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The integrated environmental sustainability strategy of BSB City, Semarang

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Abstract

This study aimed to evaluate the integrated environmental sustainability strategies adopted in Bukit Semarang Baru (BSB) City, Semarang, Indonesia. The study technique involves a thorough examination of both primary and secondary data, as well as stakeholder discussions and literature studies. The core data were gathered from questionnaires distributed to specialists and the general people in BSB City. The collection of secondary data involved both bibliometric analysis and a survey of academic literature pertaining to sustainability, sustainable development, and environmental issues. The findings provide light on the strategic approaches and activities for sustainable development in BSB City. The paper emphasizes the necessity of stakeholder participation, policy execution, and cooperation in accomplishing sustainability objectives. The findings of this study can help BSB City's decision-makers and stakeholders navigate a more sustainable future.

Keywords: Sustainability; Bukit Semarang Baru (BSB) City; Factors; Strategies; Vos Viewer

1. Introduction

Cities emerge through complex networks developed from countless human initiatives, wielding notable influence over societal, cultural and economic progress across nations (1). Projections foresee continuing rural-urban migration combined with worldwide population growth potentially directing around 2.5 billion people into urban settings by 2050, with practically 90% of this population surge in Asia and Africa (2). This phenomenon breeds technical, social, economic and administrative complications, endangering cities' financial and ecological sustainability. Addressing such hardships becomes pivotal to enhancing livability through sustainable development (3). City managers must devise clever strategies for optimizing activities, environments, energy use and quality of life when planning. Many cities are now classified as smarter places thanks to information and communication infrastructure that enhances efficiency, resilience and wellness. Smarter, sustainable cities necessarily ensure fair career and business prospects, good public transportation, affordable, secure housing, participatory governance and shared prosperity (4, 5). The vision interconnects with kindred concepts like sustainable, digital and eco-cities (6).

Over the past two decades, strategically directing urban hubs has increasingly surfaced as a pivotal pursuit for establishing sustainable progress (7). The UN acknowledged the seminal role played by eco-conscious metropolitan zones and their surrounding communities in advancing socioeconomic flourishing, encapsulating this within their 11th developmental objective, seeking to create locations that are participatory, safeguarded, adaptable and environment-conscious (8). The notions of a "sustainable metropolis" remain subjective and evolving, shaped by standpoints and affected by financial, societal, ecological and technological transformations (9). The assessment of sustainability can be viewed as a challenge in effective management. Prophesied policy modifications may foster locations providing improved access, functionality and eco-friendliness, together with strengthened unity and incorporation, where present and potential denizens alike can jointly prosper in harmony (10). Ensuring lasting equilibrium amidst economic, societal and ecological elements is the goal of city sustainability. Effectively addressing these "Triple Bottom Lines" bolsters urban progress and protects the environment (11). Scholars agree that evaluating sustainability outcomes within urban

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settings generates useful understandings for establishing aims, crafting approaches, and providing many advantages to public stakeholders (12-14). Appraising metropolitan region sustainability fulfills a pivotal function in gauging and tracking cities' levels of stability over time. It acts as a beneficial instrument for translating the overarching notion of urban sustainability into practical and applicable development initiatives led by local governing bodies (15, 16). And by doing assessments, local authorities will be able to identify strengths and weaknesses and the amount of progress made in the sustainability of their cities. Methods which based on indicators have increasing in usage among researchers in recent years for evaluating sustainability dimensions. The primary objective of these methods is to integrate these dimensions and set benchmarks for global cities (5). By using indicators, researchers can effectively assess various aspects of sustainability in cities.

For example Wątróbski, Bączkiewicz, Ziemba and Sałabun (17) proposed in their paper an innovative sustainability assessment method which is DARIA-TOPSIS method, or Data Variability Assessment Technique for Order of Preference by Similarity to Ideal Solution. It combines the multi-criteria decision analysis (MCDA) approach with the variability of the alternatives' performance measurement. In 26 European countries, sustainable communities and cities were evaluated using this method.

Also Ozkaya and Erdin (18) wrote an article about evaluation of sustainable cities using a hybrid MCDM approach based on ANP and TOPSIS technique. They made comparisons by TOPSIS for 44 cities around the world according to 47 indicators like the innovative spirit, attractivity of natural, conditions, smart living, smart governance etc...

Indonesia has rapidly urbanized in recent decades to become one of the most populous nations worldwide, comprising over 270 million citizens across its expansive archipelago as of the 2020 census. Approximately 56% of Indonesia's urban residents inhabit the densely populated island of Java, with cities there growing annually at 2.5%. One such urban center experiencing substantial changes is Semarang City in Central Java, home to over 1.65 million people. As the primary metropolis in the region, Semarang has undergone significant land use and land cover (LULC) alterations as expanding development converts agricultural parcels to built-up areas to accommodate its rising population. This pattern of conversion from rural to urbanized spaces to house growing communities is a larger issue across Indonesia as the country works to balance economic needs, environmental stewardship, and social welfare in its land and infrastructure planning. Sustainable best practices will be important to consider to support healthy, resilient and equitable development at local and national scales (19). Additionally, Semarang City holds significance as one of 47 officially designated metropolitan coastal cities within Indonesia (20).

As one of these dynamic waterfront metropolises itself, Semarang undoubtedly faces intricate planning needs to balance the demands of an actively growing populace with environmental sustainability in its coastal setting. Its experience offers insight applicable to guiding other thriving coastal cities towards resilient, equitable and harmonious development within local ecosystems.

Bukit Semarang Baru (BSB) City within Semarang City is therefore designed as a model of urban planning with environmental stewardship and social progress at its core.

Built from the ground up on a reforested site starting 2012, BSB City prioritizes compact, mixed-use development to minimize sprawl. Over 80% of the city is reserved for public greenspace including urban farms, restoring natural habitats. Waste management also focuses on circular systems like composting and renewable energy from solar and hydropower plants. BSB City is uniquely designed with walkability and accessibility in mind. Narrow streets and bike-friendly lanes discourage vehicle usage and promote active lifestyles. Public transportation including electric shuttles is also subsidized for residents. Through these smart growth approaches, BSB City has already achieved a 40% reduction in carbon emissions compared to conventional cities of its size. Community engagement is another strength, with participatory planning and community gardens/cooperatives empowering residents. Affordable housing helps realize the vision of an inclusive, equitable city.

The aim of this paper is to conduct a first-hand assessment of the environmental sustainability practices adopted by BSB City in Semarang, Indonesia through primary data collection and analysis.

Specifically, this research will:

- Analyze the impact of current environmental practices in the city of BSB on environmental sustainability and the preservation of natural resources.
- Identify the strengths and weaknesses in the readiness of the city of BSB to implement smart city concepts.3. Identify potential opportunities and initiatives to enhance environmental sustainability in the city of BSB.

- Develop a comprehensive strategy to promote environmental sustainability in the city of BSB, including natural resource management, biodiversity conservation, pollution reduction, and promotion of sustainable energy.
- Highlight the economic and social benefits of implementing environmental factors and environmental sustainability in the city of BSB.

As an original case study, this article aims to contribute new empirical understanding of how this eco-city has pursued environmental stewardship and social progress goals on the ground. Findings can guide further development of BSB City as well as inform similar initiatives regionally.

The study focuses on identifying strategic approaches for achieving environmental sustainability in BSB City. As cities face increasingly complex sustainability challenges, it is crucial to develop effective strategies that can address these challenges and promote sustainable development. The research also emphasizes leveraging the existing competencies and strengths of BSB City. By identifying and capitalizing on the city's expertise in areas such as renewable energy and waste reduction, the research aims to maximize the potential for sustainable development.

The research incorporates stakeholder consultations, ensuring that the perspectives and insights of various stakeholders, including local authorities, experts, and the public, are taken into account. This participatory approach enhances the relevance and effectiveness of the strategies proposed, as it considers the needs and aspirations of the community.

Overall, this research is important as it provides a roadmap for BSB City to achieve environmental sustainability. By leveraging local competencies, engaging stakeholders, promoting collaboration, and fostering community engagement, the research aims to guide BSB City towards a more sustainable and resilient future.

2. Material and methods

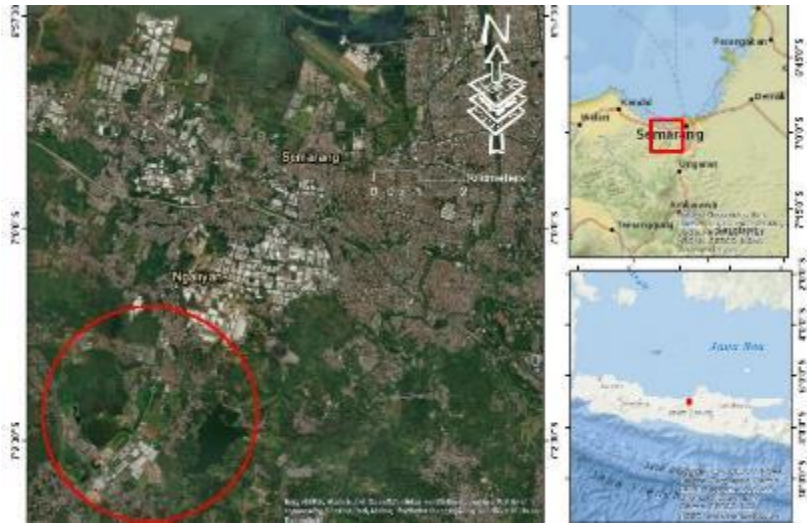

Figure 1 Research location

This study aims to develop an integrated sustainability strategy for BSB City, Semarang based on assessing its readiness for implementing smart city concepts. BSB was selected as the focus area as a satellite city within Semarang metropolitan region that plays an important supporting role in regional development. Surveys were used as a primary data collection method in this study. The surveys were administered to gather information and opinions directly from the targeted participants in BSB City. The survey questions were designed to elicit responses related to sustainability practices, challenges, and potential strategies. The participants were selected based on their relevance to the study, such as experts, and members of the community. The survey responses provided valuable insights and perspectives that were incorporated into the analysis and discussions of the research findings. The secondary data was obtained through bibliometric analysis and a review of scientific literature published in journals and conferences related to sustainability and sustainable development. These sources were analyzed and reviewed to extract the most relevant information and recommendations pertaining to sustainable strategies and initiatives. Overall, this comprehensive methodology was implemented to ensure robust and supported findings that contribute to identifying strategic priorities and guiding sustainable development in BSB City.

3. Systematic Review

Systematic reviews can be classified into three main types: domain-based reviews, theory-based reviews, and review-based methods. Domain-based reviews encompass structured reviews, bibliometric frameworks, hybrid structured reviews–bibliometric studies, and studies focused on theory development. Theory-based reviews, on the other hand, center around theories and aim to analyze and synthesize existing literature to further develop theoretical frameworks. Lastly, review-based methods involve the use of systematic review techniques to examine and evaluate existing reviews on a specific topic.

Structured reviews play a crucial role in identifying research gaps within theories and methodologies. They are constructed by compiling and analyzing relevant information from various sources, providing researchers with a comprehensive overview of the existing literature in a particular field. To define and investigate the aspects that influence sustainability in cities, literature reviews were undertaken using the methodology of (21), which included the PRISMA 2020 process as a qualitative systematic review. Science mapping was used to examine the sustainability factors of cities, which are being investigated worldwide by various scholars. The systematic review was conducted using the PRISMA 2020 guideline (22). This process included steps for inclusion, eligibility, screening, and identification before scientific mapping and qualitative content analysis. Using paper selection and delimitation as a guide, the identification phase of the systematic review was carried out in order to locate relevant publications and their metadata that have an impact on sustainability in urban areas. Extensive metadata and citation information were extracted in substantial quantities. using the Scopus database (accessed on January 25, 2024). During the initial screening of relevant articles, three keywords were employed to facilitate the process. The term “sustainable” (168,273 documents) was used. Furthermore, more search results for the words "factor" (3,345 papers) and "city" (14,908 documents) were obtained. Some researches were eliminated from the pool of studies due to confusing methodologies, inadequate data, and low quality. During the screening process, only English-language research publications, review articles, and conference proceedings were considered. The papers were confined to journal sources (2907 documents) and spanned three years, from 2020 to 2023. The articles were then restricted to the keywords "Environmental factor", "Factor analysis", and "Risk factor". The publication stage was complete, and all materials were open access. Two journals with the most articles in the field of city sustainability implementation were chosen. These were Sustainability Switzerland (44 documents) and the International Journal of Environmental Research and Public Health (40 documents). During the eligibility process, 84 documents were discovered. The researchers observed and identified papers that fulfilled the following criteria: (1) publications that focused on the case-study approach, (2) studies that emphasized the design, promotion, and implementation of sustainability in cities, and (3) studies that investigated the impact of sustainability benchmarking across cities. In the inclusion phase, a total of 61 papers were further examined. During this process, all abstract and title metadata were extracted to facilitate bibliometric and qualitative evaluation.

3.1. Qualitative Content Analysis

Bibliometric analysis was used to identify environmental sustainability factors (23). VOSviewer version 1.6.15, which produces complex and dynamic interactions within a single image, might be used to extract critical components. Because the focus of this research is on the strategies that are derived from the elements that have been established, van Eck and Waltman's work provides further reading for VOSviewer (Van Eck & Waltman, 2010). This is a useful tool for text-mining analysis, scientific mapping, and displaying a study subject. The terms were picked and chosen based on how often, how strongly, and how relevantly they relate to sustainability in cities. In the realm of sustainability in cities, leading and developing research themes and trends were reflected by stronger and more frequent occurrences (Lis & Tomanek, 2020). The corresponding term from VOSviewer was identified and connected to the definition of sustainability factors using qualitative content analysis. Bibliometric analysis could help qualitative data analysis by giving pertinent keywords (also known as factors) that arose from the investigation. To explain the factors revealed, qualitative content analysis required summarizing, rearranging, and reordering.

The EndNote X7 aided in matching the identified terms to their corresponding SWOT classifications. Further examination then involved applying SWOT-QSPM analysis.

With respect to environmental sustainability determinants impacting urban settings, Figure 1 outlines the process followed to pinpoint said variables: first exploring to uncover applicable keywords, then determining precise definitions, and lastly categorizing findings. Bibliometric scanning using VOSviewer version 1.6.15 extracted high-influence terms. Qualitative content evaluation paired these themes with their definitions as either strengths, weaknesses, opportunities, or threats.

All elements were then given clear explanations and rationally categorized by field of municipal practice. Thereafter, SWOT-QSPM illuminated strategic implications. In sum, the depicted methodology systematically derived actionable insights regarding factors shaping urban sustainability through qualified translation and clustering of research insights.

3.2. BSB City Profile Data Collection

The choice to conduct a case study on BSB City was driven by factors such as the availability of data and the opportunity to showcase initiatives aligned with the Sustainable Development Goals (SDGs) within an urban environment. Municipal structures, enterprises, investors, and other local entities had instituted programs and practices delivering community-wide benefits such as comfort, safety, wellness, and environmental protection.

Over a four-month period from October 2023 to January 2024, diverse public and private functions and events were documented that were believed to be supportive of achieving the UN Sustainable Development Goals. Primary data collection involved direct surveys. On-location observations and stakeholder consultations provided insights into initiatives and operations with potential relevance for advancing the SDGs at a municipal scale in BSB City.

The selection of this case provides a useful case study for assessing linkages between specific urban interventions, activities, and resultant impacts aligned with the global sustainable development framework. The mixed methodology enhanced the comprehensiveness of data gathering, while direct engagement strengthened the validity and contextual relevance of findings.

3.3. SWOT–QSPM Analysis

A Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis was conducted to help guide strategic planning aimed at enhancing the city's sustainability. This established framework was adapted from previous analogous studies while retaining core analytical functions (24) (25). By systematically assessing both internal and external factors, the SWOT approach facilitates identification of leverageable attributes alongside risks and challenges within the operating environment. The resulting insights inform priority-setting and initiative design conducive to strengthening urban resilience and long-term viability considering stakeholder needs and evolving external forces.

The SWOT-based strategic framework incorporated input from key stakeholders through a validating survey. Twelve respondents participated, each meeting the following criteria:

- At least three years' involvement in the city's sustainability programs
- Minimum undergraduate-level education
- Employment as an administrator, educator, or related stakeholder

Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices objectively assessed the weight of internal and external determinants. These tools facilitated ranking influences to optimally tailor strategies.

A SWOT factor questionnaire was distributed. Respondents then assigned each variable a score between 1-4 to rate relevance as a strength, weakness, opportunity, or threat. Attributes were weighted by perceived impact on sustainability implementation.

Final factor scores resulted from multiplying weights and ratings. The total score of the IFE and EFE matrices was calculated by summing the multiplied scores. The matrices showed that a mean score > 2.5 indicated the organization's strength and opportunity, while a mean score < 2.5 indicated the city's weakness and threat position.

After conducting the IFE and EFE analyses, the organizational position within one of the four SWOT framework quadrants could be determined:

- Strengths-Threats (ST): strategies which utilize internal strengths to mitigate external threats.
- Weaknesses-Threats (WT): strategies aiming to minimize the impact of threats while considering weaknesses.
- Weaknesses-Opportunities (WO): strategies leveraging opportunities to overcome weaknesses.
- Strengths-Opportunities (SO): the most aggressive strategies combine strengths and opportunities.

As depicted in Figure 2, which illustrates the SWOT model for city sustainability planning, The SWOT analysis facilitates strategic direction-setting by systematically relating internal and external factors to identify the most advantageous position. Regular re-evaluation ensures the strategic approach maintains responsiveness amid changing conditions over time.

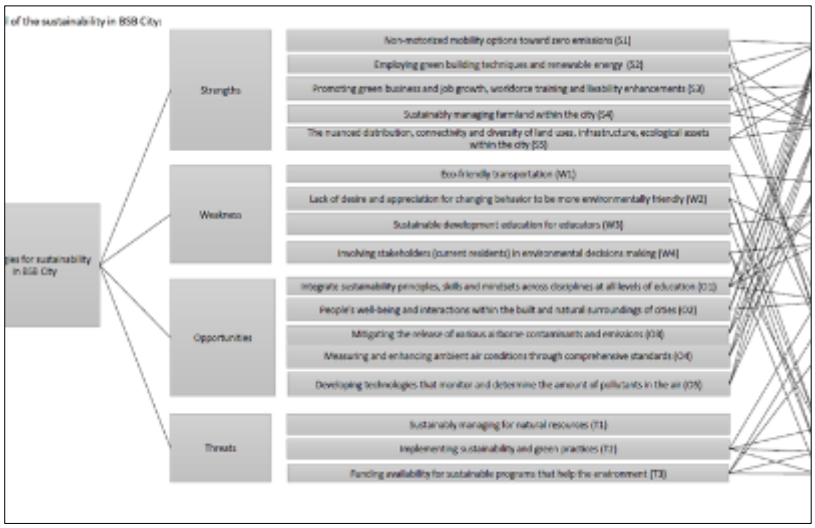

Figure 2 SWOT model of sustainability in BSB City

The QSPM (Quantitative Strategic Planning Matrix) approach was applied to objectively evaluate and rank proposed strategies. Accurately assessing strategic viability per SWOT outputs requires diligent QSPM execution.

Factors are assigned attractiveness and weight scores for each strategy. Attractiveness scores (AS) range from 1 to 4. 1 signifies no alignment, 2 minimal, 3 moderate and 4 strong alignments between factor and strategy. A 1 means a factor does not impact the strategy, 4 indicates significant impact.

Weighting represents the relative priority of factors. Multiplying attractiveness by weight derives overall attractiveness scores (ATS) for quantitative comparison across strategies. For this municipal sustainability planning environment, QSPM provides an essential quantitative mechanism to substantiate strategic selection based on analytical factors. Ongoing re-assessment maintains responsiveness to context changes over time. Engaging stakeholders cultivates understanding and buy-in critical for implementation success.

4. Results

4.1. Sustainability Factors in cities

Bibliometric network mapping using VOSviewer software can reveal core factors studied within urban sustainability research globally. Among the 61 papers examined, 902 terms were extracted from textual data for additional analysis. Figure 3 outlines a visualization of the frequently co- metadata.

The numerous environmental factors influencing sustainability efforts were reorganized within one overarching dimension relevant to urban settings as shown in Table 1. The dimension that was taken is the environmental dimension of sustainability

Here are some additional explanations regarding the internal and external classifications:

Internal factors refer to elements that a city has direct control or influence over through its governance, operations, policies and programs. These include:

- Building techniques, renewable energy and initiatives focused on resident well-being that the city can implement internally.
- How it structures education, stakeholder involvement to guide decision-making.
- Managing resources and land uses that fall within its municipal boundaries.
- Designing its internal transportation systems and defining roles/responsibilities of citizens.

External factors are generally outside a city's direct control but still impact sustainability goals. The city has less influence over:

- Mobility options, businesses and funding determined at higher scales like regionally.
- Pollution sources from economic activities, transportation and land uses in neighboring areas transported into the city via air/water.
- Technological advances developed elsewhere that can help monitor city's pollution situation.
- Shaping behaviors and attitudes relies on collaborative efforts beyond just municipal programs.
- Natural and built surroundings are joint products of urban planning at multiple governmental levels.

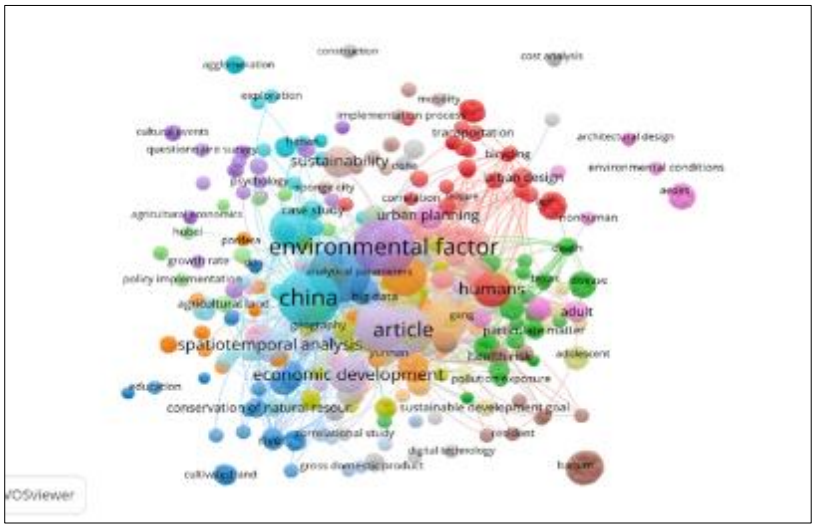

Figure 3 Co-occurrence terms in the network map of sustainability factors in cities

For sustainability planning, cities must weigh internal vs. external variables, collaborating extensively on the latter while prioritizing initiatives they can implement autonomously under their jurisdiction. Monitoring this interplay aids in crafting tailored, multi-level strategies over time.

Here is a classification of the factors according to whether they are internal or external factors in relation to environmental sustainability in BSB City:

Internal Factors:

- -Non-motorized mobility options toward zero emissions
- -Employing green building techniques and renewable energy
- -Monitoring and proactively improving residents' physical, mental and social wellbeing
- -Promoting green business and job growth, workforce training and livability enhancements
- -The roles and responsibilities of the adult population within cities
- -Sustainably managing farmland within the city
- -The nuanced distribution, connectivity and diversity of land uses, infrastructure, ecological assets within the city
- -Comfortable and safe transportation
- -Lack of desire and appreciation for changing behavior to be more environmentally friendly
- -Sustainable-development education for educators
- -Involving stakeholders (current residents) in environmental decisions making

External Factors:

- -Doing research activities
- -Integrate sustainability principles, skills and mindsets across disciplines at all levels of education
- -People's well-being and interactions within the built and natural surroundings of cities
- -Mitigating the release of various airborne contaminants and emissions
- -Measuring and enhancing ambient air conditions through comprehensive standards
- -Developing technologies that monitor and determine the amount of pollutants in the air
- -Sustainably managing for natural resources
- -Implementing sustainability and green practices

- -People satisfaction related to life and environment
- -Funding availability for sustainable programs that help the environment

Table 1 Sustainability factors in BSB City

Terms as Factors	Factor Definition	References
Transportation, transportation safety, transportation mode	Ecofriendly transportation	(26) (27)
Bicycling	Non-motorized mobility options toward zero emissions	(28) (29)
Urban design, urban planning, urban area	Employing green building techniques and renewable energy	(30, 31)
Humans	People's well-being and interactions within the built and natural surroundings of cities	(32, 33)
Air pollution, atmospheric pollution monitoring	Mitigating the release of various airborne contaminants and emissions	(34, 35)
Air quality	Measuring and enhancing ambient air conditions through comprehensive standards	(36, 37)
Emission control	Developing technologies that monitor and determine the amount of pollutants in the air	(38, 39)
Economic development, institutional framework, administrative framework	Promoting green business and job growth, workforce training and livability enhancements	(40, 41)
Agricultural land	Sustainably managing farmland within the city	(42, 43)
Spatial variation	The nuanced distribution, connectivity and diversity of land uses, infrastructure, ecological assets within the city	(44, 45)
Conservation of natural resources	Sustainably managing for natural resources	(46, 47)
Sustainability, sustainable economy, sustainable agriculture	Implementing sustainability and green practices	(48)
Education for sustainable development	Integrate sustainability principles, skills and mindsets across disciplines at all levels of education	(49)
Finance, financial management	Funding availability for sustainable programs that help the environment	(50)
Resident, decision making	Involving stakeholders (current residents) in environmental decisions making	(51)
Ecological education, management education	Sustainable-development education for educators	(52)
Behavior assessment, social behavior	Lack of desire and appreciation for changing behavior to be more environmentally friendly	(53)

4.2. Strategies Enhancing Sustainability Implementation in BSB City, WJS Heading level 2

To gain a comprehensive perspective, each influential element was categorized within either the inward-focused or outward-focused assessment instrument. This tool was intended to discern BSB City's current circumstances. The proportional weight shown in Table 2 stems from finding the average ranking granted to every factor across all respondents. Tables 2 and 3 unveil the results of internally appraising internal and external factors. Both internal and external factors surpassed the 2.5 benchmark delineated in these tables, with scores of 2670 for internal and 2836 for external dimensions. Such quotients imply BSB City must execute bold tactics to capitalize on open doors and inner qualities, with the goal of sustaining and progressing sustainable initiatives.

Table 2 Summary of internal-factor evaluation

No	Code	Factors	Normalized Weight	Rank	Weighted Score
1	S1	Non-motorized mobility options toward zero emissions	0.104	4	0.416
2	S2	Employing green building techniques and renewable energy	0.091	4	0.364
3	S3	Promoting green business and job growth, workforce training and livability enhancements	0.169	3	0.507
4	S4	Sustainably managing farmland within the city	0.156	3	0.468
5	S5	The nuanced distribution, connectivity and diversity of land uses, infrastructure, ecological assets within the city	0.095	4	0.38
6	W1	Eco-friendly transportation	0.091	2	0.182
7	W2	Lack of desire and appreciation for changing behavior to be more environmentally friendly	0.059	2	0.118
8	W3	Sustainable development education for educators	0.111	1	0.111
9	W4	Involving stakeholders (current residents) in environmental decisions making	0.124	1	0.124
IFE			1		2.67

Table 3 Summary of external-factor evaluation

No	Code	Factors	Normalized Weight	Rank	Weighted Score
1	O1	Integrate sustainability principles, skills and mindsets across disciplines at all levels of education	0.07	4	0.28
2	O2	People's well-being and interactions within the built and natural surroundings of cities	0.148	4	0.592
3	O3	Mitigating the release of various airborne contaminants and emissions	0.163	3	0.489
4	O4	Measuring and enhancing ambient air conditions through comprehensive standards	0.144	3	0.432
5	O5	Developing technologies that monitor and determine the amount of pollutants in the air	0.183	3	0.549
6	T1	Sustainably managing for natural resources	0.101	2	0.202
7	T2	Implementing sustainability and green practices	0.101	2	0.202
8	T3	Funding availability for sustainable programs that help the environment	0.09	1	0.09
EFE			1		2.836

Upon consideration of the internal strength's appraisal, ''promoting green business and job growth, workforce training, and livability enhancements'' emerged as the most impactful driving force. Meanwhile, ''employing green building techniques and renewable energy'', was a less critical strength factor. Eco-friendly transportation and sustainable development education for educators were ranked as the most essential and insignificant weaknesses. People's well-being and interactions within the built and natural surroundings of cities was discovered to be the most important opportunity factor. The internal and external factor evaluations uncovered that BSB City presently requires proactive approaches addressing evolving sustainability elements. The synopsis of external factors exceeded those of internal

factors, signifying untapped exterior potential that warrants re-examination when implementing sustainable practices. Table 4 outlines strategies BSB City must undertake to make progress on sustainability goals.

Table 4 City position and SWOT strategies

Conservative Strategies (WO): 1. Forge partnerships with neighboring cities to share best practices in air quality monitoring. 2. Engage regional educational institutions in developing training programs for sustainability topics. 3. Form committees to review environmental regulations and policies.	Aggressive Strategies (SO): 1. Hosting conferences and events to spotlight BSB City as a hub for green innovation. 2. Attract entrepreneurs and industry leaders in cleantech fields through an advisory board. 3. Launch startup funding competitions for sustainability ventures.
Defensive Strategies (WT): 1. Lobby local government for stronger environmental construction and mobility rules. 2. Conduct outreach campaigns partnering with NGOs to boost community awareness on sustainability. 3. Diversify BSB City's funding sources through grants, public-private deals, impact investments.	Competitive Strategies (ST): 1. Market BSB City internationally through targeted trade missions to increase green investment. 2. Pursue collaborative research proposals with top universities to boost BSB City's profile. 3. Promotional campaigns highlighting BSB City's sustainable lifestyle aspects.

Table 5 Quantitative strategic-planning matrix

Sustainability Factors	**Normalized Weight**	**First Strategy**		**Second Strategy**		**Third Strategy**	
		AS	TAS1	AS	TAS2	AS	TAS3
S1	0.104	2	0.208	3	0.312	4	0.416
S2	0.091	4	0.364	4	0.364	2	0.182
S3	0.169	4	0.676	3	0.507	3	0.507
S4	0.156	3	0.468	3	0.468	3	0.468
S5	0.095	3	0.285	3	0.285	4	0.38
W1	0.091	4	0.364	4	0.364	4	0.364
W2	0.059	3	0.177	2	0.118	2	0.118
W3	0.111	3	0.333	3	0.333	3	0.333
W4	0.124	4	0.496	3	0.372	3	0.372
O1	0.07	4	0.28	4	0.28	4	0.28
O2	0.148	4	0.592	3	0.444	3	0.444
O3	0.163	4	0.652	3	0.489	3	0.489
O4	0.144	3	0.432	4	0.576	2	0.288
O5	0.183	3	0.549	3	0.549	3	0.549
T1	0.101	4	0.404	3	0.303	3	0.303
T2	0.101	4	0.404	3	0.303	4	0.404
T3	0.09	4	0.36	4	0.36	4	0.36
TAS for each strategy			7.238		6.321		6.279

The data presented in Table 5 shows that the highest-ranked strategic priority was "Hosting conferences and events to spotlight BSB City as a hub for green innovation" which received a score of 7.238. The second highest rating was "Attract

entrepreneurs and industry leaders in cleantech fields through an advisory board" at 6.321. Meanwhile, listed third in order of assessment was "Launch startup funding competitions for sustainability ventures" with an attained score of 6.279.

5. Discussion

This study aimed to determine strategic approaches towards achieving environmental sustainability in BSB City. A mixed-methods methodology incorporating bibliometric analysis and stakeholder consultations was applied.

5.1. Hosting Green Conferences and Events

The top-ranked strategy of hosting conferences and events to promote BSB City as a leader in green development capitalizes on local competencies. BSB City hosts many annual conventions and the convention center provides ideal facilities to host sustainability-focused forums. This allows showcasing current projects in renewable energy and waste reduction while enabling collaborations with international peers. Dedicating organizational resources to planning, promotion and delegate recruitment is key to leveraging such platforms (54).

5.2. Establishing a Sustainability Advisory Board

Creating a multi-sector advisory board comprising experts in fields like clean technology and climate preparedness secured second position. Expert steering supports strategic direction-setting and cross-department knowledge exchange. The board could guide transition roadmaps towards emerging green industries and scrutinize new legislations (55). Defined terms of office and transparent selection maintains engagement and advisory objectivity long-term.

5.3. Promoting Sustainability-Focused Business Incubation

Launching grant programs promoting localized sustainability innovations ranked third. Business incubators endorsed by local authorities help move ideas to commercialization. Through prototyping support, market research and compliance guidance, incubators aid ventures beyond conceptual stages (56). Linking funding to milestone achievement assures support yields wider economic and environmental benefits (57).

5.4. Developing Green Job Training Programs

While lower-ranked, establishing vocational courses in sustainable sectors addresses skill gaps constraining their scale-up. Curricula could cover retrofitting, renewable installation and waste recovery requiring certifications. Modular, flexible programming caters to diverse experience levels strengthening the green talent pool (58).

5.5. Community Involvement via Voluntary Initiatives

Engaging the wider public through volunteer-driven initiatives capitalizes on grassroots momentum. Activities like communal tree-planting sessions, coastal clean-ups and educational workshops allow environmental stewardship values to manifest in tangible ways (59). Such events foster a sense of shared ownership over sustainability objectives within the local population. With advance organization and suitable liability waivers, more residents may participate in community-led drives to promote causes such as urban forestry, marine conservation and public enlightenment. Regularly scheduled volunteer activities also help maintain focus and enthusiasm for sustainability goals amongst members of the public.

6. Conclusion

The study demonstrated a rigorous methodology incorporating both quantitative bibliometric analysis and qualitative stakeholder consultations to comprehensively identify strategic priority areas toward sustainability leadership in BSB City. This process allowed the leveraging of existing competencies and empirical research while also gaining vital local perspectives. Hosting major green conferences in BSB City was shown to capitalize on current strengths in renewable energy and waste reduction, providing an avenue to showcase progress as well as facilitate knowledge exchange among international peers. However, the discussion also highlighted the importance of dedicating significant organizational resources to implementation activities like planning, promotion, and delegate recruitment to fully optimize such events. Establishing a long-term multi-sector sustainability advisory board comprising expertise from domains such as clean technology and climate adaptation was another high-ranking approach identified. The board could provide informed

strategic direction and cross-department coordination over time. Ensuring transparency in composition and term setting was also deemed crucial to preserving objectivity. Launching targeted funding programs promoting the commercialization of localized sustainability innovations through incubator support for prototyping, marketing, and compliance was shown to be a viable means of accelerating such ventures past conceptual phases and into the market. Linking monetary awarding to clear milestone achievement was posited as vital to maximizing economic and environmental outcomes from these investments. While green job training expansion was a lower priority area, the discussion proposed a modular programming structure catered to varied experience levels as preferable to address skill shortages inhibiting industry scale-up. The study found that engaging broader public participation through community-led volunteer initiatives could help raise grassroots momentum through activities ranging from reforestation events and coastal cleanups to educational workshops. However, the requisite advance organization and liability protocols would be needed to facilitate wide-scale involvement in such drives safely and constructively. In summary, BSB City is well-positioned to pursue a balanced portfolio of strategic approaches leveraging local strengths, targeted capacity-building, multi-stakeholder cooperation mechanisms, and grassroots mobilization initiatives to progressively develop sustainability leadership through an evidence-based decision-making process and periodic reassessments.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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