Journal of Information Systems Engineering and Management
2025, 10(29s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Green Infrastructure, Elevating Urban Resillience: A Literature Review

Padmashree P, Soumya Digwal, Bindhu Purnima Gudapati,
Assistant Professor, Center for Management Studies, JAIN (Deemed-to-be University), Bangalore, India.
Email Id- padmashree_p@cms.ac.in
Student, Center for Management Studies, JAIN (Deemed-to-be University), Bangalore, India.
Student, Center for Management Studies, JAIN (Deemed-to-be University), Bangalore, India.

ARTICLE INFO

Received: 24 Dec 2024

Revised: 18 Feb 2025

Accepted: 27 Feb 2025

ABSTRACT

Green infrastructure is a holistic long-term approach to water management that protects, restores or mimics the natural water cycle. This cost-effective and ecological strategy not only ensures community safety but also elevates the general quality of life. Essentially, green infrastructure circles around activities such as planting trees and restoring wetlands, rather solving environmental concerns. In short, it leverages nature to function as a crucial part of our infrastructure. The concept has gained increasing attention in the realm of urban planning and environmental resource management. The idea revolves around understanding the application of green infrastructure and emphasizing its role in creating a sustainable, interconnected network of green spaces. It advocates that green infrastructure should be integrated with traditional infrastructure and high-quality living environment for present and future generations. Design and planning of green infrastructure should occur before development to protect critical ecological hubs and linkages. Research highlights the importance of integrating green infrastructure into land-use planning. Accordingly, this alleviates the challenges presented by urban sprawls, habitat fragmentation, and unregulated land use. It advocates for a proactive approach to conservation by offering specific principle strategies and emphasizes the significance of ecological, social, and economic considerations in the planning process. The paper aims to educate regarding the importance of green infrastructure and the need for collaborative research. It seeks to support the effective implementation of green infrastructure as a fundamental component of urban and regional planning, promising a more sustainable and resilient future. It offers a sustainable path forward in the face of rapid urbanization and habitat loss

Keywords: *Collaborative approach, green infrastructure, habitat fragmentation, , sustainable development.*

INTRODUCTION

Over 56% of the global population, equivalent to 4.4 billion people, resides in urban areas, and this proportion is anticipated to rise in the forthcoming years. These are not just numbers but also represent the environmental challenges that expansion and urbanization could pose to the planet. Urban centers play a substantial role in contributing to climate change through the release of greenhouse gases. Therefore, there is a growing need for sustainable urban development to minimize environmental damage. To tackle these problems, Green Infrastructure has been a popular solution - a diverse approach that brings natural elements into city areas. This improves the environment's sustainability, stability, and welfare of the community as a whole.

As per the European Union, green infrastructure constitutes a thoughtfully arranged system of natural and partially natural regions alongside additional environmental elements. These areas are purposefully planned and maintained to provide a diverse array of ecosystem services while

simultaneously fostering biodiversity. These services include purifying water, enhancing air quality, offering recreational space. The amalgamation of land and water spaces in this network enhances environmental standards, the condition and connectivity of natural zones, and makes a positive contribution to citizens' health and overall well-being in the context of climate mitigation and adaptation. Additionally, the establishment of green infrastructure has the potential to reinforce a sustainable economy and generate employment opportunities.

Green infrastructure encompasses diverse nature-based solutions such as green roofs, urban parks, permeable pavements, and streets adorned with trees. These elements are crafted to imitate and utilize the ecological functions found in natural ecosystems but adapted for urban settings. The fundamental idea is to establish a balanced coexistence between human activities and the environment.

Although the advantages of green infrastructure are clear, obstacles remain in its broad acceptance. This paper will investigate these challenges, examining concerns linked to putting them into practice, sustaining them, and involving relevant stakeholders. Through a careful analysis of the present state of green infrastructure implementation and gathering valuable lessons from case studies, this research paper seeks to offer a thorough comprehension of the possibilities and constraints associated with green infrastructure serves as a strategy for fostering sustainable urban development.

OBJECTIVE OF THE PAPER

1. Educate the public about Green Infrastructure, elucidating its ecological benefits, including improved air and water quality, biodiversity conservation and enhanced urban resilience. Through clear communication, raise awareness about the pivotal role of green spaces in fostering sustainable and healthy communities.
2. Explore and articulate the global adoption of Green Infrastructure, illustrating how nations worldwide are integrating nature-based solutions. Highlighting successful cases and strategies that demonstrate the positive environmental and social impacts, fostering a deeper understanding of the importance of embracing Green Infrastructure practices.

THEMATIC VIEW OF REVIEW OF LITERATURE

Green infrastructure serves as a strategy for fostering sustainable urban development, woodlands and natural areas that sustain clean air, water and natural resources, enhancing quality of life. (McMahon & Benedict, 2000) Green streetscapes enhance urban biodiversity. Boosting biodiversity within urban areas has the potential to heighten environmental consciousness among city dwellers. The increasing shift in recent years towards systematic green infrastructure planning, driven by various trends such as urban sprawl, environmental mandates, public health concerns, and sustainable development efforts is taking the world towards a better future. (McMahon & Benedict, 2000) Trees and green infrastructure provide significant reductions in urban temperatures. Green infrastructure decreases the cooling demand for buildings by lowering local temperature and shading surfaces, leading to decrease in demand of energy. In addition, it also encourages many outdoor activities like cycling and walking. Green infrastructure planning diverges from conventional open space planning by concurrently incorporating conservation values with land development, growth management, and built infrastructure planning. (Benedict.M.A & McMahon.E.T, 2002) Design and planning of green infrastructure should occur before development to protect critical ecological hubs and linkages. The creation of physical linkages is essential for maintaining the ecological network. (Tache.A, Popescu.O.C, & Petrisor.A.I, 2023) Numerous advantages arise from incorporating green infrastructure into land planning, including ecological restoration, economic savings, and the creation of vibrant, connected communities. With a focus on multi-functionality, policy integration, and cooperation between organizations it has become a vital part of urban planning to create sustainable and innovative urban spaces. Green infrastructure research can be categorized into conceptual and practical research. Conceptual research involves the development of theoretical ideas, while practical application focuses on implementing green infrastructure in real-world situations. (McMahon & Benedict, 2000) Another factor contributing to the increasing popularity of green infrastructure is its ability to enhance aesthetic qualities and serve as a notable neighborhood amenity. Additionally, properties featuring tree-lined

streets are generally more highly valued compared to those lacking trees. It's seen as a mechanism to create sustainable places, fostering a connection between people and their environments while promoting prosperity. However, for it to be effective it is important to take into account a few points such as:

- Green infrastructure planning should prioritize the needs of health, social inclusion, and service provision while balancing ecological and economic factors. (Mell, 2009,March)
- Effectively addressing climate change necessitates the development of green infrastructure at an appropriate scale, emphasizing relevant focus. This demands a strategic systems approach to comprehensively understand ecological interactions and functions. (Mell, 2009,March)
- Viewing green infrastructure as a long-term process for shaping livable spaces is essential. With a holistic design approach, it has the potential to significantly contribute to successful urban renewal. (Mell.I.C, 2008)

ECOLOGY V/S RECREATION

GI emerges as a nature-based, sustainable solution contrasted with traditional 'grey' infrastructure, known for its multi-functionality and potential to provide cost-effective, environmentally friendly alternatives, particularly evident in disaster risk management, such as flood protection. Despite the absence of a unified definition, it is recognized that GI encapsulates two common underlying elements: connectivity and multi-functionality. Spatial assessment and identification of GI emerge as central, primarily focusing on Ecosystem Services (ES) mapping to pinpoint areas capable of delivering diverse ES. This process integrates environmental functioning and ecosystem condition with key species and habitat connectivity, aiming to establish thresholds for policy and socio-economic priorities. The integration of GI into various policy sectors, aims to permeate into climate, water, nature conservation, regional policy, and land and soil policies. It is further suggested that GI should be a fundamental consideration within different spatial scales and must align with various policy domains for effective implementation. (Baro, et al., 2015)

While recreation also termed as cascading or up cycling is a part of GI. Cascading is the term for reuse of a material or product in a de- graded form of inner material quality compared to the pre-consumed state. Up-cycling, alternatively referred to as creative reuse, involves the conversion of by-products, waste materials, or otherwise undesirable items into new materials or products with enhanced qualities, such as increased artistic or environmental value. It constitutes a vital component of ecology, specifically within the realm of green infrastructure. Recommendations include testing the GI concept within the Cascade Model and closely monitoring the progress of the EC's (European Commission) Working Group on Green Infrastructure for better engagement and updated insights into this evolving landscape.

GREEN INFRASTRUCTURE:

A CASE STUDY

Green Infrastructure (GI) and Its Policy Integration in Europe, emphasizes the crucial role of three key policy themes that align with green infrastructure include biodiversity, rural development, agriculture, urban development and green spaces, fostering a synergistic approach. It presents key findings from Davies and Lafortezza's policy analysis across 14 European countries, emphasizing the significance of particular themes such as social cohesion, green economy, biodiversity, and health within national policies underscores the conflicts arising from specific land uses, including transport infrastructure, energy generation, and agricultural intensification, with the preservation and development of green infrastructure. (Slatmo, Nilsson, & Turunen, 2019) Urban sprawl is also identified as a factor fragmenting habitats and reducing unbuilt land.

The study methodology involved an online questionnaire covering 32 European countries, with a focus on experts in territorial development affiliated with the European Observation Network for Territorial Development and Cohesion (ESPON) from government circles. (Guarino, et al., 2021) Despite challenges in respondent availability, the survey yielded insights into different factors responsible for

and implementing GI policies. Additionally, it examined the use of European funds, financial measures, and the access and utilization of geospatially referenced data on protected areas in decision-making processes at various governance levels.

Analyzing the policy sectors where GI is integrated, with an emphasis on certain sectors embracing GI principles more than others. The findings suggest a relationship between a country's economic status and the development of national GI policies. The responsibility for developing and implementing GI varied among researchers, NGOs, the business community, and different levels of government. Highlighting the significance of financial measures to conserve, revive, and improve green and blue spaces.

In-depth Examination of Georeferenced Information and Policy Integration in GI Implementation delves into the access and utilization of geospatially referenced data on protected areas in 32 European countries. It emphasizes the accessibility of details regarding the location and dimension of protected areas and their online accessibility. The variable availability of environmental quality data for these areas and its utilization in decision-making procedures, particularly in spatial planning at both regional and local level.

Discussing the importance of georeferenced information in decision-making processes and stresses the need for ongoing mapping of land cover and use of patterns for effective GI implementation. It concludes by advocating for improved integration of GI principles into sector-specific policies and spatial planning, emphasizing the role of landowners in GI implementation. It points out the importance of balancing knowledge and power in governance and suggests enhanced involvement of landowners to further drive successful GI implementation. (Slatmo.E., Nilsson.K., & Turnen.E., 2019)

The GREEN SURGE project, a comprehensive initiative focused on Urban Green Infrastructure (UGI) in European cities. The challenges hindering UGI adoption were extensively outlined, including physical limitations, institutional constraints, and a lack of comprehensive data regarding the link between urban green spaces and ecosystem services. The study highlights the necessity for inclusive valuation methods that consider diverse stakeholder perspectives and their varying values attributed to green spaces. GREEN SURGE aimed to bridge the gap between scientific research and practical implementation, providing a framework to understand the variety of urban green spaces, exploring human-nature relationships in urban settings, valuing UGI from multiple angles, and discovering inventive approaches for planning and governing Urban Green Infrastructure (UGI). The ultimate goal was to establish UGI as a cornerstone for integrating environmental, social, and economic sectors within European urban landscapes. (Pauleit.S., Ambrose-Oji, Andersson.E., Anton.B., & Bujis.A., 2019)

An in-depth analysis of Green Infrastructure (GI) and its pivotal role within the framework of European policies and contemporary practices. Underscores the significance of GI in urban areas, emphasizing its potential in providing multiple benefits—environmental, social, and economic. The various policy initiatives and projects surrounding GI, presenting examples of GI implementations in different European urban regions. It also highlights the role of spatial planning in building up Green Infrastructure, outlining significant EU initiatives with objectives to enhance biodiversity, mitigate climate change, and contribute to healthy living.in highly populated cities. While it notes the importance of ecological coherence and ecosystem services in green infrastructure initiatives, presenting a variety of initiatives implemented by various organizations, governmental bodies, and environmental NGOs. It emphasizes the need for stakeholder involvement in planning and evaluation while also pointing out the absence of a commonly accepted scope or definition for green infrastructure in various Member States. (Andreucci.M.B, 2013)

Both the cases underline the significant potential of UGI and GI in fostering sustainable urban development and the urgent need for effective planning, policy, and implementation strategies. They stress the necessity of stakeholder involvement, the challenges posed by rapid urbanization, and the importance of multi-disciplinary research to address the complexities of UGI and GI for effective implementation and evaluation across European urban landscapes.

BENEFITS AND CHALLENGES OF GI

The adoption of green infrastructure offers a multitude of benefits for well-being, which can be broadly classified into three primary categories: environmental benefits, encompassing the broader habitat and ecosystems surrounding us; social benefits, directly influencing our quality of life; and economic benefits, involving monetary and measurable gains. Despite existing challenges in implementing green infrastructure, these hurdles are potentially beatable and may be outweighed by the enduring advantages it provides.

Environmental benefits:

1. **Storm water Management:** Urban areas contribute to water pollution by carrying contaminants, such as pathogens, nutrients, sediment, and heavy metals, through storm water runoff into our water bodies like streams, lakes, and beaches. (Agency(EPA), 2018) In places with integrated sewer practices, powerful storm water flows can even release untreated sewage into these waters. Green infrastructure mitigates this issue by capturing rainfall from minor storms, thereby diminishing storm water discharges. This reduction in discharge volumes leads to a drop in integrated sewer surges and reduces the overall contaminants.

2. **Biodiversity Conservation:** Green areas serve as habitats for diverse plant and animal species, making a valuable contribution to the preservation of biodiversity. (Kabisch, et al., 2017)These spaces are acknowledged not only for their ability to support biodiversity conservation but also for playing a pivotal role in supporting ecosystems, serving as crucial foundations for climate change mitigation and adaptation. (Commission, 2019)

Social Benefits:

1. **Health and Well-being:** Research has put forward different reasons why being around green and, to some extent, blue spaces is good for mental health. These reasons include the natural features of these areas (the restoration theory) that make just looking at them beneficial. Also, green spaces generally have a healthier environment – they're cooler, have cleaner air, and have minimal noise pollution. Moreover, being in these spaces provides a chance for physical activity whilst helping people interact more socially. (M, et al., 2015)

2. **Community Engagement:** Green infrastructure projects frequently incorporate active participation from the local community, leading to the establishment of a profound sense of ownership and connection among residents. This involvement typically extends beyond mere physical engagement, encompassing collaborative decision-making processes, community workshops, and shared responsibilities in the planning and execution of green initiatives. By fostering a collaborative environment, these projects not only enhance the physical landscape but also contribute to the development of a cohesive and engaged community that takes pride in its shared environment. (Beatley & Tim, 2001)

Economic benefits:

1. **Property Value Increase:** The housing market consistently reveals that a significant number of individuals are willing to invest more in a property situated in proximity to a park compared to a residence lacking this amenity. The increased value of such homes results in higher property tax payments by their owners. Frequently, when the cumulative additional tax contributions from each property, linked to the presence of a nearby park, are combined, the total proves adequate to cover the annual debt obligations necessary for the retirement of bonds utilized in the acquisition and development of the park. (Crompton & John, 2001) (Zuinga-Teran.A.A, et al., 2020)

2. **Energy Efficiency:** Green roofs and walls are key contributors to energy efficiency in buildings. Acting as natural insulators, they effectively reduce the demand for heating and cooling systems. The layered composition of green roofs, comprising vegetation, soil, and drainage components, creates a thermal barrier that minimizes heat transfer, decreasing the need for excessive heating in colder seasons. Additionally, these features absorb and dissipate solar radiation, preventing buildings

from overheating during warmer periods, thus reducing the reliance on air conditioning. (Getter, Kristin, & Rowe.D., 2006)

While green infrastructure offers numerous benefits, it also faces several challenges that can impact its successful implementation and effectiveness. These challenges can be summarized as follows:

PERCEPTION AND AESTHETICS:

A notable challenge in implementing green infrastructure lies in the potential resistance from the public, driven by concerns about alterations to the urban landscape and individual aesthetic preferences. Public apprehension can arise when proposed green projects are perceived as diverging from established urban aesthetics, impacting community acceptance and complicating the integration of environmentally friendly solutions. Addressing these concerns through effective communication and inclusive design approaches is essential. (Lee, Andrew, Maheshwaran, & R, 2011)

Design norms:

The challenge related to design standards highlights the considerable ambiguity surrounding the optimal approaches for planning, designing, executing, and sustaining Green Infrastructure (GI) projects.

Customized design guidelines that take into account the unique characteristics and challenges of individual cities, adapting to their specific risks and resource constraints, are crucial for the effective orchestration of the planning, design, execution, operation, maintenance, and assessment of urban Green Infrastructure. (Zuinga-Teran.A.A, et al., 2020)

FURTHER RESEARCH

The path that green infrastructure is following holds considerable potential, propelled by ongoing advancements in research, technology, and the progression of urban planning methodologies. This course is positioned to reshape how we conceptualize, execute, and understand the significance of incorporating green elements within our constructed landscapes.

Multiple innovative technologies and designs regarding GI are on the rise and are expected to diversify and multiply in the coming years. Blending sensor technologies, data analytics, and remote sensing into the monitoring and management of green spaces can significantly improve their usefulness. Illustratively, the performance of smart irrigation systems, integration of energy-efficient technologies in green roofs, and advancements in vertical farming serve as instances where technology plays a key role in boosting the sustainability outcomes of green infrastructure. (Zuinga-Teran.A.A, et al., 2020).

In the future, ecological infrastructure initiatives are anticipated to prioritize improved involvement of the public and a more powerful focus on social equity. Essential components of this shift include the integration of community perspectives during the planning and design stages, the creation of green spaces that embrace inclusivity, and the guarantee of a fair distribution of green amenities. These reviews will be fundamental in shaping the evolution of metropolitan geographies that are both sustainable and socially unbiased. (Johan & Barthel Stephan, 2013) Given the pressing crises posed by climate change, forthcoming developments in green infrastructure are poised to experience a rise in solutions that respond to climate dynamics. This entails the crafting of green areas not only to ease environmental influences but also to adapt shifting climatic patterns. Possible strategies contain the choice of plant species resilient to climate conditions, the establishment of urban green pathways to aid species migration, and the incorporation of green roofs to regulate temperatures. (Haase, et al., 2014)

In the coming years, there is a growing acknowledgment of the imperative for strong policy and regulatory frameworks to underpin the incorporation of ecological infrastructure into urban planning. (Junqueria, Serrao-Neumann, & White, 2021) The pivotal role of policies in promoting sustainable development is underscored by researchers, emphasizing their significance in advancing green infrastructure initiatives. Regulatory support ensures the alignment of green infrastructure projects with broader environmental and social objectives, fostering an environment facilitative to their implementation. As proposed by (Tzoulas, et al., 2007), effective governance stands as a cornerstone

for enabling green infrastructure and nature-based solutions, requiring strategic policies that advocate eco-friendly development.

The trajectory toward sustainability is likely to witness the development and improvement of policies that not only encourage but also mandate and guide the assimilation of green infrastructure into urban landscapes, guaranteeing its widespread acceptance and enduring success. Additionally, we can also foresee a growing integration of green infrastructure with smart cities, leading to a synergy between sustainability and technological evolution- one major possibility that would mean co-existence of specialized development alongside environmental protection.

LIMITATIONS OF THE PAPER

- The absence of statistical analysis in this research limits the quantification of relationships and trends, potentially hindering a comprehensive understanding of the subject.

The research is confined by the absence of primary data collection, restricting direct insights from original sources.

CONCLUSION

Green infrastructure is of crucial importance in the current day and age due to the impending problems posed by climate change and environmental damage to societies and communities. However, there is ambiguity in the perception of individuals regarding the true meaning of the term “green infrastructure” and what it means, this study is aimed to educate the masses about green infrastructure, and the benefits along with the gaps, whilst also providing potential solutions obtained from research. This paper calls for greater attention to environmental protection using the means of strategies, tools and designs such as storm water management, nature conservation areas and vertical farming for instance. Explaining the vital role of ecological infrastructure and its diverse advantages in elevating the adverse effects of uncontrolled development. It stresses the importance of countering issues like the loss depletion of natural areas, fragmentation of open spaces, deterioration of water resources, and escalating public service expenditure. The integration of green infrastructure into land planning is highlighted for its potential to bring about ecological restoration, economic efficiency, and the fostering of lively, interconnected communities. Moreover, green infrastructure’s capabilities towards increasing quality of life standards and improving public health are immense and should be taken into severe consideration for the movement towards green infrastructure adaptation. The research towards understanding and advancing green infrastructure calls for a greater integration of social, economical, environmental and political boundaries to progress the well- being of general public.

REFERENCES

[1] Agency(EPA), U. S. (2018). *Benefits of Green Infrastructure*. Retrieved from United States Environmental Protection Agency(EPA): https://www.epa.gov/green-infrastructure/benefits-green-infrastructure#:~:text=Green%20infrastructure%20reduces%20and%20treats,add%20to%20communities'%20bottom%20line

[2] Andreucci.M.B. (2013). Progressing green infrastructure in Europe. *WIT Transactions on Ecology and the environment*, 179,413-422.

[3] Baro, F., Bugter, R., Gomez, B., Hauck, J., Kopperoinen , L., & Liquete, C. (2015). *Green infrastructure*. Spain: OpenNESS.

[4] Beatley, & Tim. (2001). Green Urbanism: Learning from European Cities. *Bibliovault OAI Respository, the University of Chicago Press*, 33.1-31.

[5] Benedict.M.A, & McMahon.E.T. (2002). Green infrastructure:smart conservation for the 21st century. *renewable resources journal*, 20(3), 12-17.

[6] Commission, E. (2019). *Green Infrastructure*. Retrieved from European Commission: https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en#:~:text=The%20EU%20Green%20Infrastructure%20Strategy,deliver%20their%20services%20to%20people

[7] Commssion, E. (2019). *Green infrastructure*. Retrieved from European Commssion: https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en#:~:text=The%20EU%20Green%20Infrastructure%20Strategy,deliver%20their%20services%20to%20people

[8] Crompton, & John. (2001). The Impact of parks on property values: A Review of the emphirial evidence. *Journal of Leisure Research*, 33.1-31.

[9] Getter, Kristin, & Rowe.D. (2006). The role of extensive green roofs in sustainable development. *Hortscience : a publication of the amercian society for horticultural science*, 41.1276.10.21273.

[10] Guarino, R., Andreucci, M., Leone, R., Bretzel,F, Pasta.P, & Catalano C. (2021). Urban services to ecosystems: an introduction. . *Urban Services to Ecosystems: Green Infrastructure Benefits from the Landscape to the Urban Scale,*, 1-10.

[11] Haase, Dagmar, Larondelle, Neele, Anderson, Erik, & Artmann. (2014). A Quantative Review of Urban Ecosystem Service Assessments: Concepts , Models and Implementation. *AMBIO A Journal of the Human Environment*, 43.413-33.

[12] Johan, C., & Barthel Stephan. (2013). The potential of 'URban Green Commons' in the resilience building of cities. *Ecological Economics.*, 86.156-166.

[13] Junqueria, J., Serrao-Neumann, S., & White, I. (2021). Managing urban climate change risks: Prospect for using green infrastructure to increase urban resilience to floods. *In The Imoacts of Climate Change*, pp.379-396.

[14] Kabisch, Nadja, Korn, Horst, Stadler, Jutta, & Bonn. (2017). Nature based solutions to Climate change adoption in urban areas. *Linkages between science, policy and practice*, 10.1007/978-3-319-56091-5_1.

[15] Last Name, F. M. (Year). Article Title. *Journal Title*, Pages From - To.

[16] Last Name, F. M. (Year). *Book Title*. City Name: Publisher Name.

[17] Lee, Andrew, Maheshwaran, & R. (2011). The health benefits of urban green spaces: A review of the evidence. *Journal of public health(Oxford, England)*, 33.212-22.

[18] M, G., Triguero-Mas M, Martinez, Dadvand P, Forns J, & Plasencia A. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: a systematic review. *Int J Environ Res Public Health*, 12(4).

[19] McMahon, & Benedict. (2000). Green infrastructure. *Planning commissioners Journal*, 37(4),4-7.

[20] Mell, I. (2009,March). *Can green infrastructure promote urban sustainablilty? In proceeding of the institution of civil engineers- engineering sustainability*. Thomas Telford Ltd.

[21] Mell.I.C. (2008). Green infrastructure concepts and planning. *FORUM ejournal*, Vol8, No.1.pp. 69-80.

[22] Pauleit.S., Ambrose-Oji, Andersson.E., Anton.B., & Bujis.A. (2019). Advancing urban green infrastructure in Europe. *Outcomes and reflections from the GREEN SURGE project*, Urban forestry and urban greening,40,4-16.

[23] Slatmo, E., Nilsson, K., & Turunen, E. (2019). Implementing green infrastructure in spatial planning in europe. *Land*, 8(4),62.

[24] Tache.A, Popescu.O.C, & Petrisor.A.I. (2023). Conceptual model for integrating the Green-Blue Infrastructure in planning using geospatial tools: Case study of Bucharest, Romania Metropolitan Area. . *Land*, 12(7),1432.

[25] Tzoulas, Konstataninos, Korpela, Kalevi, Venn, Stephen, & Vesa. (2007). Promoting Ecosystem and Human Health in Urban areas using Green Infrastructure: A Literature Review. *Landscape and Urban Planning*, 81. 167-178.

[26] Zuinga-Teran.A.A, Staddon.C., de Vito.L., Gerlak.A.K, Ward.S., Schoeman.Y., . . . Booth.G. (2020). Challanges of mainstreaming green infrastructure in built environment professionals. *Journal of Environment Planning and Managment*, 63(4) 710-732.