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Toward Smart Environment and Forest City Success: Embracing Sustainable Urban Solutions

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Abstract

Solutions to design a more sustainable environment are increasingly urgent in the face of the impacts of climate change and rapid urbanization. In this context, success factors in smart environments and forest cities become essential to accelerate the transformation to a more sustainable environment. This study aims to provide a deeper understanding of the success factors in adopting a smart environment and sustainable forest city from the management aspects of environmental protection, including water, soil, air, waste management, and renewable energy. This research method involves systematic steps in selecting, collecting, and analyzing relevant literature. This research revealed several consistent success factors in the literature and several good practices that can be applied in developing smart environments and forest cities. In conclusion, this research better explains relevant success factors and good practices in creating smart environments and forest cities. It highlights the need for broader and more in-depth research to support efforts to achieve sustainability goals in smart environments and forest cities.

Keywords: smart environment, forest city, environmental protection, waste management, and renewable energy

Abstrak

Solusi untuk merancang lingkungan yang lebih berkelanjutan semakin mendesak dalam menghadapi dampak perubahan iklim dan urbanisasi yang pesat. Dalam konteks ini, faktor keberhasilan dalam lingkungan cerdas dan kota hutan menjadi penting untuk mempercepat transformasi menuju lingkungan yang lebih berkelanjutan. Kajian ini bertujuan untuk memberikan pemahaman yang lebih mendalam tentang faktor-faktor keberhasilan dalam mengadopsi lingkungan cerdas dan kota hutan lestari dari aspek pengelolaan perlindungan lingkungan, meliputi air, tanah, udara, pengelolaan limbah, dan energi terbarukan. Metode penelitian ini melibatkan langkah-langkah sistematis dalam memilih, mengumpulkan, dan menganalisis literatur yang relevan. Penelitian ini mengungkapkan beberapa faktor keberhasilan yang konsisten dalam literatur dan beberapa praktik baik yang dapat diterapkan dalam pengembangan lingkungan cerdas dan kota hutan. Kesimpulannya, penelitian ini lebih baik menjelaskan faktor keberhasilan yang relevan dan praktik yang baik dalam mengembangkan lingkungan cerdas dan kota hutan. Ini menyoroti perlunya penelitian yang lebih luas dan lebih mendalam untuk mendukung upaya mencapai tujuan keberlanjutan di lingkungan cerdas dan kota hutan.

Kata Kunci: lingkungan cerdas, kota hutan, perlindungan lingkungan, pengelolaan limbah, dan energi terbarukan

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I. Introduction

A more sustainable environment has become an increasingly urgent issue in the face of worsening climate change impacts and rapid urbanization worldwide [1]. The transformation towards a more sustainable environment is critical to ensuring sustainability and quality of life in the future [2]. In this context, developing smart environments and forest cities has been recognized as a promising approach to achieving these goals. Smart environments and forest cities embrace innovative and sustainable technologies, efficient resource management, holistic environmental protection, and supportive policies [3], [4]. By combining these elements, smart environments and forest cities can create systems that optimize energy use, reduce greenhouse gas emissions, improve air quality, and maintain ecological balance [5].

However, despite the many efforts to develop smart environments and forest cities, challenges still need to be addressed. The success factors for achieving sustainable smart environments and forest cities must be better understood. The main issue is a lack of comprehensive understanding of the factors influencing the successful implementation of smart environments and forest cities, particularly regarding environmental protection management (such as water, land, and air), waste management, and energy. Therefore, this research aims to understand better the success factors in adopting sustainable smart environments and forest cities.

This research analyzes relevant success factors in developing smart environments and forest cities, particularly regarding environmental protection, waste, and energy management. This research provides a robust knowledge base and a better understanding for practitioners, decision-makers, and researchers involved in developing smart environments and forest cities. Furthermore, this research will also significantly contribute to bridging existing knowledge gaps by identifying good practices that can be adopted to achieve sustainable smart environments and forest cities.

Understanding the success factors and good practices in developing smart environments and forest cities can lead to more effective recommendations and strategies for designing and implementing sustainable environmental solutions. This research will provide significant benefits in enhancing urban sustainability, reducing negative environmental impacts, and creating a more balanced, green, and sustainable environment for future generations.

II. Literature Review

A smart environment uses information and communication technology (ICT) to optimize resource management, improve energy efficiency, and enhance the quality of life in urban environments. On the other hand, the concept of a forest city involves urban development that integrates natural elements such as forests, parks, and green spaces into its design [4]. Forest cities aim to create sustainable and eco-friendly environments while promoting a balance between development and nature conservation [5].

The concepts of smart environment and forest city have gained attention in recent years as efforts to protect the environment, including its water, land, and air components, have been made. Various relevant recent studies have been conducted in this field, including the implementation of the Sponge City program in China, which has brought breakthroughs in flood risk planning and management in urban contexts [1], [6], [7]. Other studies have also explored inexpensive sensors and remote sensing through satellites or drones for air quality monitoring in Turkey, Montenegro, and Switzerland [8]–[10]. Research related to soil quality, such as the work by Drexler [11], has proposed soil organic carbon benchmarking as part of agricultural carbon management and the potential of satellite and drone-based remote sensing technologies in smart farming.

Additionally, several studies have indicated that using a waste management systems hierarchy is an essential approach to achieving more effective waste management in various countries such as Morocco, China, and

Malaysia [12]–[14]. This approach involves waste management strategies based on the principles of waste reduction at the source, recycling, energy recovery, and disposal. Furthermore, other research has examined floating photovoltaic solar systems for sustainable energy management. This technology utilizes solar panels installed on water surfaces such as lakes or reservoirs to generate renewable energy [2], [15], [16]. Studies also focus on various crucial aspects of implementing a forest city, including sustainable design and construction, green technology utilization, waste management, energy efficiency, and restoration of natural ecosystems [3]–[5].

Although several studies have discussed the concepts and related systems of smart environment and forest city, no specific research currently analyzes the success factors in developing both ideas based on existing practices. Therefore, this article aims to identify consistent success factors in the relevant literature and gain a deeper understanding of best practices that can be applied in developing smart environments and forest cities. Thus, this article will significantly contribute to understanding the success factors in developing both concepts while strengthening the knowledge foundation in efforts to achieve sustainability goals in urban environments.

III. RESEARCH METHOD

A methodology is needed to explain the research process and provide insights into the criteria for conducting a systematic literature review. The literature review begins with planning, conducting, and reporting the study [17]. In the planning stage, the context and objectives of the review are established, research questions are formulated, and a search protocol is determined. Next, in the execution stage, relevant approaches are selected, studied, and compared using a pre-defined framework. Finally, in the reporting stage, the main conclusions of the review are compiled into a report.

A. Planning the Review

The initial step in research planning is to identify the objectives and research questions, which aim to clarify the direction and focus of the study. This research aims to conduct a systematic literature review focusing on two main concepts: smart environments and forest cities. The main goal is to identify best practices that have been implemented and analyze the factors that have contributed to the success of implementing these concepts in various countries. The research question to be answered through this systematic literature review is "What are the good practices and success factors influencing the implementation of Smart Environment and Forest City?"

Next, criteria are determined for searching for and selecting relevant literature on the research topic. These search criteria help limit the scope of the literature to be included in the study, ensuring that the selected studies meet relevant standards and align with the research objectives. Table 1 provides the selection criteria.

TABLE I
CRITERIA SELECTION

Inclusion	**Exclusion**
Publications during the period of 2018 to 2023	Publications not written in English
Titles, abstracts, or keywords include search terms	Publications not subjected to the peer-review process
Publications are written in English.	
Publications go through the peer-review process.	

Data was collected by finding relevant research studies through online searches in databases such as Google Scholar, Emerald, Science Direct, Taylor & Francis, and Springer Link. The literature search utilized queries based on titles, abstracts, and keywords related to the research topics, including: "Smart Environment," OR "Forest City," OR "Sponge City," OR "Smart Farming," OR "Waste Management," OR "Air Monitoring" OR "Renewable Energy." The selected articles met the criteria within a five-year time range. The article selection stage involved analyzing abstracts and full texts to examine their relevance to the predetermined criteria.

B. Conducting the Review

In conducting the literature review, several steps are taken to gather relevant literature, filter publications based on specific criteria, and analyze the selected articles to understand better the success factors in the context of smart environments and forest cities. A literature search using predetermined criteria and keywords, an initial search to gather potential publications aligned with the research objectives, title and abstract screening based on inclusion and exclusion criteria, and analysis and synthesis of selected articles to extract relevant findings and insights.

C. Reporting the Review

It was found that the 18 articles on smart environments and forest cities varied in terms of their perspectives. Some pieces in this research domain proposed the development of innovative new technologies, conducted in-depth analyses of related concepts, and carried out further case studies to deepen understanding and implementation of smart environment and forest city concepts. These findings support the validity of the conducted research, indicating that the selected articles have good quality and relevance to the researched topic, as depicted in Figure 1.

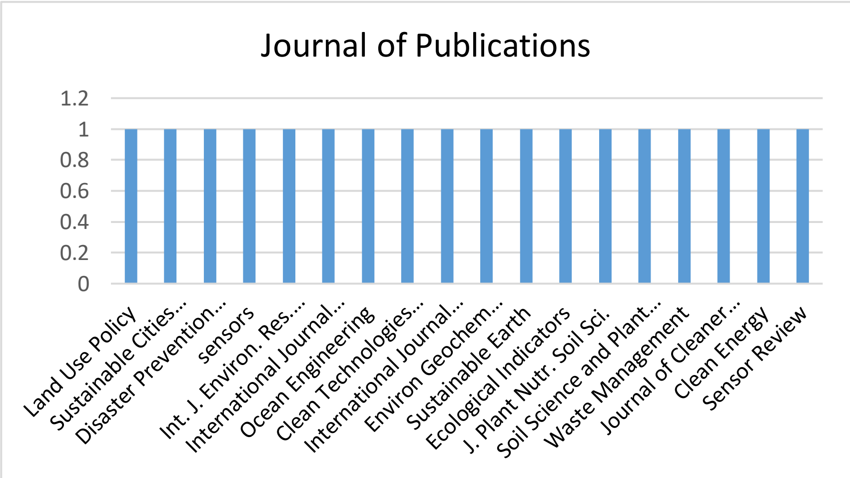

Fig. 1. Journal of Publications

IV. Results And Discussion

In this section, we present the analysis results based on 18 selected publications chosen according to the predetermined criteria in Table 1. The analysis examines the good practices and success factors in adopting the smart environment and forest city concepts.

A. Result of Research Categories

Figure 2 and Table 2 present the systematic review results, highlighting the adoption of smart environment aspects in six research categories: water protection, soil protection, air protection, waste management, renewable energy, and forest city. Researchers have identified several relevant technologies for adopting smart environments within these categories.

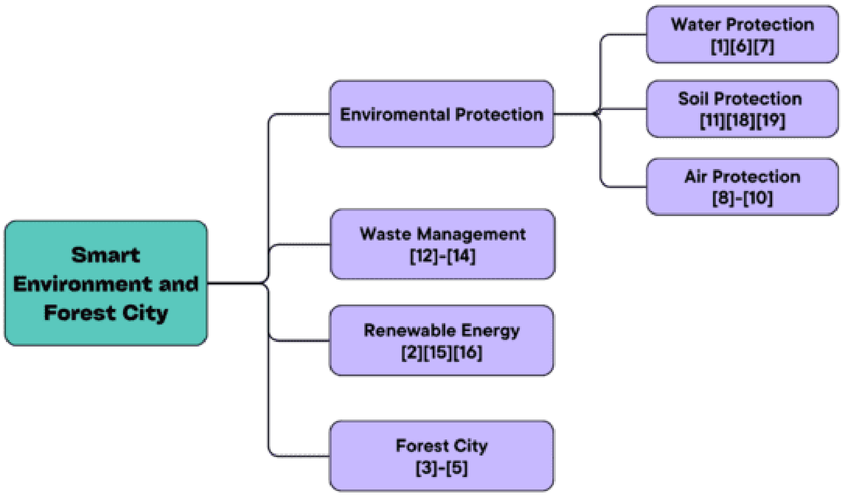

Fig. 2. Smart Environment and Forest City's Aspects

TABLE 2
RESEARCH CATEGORY DESCRIPTION

Category	Description	Articles
Water protection	Three studies revealed the development of innovative concepts such as water absorption and rainwater management systems to address flood issues and improve the urban water cycle.	[1], [6], [7]
Soil protection	Three studies identified smart sensor technologies supporting soil conservation and enhancing fertility, including erosion reduction techniques, restoration of degraded land, and sustainable agricultural practices.	[11], [18], [19]
Air protection	Three studies revealed the use of advanced monitoring technologies, such as network sensors and data processing systems, to gain a better understanding of air quality.	[8]–[10]
Waste management	Three studies have revealed the adoption of recycling technologies, organic waste processing, and plastic waste reduction methods to achieve more efficient and sustainable waste management.	[12]–[14]
Renewable energy	Three studies have proposed and tested various technologies, such as floating solar energy, as an environmentally friendly and sustainable alternative energy source.	[2], [15], [16]
Forest City	Three studies have revealed the use of technology in the development of forest-based cities, including implementing design concepts that integrate vegetation and greening in urban environments.	[3]–[5]

Technological innovation plays a crucial role in achieving the success of the smart environment and forest city concepts. Technological advancements have provided new opportunities to develop innovative, efficient, and sustainable solutions for urban environmental management. In this context, research and development of new concepts and technologies such as low-impact development (LID) [1], [6], [7], waste management system development (WMS) [12]–[14], forest city construction [3]–[5], floating photovoltaic solar systems [2], [15], [16] [2], and smart sensor technologies have played a significant role in resource monitoring and control, waste management, energy conservation, and improving environmental quality.

By adopting appropriate technological innovations, smart environments, and forest cities can enhance the sustainability of urban environments, achieve efficient management, and create a better quality of life for city residents and the surrounding ecosystems. Based on the analysis of environmental protection aspects in smart environments, it is found that three main elements require protection: water, soil, and air. Maintaining water quality, preventing soil pollution, and reducing air pollution are the primary focus in creating a healthy and sustainable environment.

B. Water Protection

Protecting water resources is essential for the realization of smart environments. It aims to address several urban issues, including increasing urbanization, expanding impermeable areas, water resource scarcity, floods caused by high rainfall and poor drainage systems, greenhouse gas emissions that affect groundwater quality, and water pollution from industrial and domestic waste [1], [6], [7]. As a solution, various innovative concepts have emerged, one of which is the concept of a sponge city, which focuses on the utilization and management of rainwater in urban areas. This concept uses sustainable drainage systems and environmentally friendly urban design technologies to create a healthy water cycle and address water and environmental pollution issues [6]. The review shows that the sponge city concept has been widely adopted in various cities in China as a tangible step toward water protection.

TABLE 3
OVERVIEW OF SELECTED PUBLICATIONS ON WATER PROTECTION

Source	Brief of Study	Good Practice	Scope
[6]	Analyzing the concept of sponge cities in China and its impact on urban land-use planning and water resource management.	Stormwater management, Low-impact development (LID)	Yanglin and Jiangbei, China
[1]	Analyzing ten pilot sponge city projects in Shanghai and identifying key characteristics and effective implementation processes.	Stormwater management, Low-impact development (LID)	Shanghai, China
[7]	Building innovative sponge city facilities and utilizing the native ecological environment to address urban flooding and water pollution issues.	Low-impact development (LID)	Chaotou Park, Jiangmen, China

Stormwater management is used to improve effective control of rainfall runoff in urban areas by storing, recycling, and filtering stormwater through upgraded drainage systems with flood-resistant infrastructure and improved drainage protection standards, as well as integrating natural water resources such as wetlands and lakes [6]. Additionally, the low-impact development (LID) approach focuses on storing and infiltrating stormwater through various methods, including [1]:

1) Bio-swales: Artificial channels planted with vegetation and filtration media capture and filter stormwater before it flows into waterways.
2) Rain gardens are specially designed to capture rainwater and allow it to infiltrate the ground.
3) Permeable pavements: are types of road or pavement surfaces made from absorbent materials or materials that allow water to pass through porous concrete, gravel, or permeable pavers, which can absorb rainwater and allow it to infiltrate the ground.
4) Green roofs: roofs covered with vegetation, commonly known as green roofs or living roofs, can absorb rainwater and prevent runoff into stormwater drains.

This approach can better manage rainwater runoff, reducing the burden on traditional drainage systems and utilizing natural resources to filter and infiltrate rainwater into the ground [7]. However, its implementation has several challenges, including a lack of public awareness about the importance of rainwater management, negative perceptions of rainwater as waste, technical difficulties in selecting and maintaining appropriate infrastructure, and the instability of climate change [6]. Based on the analysis, several critical success factors for water protection efforts were identified. These factors include controlling the quality and quantity of rainwater, regulating drainage pipes, flood mitigation, ecosystem rehabilitation, urban river ecology development, and the installation of wastewater treatment facilities and bio-retention ponds [1], [6], [7].

C. Soil Protection

In achieving a smart environment, soil protection is essential to address various issues in urban areas. One problem that needs to be addressed is poor soil quality, especially in urban areas vulnerable to pollutants, waste, and chemicals [18]. Additionally, urban soil tends to be infertile due to these conditions. Limited water availability in urban areas also poses a constraint on food production. Ground receiving an inadequate water supply can affect agricultural productivity and hinder efforts to meet food needs in urban areas.

Moreover, climate change also significantly impacts production, causing changes in weather patterns that can affect soil and agricultural yields [18]. Technology in smart farming has been widely applied to soil protection. This technology accurately measures parameters such as soil moisture, nutrients, and cover [11], [19]. It helps farmers and agricultural practitioners manage soil more effectively, optimize resource utilization, and enhance agricultural productivity [18].

TABLE 4
OVERVIEW OF SELECTED PUBLICATIONS ON SOIL PROTECTION

Source	Brief of Study	Good Practice	Scope
[11]	Creating specific soil organic carbon (SOC) standards for mineral soils in Germany used in agricultural activities.	Soil Organic Carbon Benchmark	German
[18]	Reviewing satellite-based and drone-based remote sensing technologies in monitoring crops and soil conditions in smart farming practices.	Drone-based Remote Sensing System	Hokkaido, Japan
[19]	Evaluating low-cost electronic sensors for monitoring soil moisture in experimental areas in semiarid regions.	Low-Cost Electronic Sensors in Soils	Brazil

Drone-based remote sensing technology refers to the use of drones to collect data and information about the soil through sensors attached to the drone, including [19]:

1) *Measuring soil moisture* by analyzing the spectral variations from acquired images.
2) *Assessing soil cover*, which refers to the proportion of the land area covered by vegetation, soil cover can be measured by calculating vegetation indices.
3) *Utilizing infrared thermometry* to measure soil nutrient content, such as nitrogen, using portable devices placed in the field or integrated technology on the drone [18].

Its implementation must address several challenges, including the time-consuming and costly nature of measuring and monitoring soil carbon changes, which require extensive sampling [11]. Additionally, the lack of understanding regarding the influence of organic amendments on soil carbon storage poses a challenge, as there is still a significant reliance on chemical fertilizers and synthetic pesticides to enhance soil fertility [18]. Efforts are needed to improve understanding and awareness of the benefits of organic amendments in maintaining soil quality and health. Achieving success in soil protection involves various factors that need to be considered. These factors include soil structure, erosion, and soil degradation rates, soil pH, soil nutrient content, the presence of pathogens and pesticides in the soil, understanding of soil management practices, as well as soil measurement and monitoring tools [11], [18], [19]. By addressing these factors and implementing appropriate soil protection practices, it is possible to achieve soil health and sustainability while enhancing agricultural productivity sustainably.

D. Air Protection

Air protection in smart environments emerges as a response to the increasing air pollution issues in urban areas caused by human activities such as motor vehicles, industries, and power plants that generate pollutants [8]–[10]. Additionally, the lack of air quality monitoring technology poses a challenge, necessitating cheaper and more effective monitoring technologies to track air quality in various locations [8], [9]. It drives researchers to conduct air quality monitoring using advanced and innovative technologies.

TABLE 5
OVERVIEW OF SELECTED PUBLICATIONS ON AIR PROTECTION

Source	Brief of Study	Good Practice	Scope
[8]	Measuring air quality using low-cost sensor devices is compared to regional air quality monitoring and network measurements.	Low-Cost Sensor Node	Central Switzerland
[9]	Monitoring particulate matter (PM) air pollution using low-cost sensor-based air quality measurement systems.	the Ecomar System	Podgorica and Pljevlja, Montenegro
[10]	Developing a prediction model using the LSTM (Long Short-Term Memory) method to forecast air pollutant concentrations (PM10, CO, and SO2).	Long Short-Term Memory (LSTM)	Konya, Turki

The utilization of long-short-term memory (LSTM) prediction models, a type of artificial neural network (ANN) model, has proven to be an effective method for predicting air pollution levels [10]. Furthermore, using technologies such as the Ecomar system and Sensor Node assists in measuring real-time concentrations of particulate matter and gases, as well as air humidity and temperature [8]–[10]. These technologies are crucial in aiding government organizations and environmental agencies to take appropriate preventive actions to reduce air pollution levels and safeguard human health [8].

Several challenges have been identified in implementing air quality monitoring technologies, including budget constraints, complex data processing, and difficulty identifying pollution sources. Budget constraints pertain to the investment required for affordable sensors and network infrastructure [8]. Complex data processing necessitates specialized skills and technological infrastructure to analyze real-time data and effectively communicate it to the public [8], [9]. Difficulty in identifying pollution sources is linked to the complexity of air pollution sources originating from various locations and sources. Factors contributing to successful air protection initiatives include real-time air quality data, the integration of data from multiple sensors, stringent air quality regulations and standards, and maintaining pollutant concentrations at safe levels [8]–[10].

E. Waste Management

Waste management is a critical aspect smart environment concept, given the significant increase in waste volume, particularly from household waste disposal, and the limited availability of land for waste disposal [12]–[14]. The escalating environmental issues, such as methane gas emissions impacting the climate and environmental pollution [12], further emphasize the importance of waste management. In the realm of waste management, waste management system technologies and the waste hierarchy approach have been implemented in various countries. Researchers evaluate and implement electronic waste (e-waste) management systems to ensure effective and sustainable waste management [13].

TABLE 6
OVERVIEW OF SELECTED PUBLICATIONS ON WASTE MANAGEMENT

Source	Brief of Study	Good Practice	Scope
[14]	Evaluating the effectiveness of waste management systems towards a circular economy.	Waste Management System Development Stage Concept	Marocco
[12]	Analyzing the potential, challenges, and opportunities in achieving sustainable waste management to create a zero-waste city.	Waste Hierarchy, Circular Carbon Economy	China
[13]	Implementing innovative systems in household e-waste management in the e-waste recycling sector.	Smart Electronic Waste System	Malaysia

Implementing a waste management system based on the waste hierarchy approach aims to transform waste management into resource management, involving waste reduction, recycling, and energy recovery [12]. The waste management system adopts advanced technologies such as thermal technology (incineration) and biological technology (composting) for waste treatment [12], [14]. Additionally, the system enforces strict regulations regarding waste disposal in landfills and promotes waste processing and recycling by rules. Furthermore, the plan encourages community participation in sustainable waste management programs such as recycling and waste reduction initiatives and develops single-use plastic reduction systems [12].

Researchers have identified several challenges in implementing a waste management system, including changing consumption patterns that lead to increased waste generation and requiring educational efforts to change consumer behavior [14]. Additionally, the technologies needed for waste processing are highly complex and require significant investment, particularly in effective recycling and thermal treatment. Other challenges include efficient waste collection and transportation, especially in densely populated areas with limited infrastructure [13]. Moreover, determining the pricing of waste processing is crucial to ensuring affordability for the public while considering its impact on the waste industry [12]. To successfully address waste management challenges, factors such as a circular carbon economy, domestic carbon resources, policies and regulations, waste collection and transportation, recycling, waste prevention, and reuse [12]–[14] are crucial to success.

F. Renewable Energy

Renewable energy becomes crucial in smart cities as it reduces reliance on fossil fuels, which harm the environment. Using fossil fuels like natural gas and coal to meet energy demands results in air pollution and harmful greenhouse gas emissions [15]. Additionally, limited land availability constrains the development of renewable energy sources on land [2]. Therefore, one solution adopted by researchers is floating solar power technology, which utilizes water bodies as its location. This technology holds significant potential for generating clean and sustainable energy while minimizing negative environmental impacts [16].

TABLE 7
OVERVIEW OF SELECTED PUBLICATIONS ON RENEWABLE ENERGY

Source	Brief of Study	Good Practice	Scope
[2]	Proposing a conceptual design for a partially floating solar panel (PV) system incorporating a passive cooling approach to meet energy demands.	Floating Photovoltaic Solar System, Energy Storage System	Egyptian north lakes
[15]	Investigating the microclimate impact on the energy efficiency of floating solar power plants.	Floating photovoltaic power plants (FPVPs)	Istanbul Buyukcekmece Lake, Turkey
[16]	Analysis of the structural and electrical performance of floating photovoltaic (FPV) energy generation systems.	Floating Photovoltaic (FPV) Energy Generation Systems	Istanbul Buyukcekmece Lake, Turkey

Floating solar power plants are a technology that supports sustainable energy development and reduces dependence on depleting fossil energy resources [15]. By utilizing water bodies, this technology can optimize the use of open space. Additionally, it can efficiently generate stable energy in maritime environments, thereby reducing long-term operational costs [2], [16]. Thus, floating solar power technology significantly contributes to transitioning to a more sustainable and greener society energy system.

However, researchers face several challenges in implementing floating solar power plants. One of them is the high investment cost, which includes the production costs of solar modules and relatively expensive floatation materials, transportation costs, on-site installation, and maintenance and upkeep expenses [2]. Furthermore, maintenance and upkeep of floating solar power plants become challenging due to their remote and limited accessibility, making them susceptible to damage from maritime environmental conditions [2]. Complex regulations and permits also pose obstacles to the development of these power plants, mainly due to their offshore locations. Therefore, effective coordination with relevant stakeholders is necessary to ensure compliance with environmental aspects and the appropriate utilization of marine areas [16].

The selection of suitable locations is a crucial factor, considering the availability of sufficient sunlight potential and favorable water conditions. Additionally, the design of floating solar power plants needs to be optimized to adapt to the aquatic environment and maximize solar energy collection. Reliable and efficient technology for electricity generation from sunlight is also crucial for the success of floating solar power plants. Moreover, robust security systems must be implemented to protect the floating power plants from damage and environmental threats. Finally, efficient operational management is required to ensure optimal performance and minimize losses or disruptions [2], [15], [16]. By considering these factors, implementing floating solar power plants can achieve the desired success.

G. Forest City

Urban areas are the primary source of carbon emissions. Population density, vehicles, and a lack of green open spaces exacerbate this issue. Emissions from cars, factories, and other fossil fuel combustion also impact urban air quality, negatively affecting the health of residents and the environment [3], [4]. Rapid urban development damages natural habitats, such as forests and wetlands, leading to environmental disasters [5]. In response to these challenges, the "Forest City" concept merges as a form of urban development that integrates urban spatial planning with extensive green systems, including artificial forests and green open spaces [3]. The aim is to reduce carbon emissions and promote sustainable development [4].

TABLE 8
OVERVIEW OF SELECTED PUBLICATIONS ON FOREST CITY

Source	Brief of Study	Good Practice	Scope
[3]	Evaluating the effects of national forest city development on air pollution.	National Forest City Construction (NFCC)	China
[5]	Review the use of living infrastructure, including urban forests, to enhance amenity and climate adaptation strategies.	Living Infrastructure	Canberra, Australia
[4]	Testing the role of forest city construction in reducing carbon emissions.	Forest City Constructions	China

Constructing a forest city aims to integrate green systems into urban planning, including expanding city parks, community gardens, and green open spaces [3]. Efforts are also made to reduce carbon emissions by building sustainable transportation systems like bike lanes and railways. Energy conservation is also a focus, with the implementation of green technologies like solar power generation and efficient energy management systems [5]. Through this concept, the main goal is to improve the quality of life for residents by creating a healthier and greener environment and increasing access to green open spaces [4].

One of the main challenges in implementing the forest city concept is the limited available land, especially in densely populated large cities [3]. It requires creative thinking and innovative strategies to optimize existing land use. Additionally, the concept faces challenges in relying on advanced and expensive green technologies, such as solar power generation and smart grid technology. Using these technologies requires financing and infrastructure maintenance, which can constrain factors. Furthermore, good coordination and collaboration among the government, developers, communities, and other relevant institutions are also challenges in implementing this concept [5]. Differences in interests and perspectives can hinder progress. Moreover, low environmental awareness and community participation in climate change mitigation efforts are additional challenges that must be addressed [5].

Researchers state that factors such as environmental quality, including water, soil, and air quality, as well as the quality of life for residents, are crucial factors in the success of forest city construction [3]. Additionally, efforts to reduce greenhouse gas emissions and promote the use of renewable energy are essential elements in building a sustainable city [4]. Using innovative and efficient green technologies is critical to achieving these goals. Moreover, adequate infrastructure, such as good roads, a clean water supply, effective sanitation systems, adequate healthcare facilities, and accessibility to education and recreation, is also essential to ensuring the success of forest city development [3], [5].

V. CONCLUSION

This systematic literature review identifies success factors and best practices influencing the implementation of smart environment and forest city concepts. This research provides a deeper understanding of the crucial factors in adopting intelligent and sustainable urban environments and forest cities. Regarding environmental protection, including water, soil, air, waste management, and renewable energy, best practices such as innovative technologies, effective governance, active community participation, and stakeholder collaboration have proven successful in various countries.

Best practices such as efficient water management systems, integrated waste management, renewable energy utilization, and participatory governance are crucial to creating sustainable urban environments. Furthermore, adopting smart environment and forest city concepts in various countries can serve as important references for other nations in developing and implementing strategies suitable to their local conditions and challenges. By applying these success factors, it is possible to realize smart, sustainable, and environmentally friendly urban environments while maintaining a balance between urban development and environmental protection for future generations.

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