenges (Myung & Lee, 2017). Such initiatives demonstrate how local governments are proactively incorporating health considerations into planning frameworks to enhance community well-being. Moreover, assessments of ecosystem health, as illustrated by studies focused on China's regions, reveal that understanding environmental conditions is vital for sustainable policy-making that supports both ecological and human health (Wang et al., 2018; Lei et al., 2023). This aligns with the notion that public health implications should be at the forefront of regional development strategies, emphasizing the need for frameworks that support health impact assessments (Mindell et al., 2008; Lerer, 1999). By integrating diverse stakeholder perspectives and socioeconomic factors, policies can more effectively address the complex interplay of health outcomes and environmental sustainability (Kohlhuber et al., 2006; Mickwitz & Kivimaa, 2007). Effective governance models that promote both ecological health and economic competitiveness often incorporate principles of ecological compensation, local self-governance, and multi-dimensional competition among local governments. The empirical research in the Shiyang River Basin demonstrates that ecological compensation policies can boost local economies while improving ecological conditions, indicating a successful model where ecological health aligns with economic incentives (Shang et al., 2022). Additionally, the case of rural community ponds in Kerala, India, illustrates the effectiveness of polycentric governance, showcasing that local governance structures can enhance ecological outcomes while engaging communities in decision-making (Sankar, 2022). Furthermore, recent studies highlight the impact of local government competition on ecological welfare performance (EWP), demonstrating that a balance of economic and environmental assessments can contribute to sustainable governance (Deng et al., 2019; Li et al., 2023). Specifically, incorporating ecological criteria into local competition has the potential to foster innovation and promote green economic growth (You et al., 2023; Su et al., 2022). Such integrative models demonstrate that governance structures emphasizing cooperation and accountability across political, social, and ecological dimensions can enhance both ecological health and regional competitiveness. Public participation and intersectoral collaboration are instrumental in enhancing the effectiveness of health policies and interventions. These approaches ensure that diverse perspectives are incorporated, creating policies that reflect community needs and promote comprehensive health outcomes. As highlighted by Tancred et al., effective collaboration across sectors is crucial for advancing "Health in All Policies" (HiAP), as it enables stakeholders from multiple sectors to work collectively toward shared health goals (Tancred et al., 2024). Research further emphasizes that proactive engagement of non-health sectors enhances the likelihood of achieving intersectoral objectives. For example, Hendriks et al. argue that providing policy advice free of charge could incentivize municipal departments to seek health-related guidance and lead to a clearer interpretation of an intersectoral approach, ultimately supporting more effective childhood obesity prevention strategies (Hendriks et al., 2013). Additionally, Macfarlane et al. identify critical success factors that facilitate tangible outcomes in interventions addressing complex social issues, such as homelessness, through collaborative governance (Macfarlane et al., 2024). Collectively, these findings highlight that fostering strong partnerships and ensuring community voice in decision-making processes not only enhances policy effectiveness but also supports sustained health equity across populations (Such et al., 2022; Kriegner et al., 2020). Barriers to mainstreaming environmental health in competitiveness strategies can be categorized into several dimensions, including awareness, institutional frameworks, and resource limitations. First, a lack of environmental health literacy among the general population significantly impedes the adoption of pro-environmental behaviors essential for integrating environmental health into competitiveness strategies (Bert et al., 2023). Without widespread understanding and engagement, initiatives may struggle to gain the necessary public support and participation. Furthermore, institutional barriers within organizations often hinder the effective implementation of environmental strategies. As noted by Huang and Li, aligning resources and strategic objectives can be challenging, especially in environments where environmental management is not prioritized (Huang & Li, 2018). This disconnect can lead to a failure

in recognizing the economic benefits of sustainable practices, thereby limiting the potential competitiveness derived from environmentally responsible actions (Wang et al., 2022; Do & Nguyen, 2020). Additionally, competing priorities and insufficient incentives to adopt green strategies can act as significant obstacles. Firms may prioritize short-term gains over long-term sustainability goals, thereby deterring the adoption of proactive environmental strategies that enhance competitive advantage (Wang et al., 2022; Do & Nguyen, 2020). Consequently, addressing these barriers requires comprehensive policies that promote environmental health awareness, align institutional resources, and incentivize green innovation for effective integration into competitiveness strategies.

DISCUSSION

The findings related to sustainability and competitiveness enrich existing theories while also presenting challenges to traditional views. The sustainability-based view posits that continual adaptation of a firm's sustainability strategy is essential for maintaining competitive advantage in changing contexts, supporting the dynamic capabilities theory (Lichtenthaler, 2021). Moreover, research emphasizes the role of stakeholder engagement, tacit knowledge, and corporate reputation as vital components of sustainable competitive advantage, indicating an evolving understanding of competitive dynamics within the sustainability framework (Toaha et al., 2019). Contrastingly, some studies argue that while sustainability can provide a competitive edge, it is not without limitations. The necessity for firms to continually renew their strategic resources and capabilities underscores the transitory nature of competitive advantages within fluctuating market conditions (Tarnovskaya, 2023). Therefore, while theories suggest a durable link between sustainability and competitive advantage, the implications of environmental changes and industry dynamics complicate this narrative, necessitating a re-evaluation of established models (O'Shannassy, 2008; Andrevski & Ferrier, 2008). Integrating environmental health into regional economic planning entails several critical policy implications. First, the necessity for holistic approaches that bridge environmental sustainability and economic growth is paramount. It is evident that economic policies must consider environmental impacts, particularly the costs associated with environmental degradation, which can adversely affect public health and economic outputs (Boateng et al., 2025; Abouzeid, 2024). Policymakers should adopt frameworks that emphasize technology, stakeholder collaboration, and balanced policy mechanisms to foster synergy between these sectors (Adanma & Ogunbiyi, 2024). Moreover, establishing coherent environmental regulations is essential, as they must effectively manage pollution and promote sustainable practices while spurring economic development (Xu et al., 2022). This includes investing in green technologies and ensuring policy consistency to reduce uncertainty in economic planning, thereby facilitating long-term investments in sustainability (Zahra & Badeeb, 2022). Finally, recognizing the regional disparities in environmental health impacts can guide targeted interventions, making policies more effective and equitable across different locales (Zhao et al., 2022). In summary, a comprehensive, integrated policy framework is necessary for sustainable regional economic development that prioritizes both environmental health and economic resilience. Research findings can significantly enhance the design of sustainability indicators that accurately reflect both health and competitiveness outcomes. Studies indicate that a comprehensive framework is essential for integrating multiple dimensions of sustainability, including environmental performance, economic viability, and health outcomes (Máté et al., 2022; Gani, 2023). For instance, the interplay between health promotion and economic competitiveness can be evaluated using a multi-criteria approach that considers how environmentally sustainable practices translate into health benefits and competitive advantages in various sectors (Bilbao-Terol et al., 2017). Furthermore, it is crucial to consider contextual factors such as income levels and regional characteristics, as these variables can impact the relationship between competition, health, and sustainability (Fisher et al., 2021; Nunes et al., 2016). Effective indicators should leverage qualitative insights alongside quantitative metrics, focusing on community-specific sustainability challenges and health-related outcomes (Sarriot et al., 2014). By doing so, they can provide actionable insights for policymakers, guiding interventions that bolster health equity while enhancing economic competitiveness. Future research on advancing integrative models of environmental and economic resilience should prioritize the following key areas:

1. **Synergistic Frameworks:** Developing models that balance environmental sustainability and economic growth is essential. Emphasis on systems thinking can help identify interactions and dependencies between environmental health and economic factors, thus creating pathways that promote both sustainability and competitiveness (Teschner et al., 2010).
2. **Impact Assessments of Policy Changes:** Research should evaluate the socio-economic impacts of environmental policies, particularly in terms of public health outcomes and economic viability. Quantitative metrics and qualitative evaluations will be vital in determining how various factors, including health expenditures and environmental degradation, affect overall resilience (Boateng et al., 2025; Assumma et al., 2022).
3. **Spatial and Temporal Analyses:** Understanding how regional disparities influence resilience strategies is crucial. Studies that incorporate spatial data and temporal changes can offer insights about effective intervention points and long-term planning needs in different geographical contexts (Wang et al., 2018; Khan et al., 2020).
4. **Adaptive Management Strategies:** Investigating adaptive policies that respond to environmental shocks, such as climate change, can provide valuable guidance for building resilient economic systems. The interplay between ecosystem services assessments and economic planning should be a critical component of future research to enhance decision-making frameworks (Assumma et al., 2022; Osei et al., 2024).
5. **Community Engagement and Equity:** Finally, integrating community perspectives into the modeling process can help ensure that resilience strategies address equity and social well-being. This includes evaluating how cultural heritage and public health considerations can drive sustainable local development (Dell'Ovo et al., 2021; Zhao et al., 2022).

CONCLUSIONS

This study underscores the intricate relationship between environmental health quality and regional competitiveness, revealing that improvements in air and water quality, reduction of pollution, and robust health systems significantly contribute to economic productivity, innovation, and investment attractiveness. The findings highlight that environmental degradation adversely affects public health and labor efficiency, while well-integrated environmental health policies enhance economic resilience and long-term growth. By synthesizing diverse theoretical frameworks including sustainable competitiveness, regional resilience, and regulatory governance, this research advances the conceptual understanding of how environmental and economic systems interact. It contributes to the field by bridging disciplinary gaps and emphasizing the necessity of multidimensional indicators that capture both health and competitiveness outcomes. The study calls for policy integration, stakeholder collaboration, and adaptive governance to mainstream environmental health into regional development strategies. Future research should focus on building synergistic frameworks, conducting spatial-temporal impact analyses, and designing community-based resilience models to better inform sustainable regional planning.The implications of this study suggest that integrating environmental health into regional development strategies is essential for achieving sustainable economic competitiveness. Policymakers should prioritize the adoption of comprehensive indicators that combine environmental quality and public health metrics with traditional economic benchmarks. Doing so would enable more effective planning and evaluation of regional growth initiatives. Additionally, investment in pollution control, green infrastructure, and public health systems not only enhances human well-being but also strengthens labor productivity and innovation capacity, which are critical for attracting businesses and skilled labor. The study also emphasizes the need for multi-level governance frameworks that align environmental and economic objectives, supported by participatory planning and intersectoral collaboration. These integrated strategies are vital in mitigating health disparities, reducing environmental risks, and promoting equitable economic development. Finally, the findings urge stakeholders to view environmental sustainability not merely as a constraint but as a catalyst for long-term regional resilience and global competitiveness.

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