

A missing fifth sustainability dimension (wellbeing and health) when describing eco-districts

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Abstract. This study aims at examining whether wellbeing and health should be considered as a fifth dimension of sustainable eco-districts. This study assesses the four dimensions of sustainable eco-districts (energy, socio-economic, mobility, urban design) and nine categories of health & wellbeing (physical, emotional, financial, intellectual, career, social, creative, environmental, spiritual) to understand the benefit of incorporating wellbeing and health. A thorough systematic review literature analysis was conducted using secondary data sources, including academic literature, industry reports, and government publications to compile available data. To categorize and find patterns in the data, thematic analysis was used. According to the research, there has to be a relationship between the growing number of hospital-led certified eco-districts and a fifth dimension of sustainable eco-districts (wellbeing and health) in order for residents of these communities to lead healthy lifestyles that support all facets of their wellness. This study adds to the existing body of knowledge and further investigates the impact of including wellbeing and health into sustainable eco-district design and construction. It sheds light on the importance of incorporating quantitative and qualitative techniques and the use empirical data gathering techniques for research studies.

1 Introduction

1.1 Sustainability dimensions of eco-districts

An urban experiment with restricted area and people is called an eco-district; its goal is to evaluate the city's capacity to create sustainable neighborhoods [1]. Words like "smart city", "eco-city", "smart urbanism", "sustainable neighborhood", and "eco-district", to mention a few, have crept into common usage and can frequently be a cause of confusion [2]. Eco-districts place a high importance on the sustainability of integrating low-energy buildings, diverse land use, density, and greening. Integrating ecological and compact design principles leads to a well-balanced integration of sustainability dimensions [3]. The following section outlines what those dimensions are.

Four dimensions are commonly used to quantify the features of eco-districts as demonstrated in this section. The first component, "Energy (and natural resources)", emphasizes how important energetic factors are in connection to daily actions that significantly improve the environment [4] as opposed to environmental factors. This pillar takes into account sustainable solutions for water and waste management, building materials and energetic performances and energy systems. But there are also other initiatives that are meant to enhance fundamentally environmental-natural conditions (such protecting against flooding or boosting biodiversity). In addition, the second component (socio-economic) offers

details on investor kinds, decision-making processes (top-down vs. bottom-up), diversity among neighbors, and the involvement of residents and employment prospects both before and after the project [5, 6]. Because it yields two benefits, the third-dimension mobility represents a major component of all eco-district activities. On the one hand, it makes it possible to reduce the adverse consequences associated with driving a private vehicle because public transportation and other forms of alternative transportation have increased significantly. Conversely, it suggests using the streets as a shared space for cyclists and pedestrians. Comfortable outdoor spaces support pedestrian activity and traffic, which greatly enhances the livability and vibrancy of metropolitan areas. The neighborhood's physical attributes, including its public and private areas, are taken into account in the fourth dimension, which is urban design. Given that most current eco-districts are located in undeveloped or brownfield sections of the city, this component is especially crucial [7, 8].

The main objectives of this paper are to 1) define what are the sustainability dimensions of eco-districts, 2) define what are the general dimensions of wellbeing and health, 3) identify case studies of hospital-led certified eco-districts. Attempting to answer this research question: should wellbeing and health be the fifth dimension of sustainable eco-districts?

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1.2 What are the sub-dimensions of the proposed wellbeing and health eco-district dimension

Wellbeing and health have many facets and connections through nine categories. Although eating healthily, exercising, and taking preventative measures against illness are apparent aspects of wellbeing, other factors should also be taken into account. One's physical and mental well-being, for instance, are influenced by your spiritual, emotional, and financial soundness. The first category is physical wellness whereby being physically well entails more than just exercising; it also involves eating correctly, treating health problems early on, and upholding good daily habits. Significantly lowering chances of developing heart disease, diabetes, back pain, and many other chronic diseases by adopting four healthy behaviors: 1) Engaging in physical activity for 30 minutes on five days a week minimum. 2) For men and women alike, limiting alcohol consumption. 3) Abstaining from tobacco. 4) Consuming five fruits and vegetables every day as part of a balanced diet. Additionally, by engaging in daily stress reduction and getting at least seven hours of sleep each night, there can be a significant lower chance of developing chronic illness. The second category is emotional wellbeing whereby being emotionally healthy allows individuals to recognize, communicate, and control the whole spectrum of their emotions. Seek assistance if feelings take control of them or become in the way of their ability to operate. Using mindfulness exercises and cognitive-behavioral strategies to help them combat feelings of stress, depression, and anxiety. The third category is financial wellbeing whereby financial stress may have negative physical, emotional, and psychological effects on people and lead to harmful coping mechanisms. Being financially healthy entails managing finances to reach reasonable objectives and having a complete understanding of one's financial situation and budget [9].

The fourth category is intellectual wellbeing whereby a flexible mind denotes intellectual health, just as a flexible body does so in terms of physical health. A person in good intellectual health values lifelong learning, encourages critical thinking, develops moral reasoning, broadens their perspective, and pursues education as a means of information acquisition. Constructing intellectual well-being every time a person picks up a new ability or idea, attempt to comprehend something from a fresh angle, or challenge their intellect with puzzles and games. Additionally, research indicates that engaging in intellectual activities may enhance the physical makeup of one's brain, therefore averting cognitive aging. Career wellbeing is the fifth category which is the state of doing work that fulfills and enriches a person by aligning to one's beliefs, objectives, and way of life in order to maintain professional well-being. Given that individuals spend the majority of their time at work after sleep. Social wellbeing is the sixth category and the result of establishing a support system with one's friends, family, and coworkers that is built on mutual respect, interdependence, and trust. Another aspect of social wellbeing is the development of sensitivity and understanding of the sentiments of others.

Research demonstrates that maintaining social ties keeps us healthy and helps us manage stress. In order to comprehend and enjoy one's surroundings, a person should value and engage in a wide variety of artistic and cultural events. Ensuring access to quality childcare, education, and eldercare support, including eco-friendly facilities, is vital for social wellbeing, particularly for women facing gender disparities. This holistic approach alleviates stress and depression, fostering healthier family dynamics and community cohesion. This is known as creative wellbeing and is the seventh category. Stress may be effectively reduced by using the arts to express one's feelings and opinions. Environmental wellness is the eighth category, evidence suggests that lung cancer, the leading cause of cancer-related deaths in the US, can be brought on by air pollution. To be ecologically well means to value one's relationship with nature and to acknowledge one's duty to conserve, protect, and enhance the environment. Environmental wellness encompasses maintaining harmony with surroundings, including indoor spaces. Prioritizing indoor environmental quality involves utilizing building materials devoid of volatile organic compounds, ensuring thermal, acoustic, and visual comfort. This holistic approach fosters a healthy, balanced environment conducive to overall well-being. Social and environmental wellbeing come together when one works to protect the environment for coming generations and to make the lives of people everywhere better. The final and ninth category is spiritual wellbeing which includes engaging in quiet introspection, reading, and candid conversation with others are just a few methods to pursue spiritual well-being [9].

2 Methodology

In this section, the methodologies followed for data collection and analysis will be outlined.

2.1 Data collection

To compile pertinent data on sustainable eco-districts and wellbeing & health, a thorough literature review was carried out in accordance with the PRISMA statement guideline. Peer-reviewed articles, review papers, conference papers and grey literature were sought out using academic databases including Scopus from 2010 to 2023. Search terms included "sustainable eco-district", "sustainable eco-district dimension", "healthcare dimensions in sustainability", "wellbeing dimensions in sustainability", "health in eco-district", "wellbeing in eco-district", "hospital lead eco-district" and associated concepts were utilized as search criteria. The search was restricted to studies written in English and published in scientific journals. We identified 242 papers related to the main topic. However, the number of papers discussed in the review was limited to 12 due to the exclusion criteria identified below alongside 2 grey literature sources totaling 14.

Inclusion Criteria

Empirical studies, academic book sections, Lit reviews

Papers with clear research questions/objectives on sustainable eco-districts
 Time period: from 2010 to 2023 (13 years)
 Papers published in English

Exclusion criteria

Conference proceedings, conceptual papers, editorials are excluded
 Other industrial sectors excluded
 Publications before 2010, excluded
 Other languages, excluded

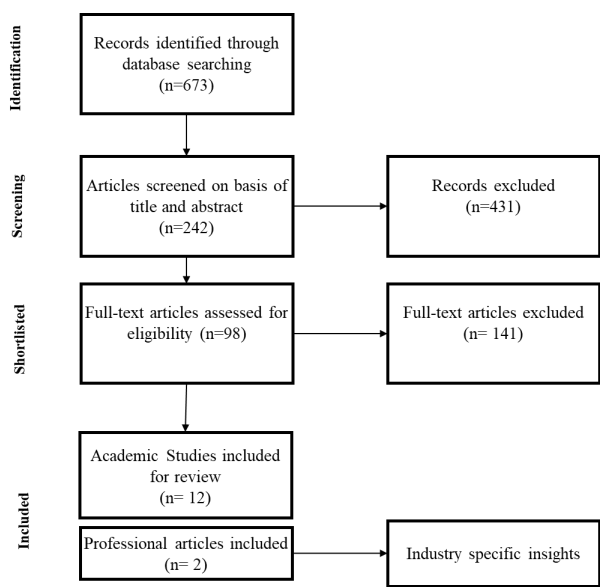


Fig. 1. Consort diagram of the systematic review process [10].

2.2 Data selection

Information from the shortlisted 41 references was compiled in soft copy folder, these references were independently reviewed by the main author, who selected the final list of papers to be analyzed. The first author examined the articles’ topics and content and used our criteria for inclusion and exclusion of material to eliminate papers whose research questions were not fully aligned with the scope of this review and papers that did not include empirical research or literature revision. The criteria are the characteristics that must exist to be included in this paper while exclusion criteria are those characteristics that disqualify a data source from inclusion in the paper which lead to the identification of 12 relevant journals published within 2011 and 2023.

Given the topic is a key industry trend topic, it was essential that the search radius be expanded to reliable industry sources and official newspapers which capture the insights of subject matter experts and yielded supplementary sources from reliable sources and industry insights. This led to a total of 4 relevant supplementary sources that were reviewed in the research paper. The structure of the search strategy followed the well-known PICO framework. The reference list of the final selected articles was consulted to find additional relevant studies. The literature

evaluation gave a framework for comprehending the state of the field’s knowledge and its knowledge gaps. Furthermore, for this review there was no restriction with regard to study design. The initial resulting yield underwent rigorous review, in this order: verification of the eligibility criteria, elimination of duplicate studies, critical analysis of the title and abstract, critical reading of the discussions.

2.3 Data analysis

The study used secondary data sources, such as scholarly writing, and business reports and publications for concepts and definitions. As for the grey literature, the author relied on reliable industry sources to identify existing cases of hospital-led certified eco-districts to demonstrate the existence of dependency. A thematic analysis method was used to examine the data that had been gathered. Based on the main themes that emerged, the data acquired from the literature research was thoroughly examined and categorized in the introduction and case study discussion. In order to understand the relationship between the existence of hospital-led certified eco-districts prompting the need to incorporate the wellbeing and health dimension into the sustainable eco-district dimensions as a fifth one; the literature was analyzed and key findings identified.

3 Discussion

In this section, examples of hospital-led certified eco-districts will be explored.

3.1 Hospital-led certified eco-districts

Given the importance of hospitals in communities and the testament that more eco-districts are revolving around them, supports the concept of including wellbeing and health as a dimension of sustainable eco-districts. Following are examples of eco-districts that are anchored by a health system as illustrated in Tables 1. The case studies used in this study demonstrate the growing trend in developed countries to plan and build hospital-led certified eco-districts or repurpose existing closed hospital buildings into eco-districts [11, 12]; however, at the moment, health and wellness are not taken into consideration as foundational elements when creating such sustainable eco-districts. Hospitals, although being costly, are an essential component of every healthcare system. Both the original investment and hospital operations come with exorbitant expenditures [13]. As a result, it clarifies why the focus of these hospital-led certified eco-districts is on renovated hospitals rather than environmentally friendly initiatives. Sub-dimensions of health and wellness are further embraced inside such sustainable eco-districts upon repurposing of iconic hospitals.

Table 1. Ecodistrict case studies.

Country	United States of America	France
Organization	Clark-Fulton MetroHealth EcoDistrict	Saint-Vincent-de-Paul Hospital's eco-district
Description	Anchored by a health system makes the Clark-Fulton/MetroHealth EcoDistrict the first EcoDistrict in the world.	An ambitious plan to create an “eco-district” in the French capital. It is located in the center of Paris’s 14th arrondissement, surrounded by gardens belonging to religious congregations, the Observatoire de Paris, and the Cartier Foundation, an outstanding hub for contemporary art. It is halfway between the transportation hubs of Denfert Rochereau and Port Royal. Even before to the start of the construction project, Saint-Vincent-de-Paul, a former hospital that is now set to become a residential neighborhood, had a favorable and welcoming reputation among Parisians.
Health & Wellbeing Sub-dimension	Physical Wellness and Environmental Wellness	Physical, Environmental, Creative, Social Wellness
Feature	A new hospital constructed along the West 25th Street corridor as part of the MetroHealth Transformation Plan, includes 25 acres of fresh green space. A crucial feature and new community asset within the new green space is a 12-acre public park for the neighborhood’s benefit and wellness. This eco-district, includes the MetroHealth Line bus-rapid-transit system, a free neighborhood wi-fi network, the La Villa Hispana Streetscape, an extension of the Towpath Trail, and the construction of market-rate and affordable housing, which includes moving MetroHealth’s police headquarters into the neighborhood.	The Saint-Vincent-de-Paul project is the current embodiment of a new type of urban development in Paris, which is based on three principles: envisioning the future, public engagement, and ecological transition. The temporary occupation of the property has updated and expanded the hospital history with its social diversity, accessible public spaces, and development of artisanal skills and the social and inclusive economy. The goal of the future neighborhood is to embody the same vibe.
Reference	[12]	[11]

4 Conclusion and future areas of research

The concept of an eco-district transcends mere environmental infrastructure and green building initiatives; it embodies a holistic approach to sustainable development. These districts are emblematic of life cycle thinking, emphasizing not just the environmental impact, but also social cohesion and economic sustainability. A key aspect of eco-districts is their potential to foster community bonds and cooperative economies, vital for long-term sustainability [14]. Central to this endeavor is the notion of community building, which thrives on the foundation of a healthy populace. In this context, the Structure Literature Review (SLR) serves as a cornerstone, fulfilling the primary objectives of delineating the sustainability dimensions of eco-districts, elucidating the broader dimensions of wellbeing and health, and pinpointing case studies of hospital-led certified eco-districts. This comprehensive investigation underscores the necessity of integrating a fifth dimension ‘wellbeing and health’ into the framework of sustainable eco-districts. However, determining the precise components of wellbeing and health that should be incorporated poses a significant challenge. Should all nine categories be considered, or only those that intricately intertwine with the other four dimensions: physical wellness, creativity,

social cohesion, and environmental stewardship? Further research is imperative to unravel this complexity.

Other avenues of research can include Health and Wellbeing Metrics Development through investigating the development of comprehensive metrics or indices for assessing the health and wellbeing aspects within eco-districts. This could involve defining specific indicators, measurement methodologies, and benchmarks tailored to the unique characteristics of sustainable communities. Secondly, conducting longitudinal studies to track the evolution of health and wellbeing outcomes within eco-districts over time. By examining trends and patterns, researchers can better understand the long-term impacts of sustainable design and community development initiatives. Thirdly, conduct a comparative analysis that compare the health and wellbeing outcomes between eco-districts and conventional urban developments. This comparative analysis can provide valuable insights into the relative effectiveness of sustainability-focused interventions in promoting community health and wellbeing. Fourthly, explore cultural and socioeconomic factors and their influence on health and wellbeing within eco-districts. This research could involve examining how diverse communities perceive and experience wellness, and how these perceptions shape behavior and outcomes. Fifthly, investigate the role of community participation and empowerment in promoting health and wellbeing within eco-districts. This could include studying

participatory decision-making processes, community-led initiatives, and the impact of social capital on collective wellbeing. Sixthly, explore the relationship between green infrastructure (e.g., parks, green spaces, urban agriculture) and public health outcomes within eco-districts. Research in this area could examine the physiological, psychological, and social benefits of access to nature in urban environments. Seventhly, investigate the intersection of health, wellbeing, and social equity within eco-districts. This research could focus on identifying and addressing disparities in access to resources, services, and opportunities, and exploring strategies for promoting health equity within sustainable communities. Eighthly, examine the resilience and adaptive capacity of eco-districts in the face of environmental, social, and economic stressors. This research could explore how sustainable design features, community networks, and governance structures contribute to the ability of eco-districts to withstand and recover from shocks and disturbances. Ninthly, analyze the role of policy and governance frameworks in shaping health and wellbeing outcomes within eco-districts. This research could involve assessing the effectiveness of regulatory mechanisms, incentive programs, and planning strategies in promoting sustainable and healthy communities. Lastly, explore opportunities for cross-sector collaboration between public health, urban planning, environmental sustainability, and other disciplines to advance the health and wellbeing agenda within eco-districts. This research could identify synergies, trade-offs, and best practices for interdisciplinary cooperation in sustainable community development.

These research areas offer diverse opportunities for advancing knowledge and informing policy and practice in the field of eco-districts and community health and wellbeing. By delving into the nexus between wellbeing, health, and the sustainability dimensions of eco-districts, future studies can unravel nuanced insights, guiding the evolution of these communities towards a more resilient and thriving future.

References

1. A. Zareba, A. Krzeminska and J. Lach, "Energy sustainable cities from eco villages, eco districts towards zero carbon cities", *E3S Web of Conferences*, vol. 22, p. 2017.
2. S. Wagrell, M. I. Havenvid, A. Linne and V. Sundquist, "Building sustainable hospitals: A resource interaction perspective", *Industrial Marketing Management*, vol. 106, pp. 420-431, 2022.
3. K. Ouli, "Assessment of the mixed local climate zones as the best design for future eco-districts in sub-humid climate: A case of rabat", *International Journal of Sustainable Building Technology and Urban Development*, vol. 14, no. 1, pp. 3-17, 2023.
4. P. Lombardi and E. Trossero, "Beyond energy efficiency in evaluating sustainable development in planning and the built environment", *International Journal of Sustainable Building Technology and Urban Development*, vol. 4, no. 4, pp. 274-282, 2013.
5. M. Holden, C. Li and A. Molina, "The emergence and spread of ecourban neighbourhoods around the world", *Sustainability (Switzerland)*, vol. 7, no. 9, pp. 11418-11437, 2015.
6. M. Bottero, C. Caprioli, G. Cotella and M. Santangelo, "Sustainable Cities: A Reflection on Potentialities and Limits based on Existing Eco-Districts in Europe", *MDPI Sustainability*, vol. 11, no. 5794, pp. 1-22, 2019.
7. C. Flurin, "Eco-districts: development and evaluation. A European Case Study", *Procedia Environmental Sciences*, vol. 37, pp. 34-45, 2017.
8. K. Boquet, C. Froitier, J. Li, K. Xu and X. Zeng, "Eco-districts in France: What tools to ensure goals achievement?", *Science China Earth Sciences*, vol. 63, no. 6, pp. 865-874, 2020.
9. B. M. Melnyk and S. Neale, "9 Dimensions of Wellness - Evidence based tactics for optimizing your health and well-being", Ohio State University, Columbus, 2021.
10. D. Ding, Design strategies of passive solar greenhouses: A bibliometric and systematic review, *Ain Shams Engineering Journal*, vol. 15, no. 5, 2024.
11. W. Dufourcq, S. Laisney and N. Detrie, "parisetmetropole-amenagement", Saint-Vincent-de-Paul (Paris 14th), [Online]. Available: <https://www.parisetmetropole-amenagement.fr/en/saint-vincent-de-paul-paris-14th>. [Accessed 3 December 2023].
12. The MetroHealth System, "Clark-Fulton MetroHealth EcoDistrict", The MetroHealth System, 16 December 2019. [Online]. Available: <https://www.metrohealth.org/transformation/transformation-blog/clark-fulton-metrohealth-ecodistrict>. [Accessed 16 December 2023].
13. R. W. Furst and R. E. Markland, "How Hospital Capital Investment and Operating Costs Relate", *Inquiry*, vol. 17, no. 4, pp. 313-317, Winter 1980.
14. S. E. Bibri, "Eco-districts and data-driven smart eco-cities: Emerging approaches to strategic planning by design and spatial scaling and evaluation by technology", *Land Use Policy*, vol. 113, 2022.