**Vigan's Living Heritage: A Brown-Green Path to Sustainable Community and Conservation**

***Abstract***

The environmental impact stemming from increased foot traffic, overcrowding, and over-tourism presents significant challenges, thereby impeding Vigan City's full realization as a sustainable urban center. It is emphasized that the fundamental structural characteristics of the indigenous dwelling, notably its elevated floor plan and strategic design for air movement, were skillfully reinterpreted and modified by local craftsmen. This allowed for the accommodation of colonial and immigrant aesthetics without compromising the house's effective natural cooling and ground separation. Renewable Energy Integration and Energy-efficient green infrastructure: This initiative focuses on shifting Vigan's energy consumption from fossil fuels to clean, sustainable sources, as well as designing and retrofitting Vigan's built environment to minimize energy consumption and environmental impact. In order to achieve Green Economics and Green Accounting, it is necessary to adhere to Economic Valuation Studies, Green Tourism Product Development, Investment in Green Skills Training, Support for Eco-Friendly Businesses, Sustainability Accounting and Integrated Budgeting, and Green Infrastructure Heritage Restoration Projects. The comprehensive strategy, meticulously aligning with UN SDG 11, aims to establish Vigan as a global exemplar, demonstrating how a city can successfully balance progress with preservation, fostering a prosperous and resilient future for all its inhabitants.

Keywords: Sustainable Community, climate-adapted system, architectural landscape, socio-cultural implications

**INTRODUCTION**

Vigan City, located in the province of Ilocos Sur, Philippines, is notable for the exceptional preservation of its Hispanic colonial attributes, specifically its distinctive grid street pattern and meticulously maintained historic urban plan. A key aspect of Vigan's importance lies in the seamless amalgamation of various architectural styles, culminating in a visually unified and historically rich townscape (UNESCO Office Bangkok and Regional Bureau for Education in Asia and the Pacific & Philippines, and City Government of Vigan, 2010).

According to a journal published by UNESCO Bangkok (2010), Vigan's domestic architecture showcases a unique structural paradigm, representing the fusion of Spanish and Chinese building norms with the native house's inherently climate-adapted system. Further, it also emphasized that the fundamental structural characteristics of the indigenous dwelling, notably its elevated floor plan and strategic design for air movement, were skillfully reinterpreted and modified by local craftsmen. This allowed for the accommodation of colonial and immigrant aesthetics without compromising the house's effective natural cooling and ground separation. Thus, making it sustainable and eco-friendly.

Although Vigan City's architectural landscape has evolved through distinct phases—including Wood and Brick with Flush Façade, Wood and Brick with a Volada Façade, American Colonial Period, and All Brick Type—it consistently demonstrates a shared feature: cultural inspirations and architectural adaptation to its climate (Heritage Homeowner's Preservation Manual, 2010). Nevertheless, with the advent of modernization in Vigan City, many of these climate-adaptive structures and spaces have been converted into fully modernized infrastructure. This transformation often prioritizes cultural aesthetics, diverging from the original cultural inspirations and practical climatic considerations that once defined them.

Further modernization has also altered these spaces to allow new uses; many structures have lost their authenticity. The escalating conversion of Vigan's historic structures and traditional houses into hospitality establishments reflects an urgent need to accommodate rising tourist demands (Basilio, K., et al., 2025). This rapid transformation, however, carries significant socio-cultural implications, as it is leading to the displacement of local residents and simultaneously undermining the integrity and authenticity of the urban heritage.

Vigan, renowned for its beautifully preserved historical architecture, has earned significant global recognition, including its designation as a UNESCO model for World Heritage site management in 2014, one of the New Seven Wonders Cities in 2015, and a top destination by Travel + Leisure Asia for 2025. These accolades highlight the city's rich cultural heritage and the community's commitment to its preservation. Economically, Vigan thrives with robust commercial activity concentrated in its main market areas. The city issued over 4,200 business permits in 2017, largely for local industries, and saw a substantial increase in commercial establishments between 2013 and 2015, creating nearly 10,000 jobs. While wholesale and retail businesses dominate, financial services also play a significant role. Tourism, driven by Vigan's historic charm, is a primary economic engine, complementing traditional local industries like weaving, pottery, and sausage making. This deep connection between cultural heritage preservation and tourism success not only generates jobs and revenue but also solidifies Vigan's tourism-driven economy. However, this popularity brings challenges; Vigan's status as a global wonder and its thriving tourism economy have significantly increased visitor numbers, attracting 1.4 million tourists by 2017 and anticipating up to 50,000 visitors daily during peak seasons. This influx leads to heavy foot traffic and overcrowding, posing an environmental threat that underscores the urgent need for sustainable tourism programs and development.

**PROBLEM STATEMENT**

Vigan City's robust tourism-driven economy, characterized by expanding industries and business ventures, coupled with its commitment to heritage conservation as driver for development, positions it favorably towards achieving Sustainable Development Goal 11: Sustainable Cities and Communities) (The Global Goals, 2015) Nevertheless, the environmental impact stemming from increased foot traffic, overcrowding, and over-tourism presents significant challenges, thereby impeding Vigan City's full realization as a sustainable urban center.

**PROPOSED SOLUTION**

Vigan's growth, fueled by its heritage and tourism, has significantly transformed the city. However, minimal environmental initiatives within this development pose a serious risk to its natural surroundings. This paper introduces the *Biguenios’ Brown-Green Initiative*. Anchored on the sustainability objective of the people of Vigan City, Ilocos Sur, it aims to develop a comprehensive and actionable framework for integrating sustainable environmental practices into Vigan's ongoing development, ensuring that economic prosperity and heritage preservation do not come at the expense of its vital ecological balance. This paper is limited only to the parameters of Vigan city to ensure a focused approach to development.

Integrating culture and science for holistic development faces significant hurdles, including reconciling distinct approaches, risking superficial integration, and ensuring equitable power dynamics and scalability. However, "Vigan's Living Heritage: A Brown-Green Path to Sustainable Community and Conservation" aims to overcome these risks by demonstrating how a culturally rich site, with its cultural roots and community engagement, can align with sustainable, science-based conservation practices, fostering genuine integration and shared benefit.

 The Biguenios’ Brown-Green Initiative is a framework, anchored on a human-centred approach, thereby benefiting the well-being and quality of life for our community, not at the expense of our vital ecological balance. The framework is rooted in Science and Technology, Cultural Heritage, and Green Economy.

With the immense potential in leveraging science and technology, Vigan City can propel towards a truly sustainable future. Vigan's unique historical and cultural heritage presents both opportunities and challenges, and the thoughtful application of science and technology can help preserve its past while building a resilient future. This can be achieved through several key avenues:

Real-time Urban Monitoring & Analytics Dashboard: This initiative leverages data science and IoT to manage Vigan's dynamic urban environment, particularly crucial for a tourist-heavy heritage site, thus aiming crowd control and foot traffic mitigation. By mitigating congestion in pedestrian zones and around parking areas, vehicle idling time is reduced, leading to lower air pollution and carbon emissions, especially important in Vigan's historical core.

Renewable Energy Integration and Energy-efficient green infrastructure: This initiative focuses on shifting Vigan's energy consumption from fossil fuels to clean, sustainable sources, as well as designing and retrofitting Vigan's built environment to minimize energy consumption and environmental impact (International Renewable Energy Agency, 2019). Promote widespread installation of rooftop solar panels on suitable public buildings (schools, markets, government offices), commercial establishments (hotels, restaurants), and residential homes. This includes net-metering schemes to allow electricity generation to offset consumption. For new constructions and major renovations, integrate principles from traditional Vigan architecture and urban gardening/landscapeing (e.g., high ceilings, wide eaves, cross-ventilation, use of local, breathable materials like wood and stone, native plants, greenery) that naturally reduce heat gain and promote airflow.

Electric Vehicle (EV) Integration for Public Transport: This focuses on transitioning Vigan's local transport system to cleaner, more efficient electric alternatives. Implement pilot projects for electric shuttle services connecting key heritage sites with parking areas outside the core. When charging is powered by renewable energy, the carbon footprint of transport becomes almost zero (The Environmental Protection Agency, 2025)

Citizen Science & Crowdsourcing for Data Collection: This empowers Vigan's residents to actively participate in data collection, fostering a sense of community and increasing data granularity. Provides highly granular data points that official sensors might miss, allowing for more precise environmental interventions (Owalde et. al., 2024)

Geospatial Analysis for Risk Assessment, Microclimate Analysis, & Resilient Planning: This uses advanced mapping and spatial data to understand and plan for Vigan's vulnerabilities, especially regarding climate change (Mahmood et. al., 2024). Combine various geographic datasets in high-resolution satellite imagery, LiDAR (Light Detection and Ranging) elevation data, topographic maps, historical flood records, climate change projection models (e.g., sea-level rise scenarios for Ilocos Sur), building footprints, and infrastructure locations.

Environmental Forensics: According to Deng, H. et. al. (2022), Environmental forensics uses these detailed chemical and biological analyses to "fingerprint" pollutants. It includes a network of high-precision air quality sensors, a water quality monitoring program using standardized laboratory techniques, and soil analyses in agricultural lands. These will provide sufficient information on what scientific steps should Vigan do to prevent environmental problems and to promote sustainability in general, as well as safeguarding Public Health and Tourism.

Furthermore, a primary focus for Vigan City's sustainability would be to deeply embed the principles of cultural heritage preservation into every aspect of urban development. This isn't just about protecting old buildings; it's about recognizing that culture is the soul of Vigan, the engine of its economy, and the foundation of its social cohesion. By strengthening and leveraging Vigan's unique cultural assets, a sustainable city can be created that is authentic, resilient, and thrives from within. To achive this goal, it is necesarry to initiate Digital Tourism & Heritage Preservation, Support for Traditional Crafts & Artisans, Adaptive Reuse of Heritage Structures and spaces, Adaptive Reuse of Heritage Structures and spaces, Sustainable Materials Sourcing, and Heritage Education Programs and Homeowner Empowerment.

Digital Tourism & Heritage Preservation: According to Ahuja Y. (2024), this area focuses on using cutting-edge technology to protect and promote Vigan's heritage, enhancing its economic viability while mitigating physical wear and tear. This involves creating highly detailed digital records of Vigan's historical structures, artifacts, and documents. This also involves establishing online marketplaces specifically designed to showcase and sell the traditional crafts and products made by Vigan's local artisans

Support for Traditional Crafts & Artisans: This goes beyond just selling, focusing on the human element behind Vigan's unique cultural product. This involves technical training and programs aimed at sustaining the practice of Vigan's traditional crafts. Moreover, according to Kumar G., Vidyullath RJ , and Dileep G. (2021), Art and architecture, through time-tested creativity, embody the unique aesthetic and cultural heritage of a place. Incorporating traditional arts and crafts into modern design preserves skills and knowledge, enriching urban environments with a humane architectural legacy.

Adaptive Reuse of Heritage Structures and spaces: According to Savoie, É., Sapinski, J. P., & Laroche, A. (2025), this principle focuses on giving new life to old buildings in a respectful and economically viable way. It avoids the demolition of existing structures and the significant environmental impact (waste generation, material extraction, energy consumption) associated with new construction. Reusing buildings and transforming them into green buildings is inherently more sustainable than building new ones (Liang, L. et. al., 2023). It also includes developing plain sites into sustainable income-generating locations, such as Riverine Heritage, where the main rivers can be transformed into healthy ones that can be a basis for new tourism offerings (e.g., eco-boat tours highlighting its history and ecology), promoting sustainable recreation and generating local income. Furthermore, according to Bullen and Love (2011, conserving heritage buildings through adaptive reuse contributes to a more sustainable urban environment by leveraging their economic, cultural, and social benefits for urban regeneration.

Sustainable Materials Sourcing: This emphasizes the environmental responsibility behind the materials used in Vigan's development and conservation (Mfon, 2023). This involves making conscious choices about where and how construction and repair materials are obtained, prioritizing materials that are environmentally responsible, locally available, and culturally appropriate (Mfon, 2023).

Heritage Education Programs and Homeowner Empowerment: These initiatives focus on building human capacity and fostering a shared sense of responsibility for Vigan's heritage. According to UNESCO, knowledge and ownership are key to sustainable preservation. Educated youth grow into adults who value and protect their heritage. Well-maintained heritage properties contribute to Vigan's overall aesthetic appeal, which is vital for its tourism economy (Cruz, 2017). When the community sees itself as the primary custodian, sustainability efforts are more likely to be embraced and endure.

Another crucial integration for Vigan City to achieve sustainability would be firmly rooted in Green Economics and Green Accounting. This approach entails re-framing economic activity to explicitly value natural capital and ecosystem services, internalize environmental costs, and promote sustainable wealth creation. For Vigan, as a UNESCO World Heritage City, this specifically means integrating its unique cultural assets into a robust green economic framework. In order to achieve Green Economics and Green Accounting, it is necessary to adhere to Economic Valuation Studies, Green Tourism Product Development, Investment in Green Skills Training, Support for Eco-Friendly Businesses, Sustainability Accounting and Integrated Budgeting, and Green Infrastructure Heritage Restoration Projects.

Economic Valuation Studies: Conduct studies to quantify the monetary value of Vigan's natural assets (Ecological Economics, 2021). For example, calculate the economic benefit of flood regulation provided by surrounding wetlands and the Mestizo River's natural flood plains, the value of clean water for tourism and local consumption, or the carbon sequestration value of its urban trees.

Green Tourism Product Development: Market Vigan's heritage not just for its architecture, but also for its commitment to environmental sustainability. Offer eco-tours (e.g., Mestizo River clean-up and cultural boat tours), highlight traditional sustainable practices in local crafts and food production, and attract a growing segment of environmentally conscious tourists.

Investment in Green Skills Training: Partner with TESDA and local vocational schools to train Viganians in skills relevant to the green economy (TESDA, 2017) – including solar panel installation and maintenance, waste management and recycling operations, ecological restoration, sustainable agriculture, and heritage conservation using green techniques, including waste-to-wealth initiatives and Water Recycling and Reuse.

Support for Eco-Friendly Businesses and local entrepreneurs: Provide incentives (e.g., tax breaks, grants, streamlined permitting) for local businesses that adopt green practices – energy-efficient hotels, organic farms, artisan workshops using sustainable materials, and tour operators promoting low-impact tourism (Ahenkan, A., 2025). Holistically assisting local entrepreneurs by providing financing, marketing, and general business training. This initiative aims to enable Vigan City to thrive economically and further uplift the socio-economic status of local communities.

Sustainability Accounting and Integrated Budgeting: Systematically measuring the stock and flow of Vigan's natural resources and ecosystem services, and integrating these into official economic accounts (Bisogno, M., 2025). Publicly reporting on Vigan's environmental and social performance alongside its financial performance, using a standardized set of indicators. Incorporate environmental and social costs and benefits directly into the city's annual budgeting process (Pojani, 2025). This means, for instance, evaluating infrastructure projects not just on direct financial returns, but also on their environmental footprint and social equity.

Green Infrastructure Heritage Restoration Projects: According to Barbosa (2018), the conduct comprehensive cost-benefit analyses that factor in not just the direct restoration costs, but also the long-term economic benefits (increased tourism, property value appreciation, job creation) and non-market values (cultural significance, community pride, avoided degradation costs) of heritage preservation. Thus promoting green infrastructure projects, including buildings and spaces to integrate a thriving eco life.

To establish Vigan City as a globally exemplary model of a sustainable urban heritage settlement, characterized by the synergistic integration of advanced scientific and technological innovations with profound cultural preservation strategies. This endeavor aims to cultivate a resilient and inclusive urban ecosystem that fosters a dynamic green economy, ensures the equitable distribution of resources, and empowers an environmentally literate citizenry to actively participate in the stewardship of its built, natural, and intangible heritage. Through this transformative process, Vigan will achieve sustained socio-economic prosperity, enhance urban liveability, and mitigate environmental degradation, thereby contributing demonstrably to global sustainability agendas and serving as a pragmatic case study for achieving UN SDG 11 within culturally significant contexts.

 **EXPECTED OUTCOMES**

With its three-part framework, the overarching aim is to transform Vigan City into a truly sustainable urban center. This development is envisioned as being driven by a green tourism-based economy, a robust focus on cultural heritage preservation, and comprehensive environmental protection. The proposed solutions are expected to facilitate the city's evolution into a prominent cultural hub, an economically thriving locale, and a model of environmental conservation.

Through the strategic application of science and technology across urban monitoring, renewable energy, sustainable transport, citizen engagement, spatial planning, and environmental analysis (Shao, J., & Min, B., 2024), Vigan City will evolve into a smart, resilient, and environmentally harmonious heritage city. This integrated approach will foster a data-driven culture for sustainable urban management, significantly reduce Vigan's ecological footprint, enhance the well-being of its citizens, and ensure the long-term preservation of its unique cultural heritage for future generations, ultimately solidifying its status as a leading example of sustainable urban development.

Vigan City's strategic investment in heritage and culture, empowered by innovative approaches (Cruz, 2017), will lead to its emergence as a globally recognized model for sustainable heritage cities. This will be characterized by a thriving local economy driven by revitalized traditional crafts and responsible tourism, a resilient built environment that respects and reuses its past while embracing green principles, and an empowered community deeply engaged in the ongoing preservation and innovative adaptation of its unique cultural identity for future generations (Jiang et al., 2023).

Vigan City's dedicated efforts in economic valuation, green tourism, skills development, business support, and integrated governance will establish it as a leading example of a thriving, sustainable, and inclusive heritage economy. This comprehensive approach will ensure that Vigan's economic growth is intrinsically linked to its environmental health and social well-being, fostering a green and resilient local economy where natural capital is valued, businesses are eco-conscious, the workforce is skilled in sustainable practices, and city finances are managed with a long-term commitment to environmental and social prosperity.

**IMPLEMENTATION PHASE**

 Achieving true sustainability in Vigan City, as envisioned by our comprehensive goals, solutions, and anticipated outcomes, requires a two-part and highly integrated implementation process. This isn't just about launching individual projects; it's about establishing a systemic change that permeates governance, community behavior, and economic activities.

Part I: Foundational Pillars for Implementation

Building a truly sustainable city hinges on a few key things. First, you need strong political will and leadership from the city's executive government, city council, and relevant departments. They need to consistently champion the sustainability agenda by allocating budgets, issuing executive orders, and advocating for supportive policies (Speeches: Taking the Philippine Procurement System to the Next Level, 2023. This commitment sets the tone and ensures projects have the resources to succeed. Second, robust governance and regulatory frameworks are essential. This means reviewing and updating existing city ordinances—like those for zoning, building codes, and waste management—to explicitly align with sustainability principles, and empowering relevant bodies with clear mandates. Finally, cross-sectoral collaboration is vital. You need to bring together representatives from local government units (including barangays), academia, the private sector, and civil society organizations to work together on a "Brown-Green Task Force."

Part II: Strategic Implementation Phases and Specific Approaches

The second part requires three phases for effeieicnt implmentation. Data-Driven Planning & Capacity Building (Years 1-2), Pilot Projects & Phased Rollout (Years 2-5), and Scaling & Institutionalization (Years 5-10+).

Phase 1: Data-Driven Planning & Capacity Building (Years 1-2)

To build a sustainable future, we first need to get smart about data. That means immediately implementing a Real-time Urban Monitoring & Analytics Dashboard and an Environmental Forensics network to gather crucial baseline information, and also conducting Economic Valuation Studies to understand our natural assets. We can even partner with academic institutions to train our city staff and local professionals in data science and environmental analysis. Alongside this, we need to invest in our people through capacity building and awareness campaigns. This involves launching Heritage Education Programs in schools and communities, running public awareness campaigns on sustainable practices like waste segregation and energy conservation, and developing Green Skills Training programs with TESDA and local vocational schools to teach practical skills like solar panel installation and waste management.

Phase 2: Pilot Projects & Phased Rollout (Years 2-5)

To achieve these goals, the city should initiate Demonstration Projects for Key Initiatives. This involves piloting Rooftop Solar Panels on select public buildings and integrating Electric Vehicles (EVs) into public transport, such as through electric shuttle routes. Additionally, a heritage structure could be adaptively reused as a "green building" or a sustainable income-generating space to showcase these principles. The city can also implement specific Green Tourism Product Development initiatives, such as a guided Mestizo River eco-tour, and launch an online marketplace for local crafts.

The second phase focuses on Community Empowerment and Incentivization. This can be achieved by rolling out a Citizen Science & Crowdsourcing for Data Collection program, providing accessible tools and training to residents. The city should also develop and implement a Homeowner Empowerment program, offering technical assistance, small grants, or low-interest loans for heritage property maintenance and sustainable retrofits. Furthermore, an incentive framework for Eco-Friendly Businesses and Local Entrepreneurs should be established, possibly through a "Green Business Certification" offering tax breaks or marketing support.

Phase 3: Scaling & Institutionalization (Years 5-10+)

The final phase encompasses Full-Scale Implementation and Infrastructure Development. This involves scaling up successful pilot projects, expanding rooftop solar installations city-wide, and gradually transitioning the entire public transport fleet to electric vehicles, supported by established charging infrastructure. The city will also develop additional green infrastructure projects, such as permeable pavements and urban green spaces, informed by geospatial analysis for risk assessment. Furthermore, Sustainable Materials Sourcing guidelines will be systematically applied to all public and private construction projects.

This third phase also includes Integrated Planning and Financial Sustainability. This requires fully institutionalizing Sustainability Accounting and Integrated Budgeting, ensuring all city departments incorporate environmental and social considerations into their budget proposals and performance metrics. The city can explore innovative financing mechanisms, including Public-Private Partnerships (PPPs) for large-scale green projects, green bonds, and leveraging international climate finance.

To solidify these initiatives, there should be Continuous Monitoring, Evaluation, and Adaptation. This entails establishing a permanent monitoring and evaluation framework, utilizing dashboards and citizen science data to track progress against key sustainability indicators. Regular reviews will be conducted, and strategies will be adapted based on performance data, emerging technologies, and changing community needs, ensuring the city remains agile in its sustainability journey.

**CONCLUSION**

Vigan City, Ilocos Sur, is on an ambitious path to become a sustainable urban heritage settlement, a vision that seamlessly integrates its UNESCO World Heritage status with a future of prosperity and resilience. This transformation hinges on a multi-pronged strategy that leverages science and technology, deeply rooted cultural preservation, and the cultivation of a green economy (Cruz, 2017). Key initiatives include the implementation of a real-time urban monitoring and analytics dashboard to optimize tourism flow and enhance urban mobility. Concurrently, Vigan is committed to transitioning towards renewable energy and developing energy-efficient green infrastructure. Sustainable transport is championed through electric vehicle integration, while citizen science programs empower residents in data collection for precise environmental interventions. Crucially, geospatial analysis and environmental forensics are vital for proactive risk assessment, resilient planning, and safeguarding public health, ensuring that all decisions are evidence-based (Jiang et al., 2023).

Beyond technological and environmental advancements, Vigan's sustainability blueprint profoundly integrates its heritage and economic vitality. Initiatives like digital tourism and heritage preservation not only safeguard invaluable cultural assets but also diversify revenue streams (Ahuja, 2024). Robust support for traditional crafts and artisans through training and market access ensures the continuity of Vigan's unique cultural products (Cruz, 2017). The adaptive reuse of heritage structures into green buildings (Savoie et al., 2025), coupled with the sustainable development of natural sites like the Mestizo River, underscores a commitment to environmentally responsible growth. Furthermore, an emphasis on sustainable materials sourcing, heritage education programs, and homeowner empowerment fosters a collective sense of responsibility and stewardship. Economically, the city is set to thrive through green tourism product development, strategic investments in green skills training, and incentives for eco-friendly businesses (Green Skills for Green Jobs, 2017). Crucially, sustainability accounting and integrated budgeting will ensure transparent, long-term financial planning that values natural capital, while green infrastructure heritage restoration projects will blend cultural preservation with ecological benefits (Shao & Min, 2024). This comprehensive strategy, meticulously aligning with UN SDG 11, aims to establish Vigan as a global exemplar, demonstrating how a city can successfully balance progress with preservation, fostering a prosperous and resilient future for all its inhabitants.

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