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Advocating ‘eco-village’ for sustainable development: The dayalbagh way of life

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Abstract: India as a country has its identity deeply rooted in its rural culture. Whether we talk about agriculture, tradition, food, art, or music, the rural society of India has always proven itself a representation towards the national front. The Dayalbagh society in Agra city of Uttar Pradesh (India) is engaged to strengthen the nation’s roots through education, technology, sustainability, management, innovation, research, and most importantly, selfless service. The major potential for economic growth in India lies in the development of its rural areas. This article is an attempt to spot the outlook of a society that has its inception for the past 100 years and is continuously making efforts to glorify the message of sustainable development, environmental protection, and rural development through its effective plans in designing an eco-village-based society. Based on the narrative description approach, this article highlights the efforts and strategies employed by the Dayalbagh society to promote sustainable development, environmental protection, and rural development. The focus is on how society integrates education, technology, sustainability, management, innovation, research, and selfless service to achieve these goals. The Dayalbagh society’s initiatives have taken into consideration economic, social, environmental, and human aspects, demonstrating significant contributions towards sustainable development and rural empowerment. The philosophy and successful practices of the Dayalbagh society can inspire and guide others in developing action plans for effective environmental protection and sustainable rural development. By adopting such approaches, other organizations, decision-makers, and individuals can contribute to the overall growth and well-being of rural areas in India.

Keywords: sustainable development; eco-village; Dayalbagh; rural development

1. Introduction

With the pressing issues of climate change, resource depletion, and social injustices, the need for sustainability has increased dramatically in today’s global environment [1]. A thorough context for tackling these problems is offered by the Sustainable Development Goals (SDGs) of the United Nations, which highlight the connections between social progress, environmental preservation, and economic growth [2]. The Environmental, Social, and Governance (ESG) criteria have become indispensable standards for assessing long-term resilience and corporate accountability at the same time [3]. The world’s consumption of natural resources has increased significantly as a result of industrialization, globalization, faster economic growth, population expansion, and rising living standards [4]. Nevertheless, the planet’s ability to accommodate our growing need for natural resources and to absorb our waste and emissions is finite. It is challenging to attain the three interrelated components of sustainable development—economic, environmental, and social—in real life, which may be because of underlying

obstacles, limitations, and trade-offs. The research that is now available focuses on the laws and procedures required to accomplish these external dimensions [5]. Climate change disproportionately affects disadvantaged groups; therefore, there's an increasing chance that global climate worries could lead to significant socioeconomic disparities [6]. Extreme weather, temperature rise, and changing ecosystems make already-existing disparities worse, making marginalized populations more vulnerable to the effects of environmental degradation [7]. Social divisions are widened by this imbalance, which takes many forms, such as forced migration, loss of livelihood, and food poverty. In order to guarantee that all facets of society can adapt and prosper in a changing environment, fair and sustainable solutions are becoming increasingly urgent as the climate problem worsens [8].

After India's independence, several industrialization and urbanization efforts supplied material and insights for future planning. Growth has accelerated beyond cities and older suburbs into many previously rural areas during the last several decades. Farms and woods are being converted to different uses at an increasing rate due to development. This indicates that standards in the management of the world's natural environmental resources have deteriorated, resulting in a reduction in the public benefit provided by agricultural land forests [9]. In the truest sense, development should be seen as aligning urbanization with sustainability, forging a path where cities not only grow and thrive economically but also uphold principles that ensure long-term environmental health, social equity, and resilience. Urbanization, the process by which cities expand in size and population, is a defining feature of global development. Yet rapid and unplanned urban growth often leads to environmental degradation, social inequalities, and strained infrastructure. In contrast, sustainable urbanization aims to balance growth with the preservation of natural resources, the enhancement of community well-being, and the reduction of carbon footprints [10]. Sustainable urban development prioritizes environmental conservation and restoration. This includes promoting green spaces, adopting energy-efficient building practices, and integrating renewable energy sources into city infrastructure. By reducing greenhouse gas emissions, minimizing waste, and safeguarding natural habitats, cities can mitigate climate change impacts and preserve biodiversity [11]. Sustainable cities prioritize social equity by ensuring access to basic services, affordable housing, and quality education and healthcare for all residents. Community engagement in urban planning processes fosters inclusivity and empowers marginalized groups, promoting a sense of belonging and social cohesion [12]. Sustainable urbanization fosters economic development that is inclusive, innovative, and resilient. This includes supporting local businesses, promoting green jobs in sectors such as renewable energy and sustainable transportation, and investing in infrastructure that enhances productivity and connectivity [13]. Cities face increasing risks from climate change impacts and natural disasters. Sustainable urban development builds resilience by implementing climate-adaptive infrastructure, enhancing disaster preparedness and response systems, and integrating nature-based solutions that buffer against extreme weather events [14]. Embracing technology and data-driven solutions can optimize urban systems, making cities more efficient and responsive to the needs of residents. Smart transportation networks, digital governance platforms, and sustainable waste

management systems are examples of innovations that improve quality of life while reducing environmental impact [15].

According to the scenarios examined, in order to keep global warming to 1.5 °C, greenhouse gas emissions must peak before 2025 at the latest and be lowered by 43% by 2030. Methane emissions must also be decreased by around a third during this time [16]. 2020 saw a steady rise in greenhouse gas concentrations, setting new records. With a global average temperature that was roughly 1.2 °C higher than the 1850–1900 baseline, it was one of the three warmest years ever recorded with CO₂ levels exceeding 410 parts per million. The Paris Agreement's goals of achieving net-zero carbon dioxide (CO₂) emissions worldwide by 2050 and restricting global warming to 1.5 °C over pre-industrial levels are still terribly out of reach [17].

2. Inside literature

2.1. Concept of eco village

An eco-village is a community designed with a focus on ecological sustainability, social harmony, and economic cooperation. These villages typically aim to minimize their ecological footprint by incorporating principles such as renewable energy use, organic farming, waste reduction, and conservation of resources. They often emphasize self-sufficiency in food production, water management, and energy generation, aiming for a balanced relationship with the natural environment [18]. Eco-villages are human communities, whether urban or rural, that aim to combine a low-impact way of life with a supportive social environment. Eco-village offers a feasible, sustainable future for both humans and the planet, which is a remedy for mending the world [19]. Agriculture is considered to be the 'engine' of the Indian economy. They have explored 12 different rationales under three stages/levels, viz., farm economy, rural economy, and national economy, to support their theory. The authors have drawn empirical evidence to establish the direct positive association between growth of agriculture and reduction of poverty. Under the farm economy, the benefit of agricultural growth is focused upon the incomes of farmers, including small farmers; a rise in farm wage rates and more labor engagement look for greater agricultural land [20]. Ellis and Biggs [21] argued in support of small farmers that the development is crucial for small holders as they least damage the environment, make efficient decisions, involve family members, wisely use resources, spend on locally produced goods and services, and take aid from cooperatives or self-generated marketing chains.

According to Liu et al. [22], the Chinese government views eco-village development as a successful strategy for addressing issues arising from the shift in rural population. In a rural economy context, farm incomes can lead to engagement in other non-farm activities, which ultimately facilitate educational opportunities, generation of local taxes, better infrastructure and facilities, reduced prices, expansion of earning activities, and overall welfare. Finally, at the third stage of the national economy, reduced prices of raw materials and foods, generation of taxes from rural economies create investment platforms and job opportunities for other sectors, and increased savings and earning of foreign exchange. Key features of eco-villages may

include the use of eco-friendly building materials, passive solar design, and energy-efficient systems; Designing agricultural systems that mimic natural ecosystems to maximize productivity and minimize impact; harnessing energy from solar, wind, or other renewable sources to reduce reliance on fossil fuels; emphasizing cooperation, shared resources, and decision-making processes that foster social cohesion and mutual support; implementing strategies for reducing, reusing, and recycling waste materials; and often serving as centers for environmental education and sustainability practices, providing knowledge to residents and visitors alike [23,24].

2.2. Eco-village and urban areas, together?

Urban areas can adopt concepts from eco villages by integrating principles of sustainability, community cooperation, and environmental stewardship into their development and operations. Some of the ways [25–27] are:

- **Sustainable Architecture:** Incorporate eco-friendly building materials, passive solar design, and energy-efficient technologies in new constructions and renovations.
- **Green Roofs and Walls:** Implement green roofs and walls to improve insulation, reduce urban heat island effect, and promote biodiversity.
- **Solar and Wind Power:** Increase the use of solar panels and wind turbines on rooftops and in communal spaces to generate renewable energy locally.
- **District Energy Systems:** Develop district heating and cooling systems that utilize renewable energy sources or waste heat from industrial processes.
- **Urban Agriculture:** Encourage rooftop gardens, community gardens, and vertical farming to promote local food production and reduce food miles.
- **Permaculture Practices:** Implement permaculture principles to create resilient urban food systems that mimic natural ecosystems.
- **Waste Reduction:** Promote waste reduction strategies such as composting, recycling programs, and reduction of single-use plastics.
- **Circular Economy:** Embrace circular economy principles by reusing materials, repairing products, and designing for longevity.
- **Participatory Decision-Making:** Involve residents and stakeholders in decision-making processes related to urban planning, infrastructure development, and community initiatives.
- **Community Building:** Foster a sense of community through shared spaces, events, and cooperative activities that promote social interaction and mutual support.
- **Environmental Education:** Offer programs and workshops on sustainability, eco-friendly practices, and urban ecology to residents, businesses, and schools.
- **Public Outreach:** Engage the public through campaigns, events, and demonstrations that raise awareness about eco-friendly lifestyles and behaviors.
- **Public Transit and Active Transportation:** Improve public transit systems, promote cycling and walking infrastructure, and encourage electric vehicle adoption to reduce carbon emissions and congestion.
- **Car-Free Zones:** Designate car-free zones or pedestrian-only areas to enhance

walkability and air quality in urban centers.

Through the adoption of these strategies and integrating eco-village principles into urban planning and development, cities can create more sustainable, resilient, and livable environments for their residents while contributing to global efforts to mitigate climate change and environmental degradation. So, in a nutshell, the eco-village concept does not necessarily mean its scope is confined to rural areas, but such a holistic concept can be planned along with urbanization goals for delivering a true sense of development.

3. Discussion

3.1. The Dayalbagh's eco-village way of life

Eco-villages are urban or rural communities of people attempting to combine a supportive social environment with a low-impact lifestyle. To do so, they combine elements of ecological design, permaculture, ecological construction, green production, alternative energy, community-building techniques, and more. Eco-villages are living sustainability models. They are a practical and accessible means of combating the destruction of social, ecological, and spiritual settings.

Dayalbagh, meaning “Garden of the Merciful,” is a self-sufficient community of more than 3000 people who live and give selflessly to 2235 acres of land known for its peaceful surroundings, secular establishments like industries, a bank for co-ops, hospitals, schools, and universities, as well as an agriculture farm with a dairy farm and the activities of its inmates, who lead active, disciplined, and cooperative community lives in accordance with the high spiritual ideals of their faith. Dayalbagh makes full use of the advantages of both living infrastructures with cutting-edge amenities that cannot be constructed in urban regions and rural areas. The community boasts a great variety of flora and fauna and rich landscaping. The community is known for its green business practices and efforts in women's empowerment. Sustainable development and spirituality building are core values. Dayalbagh is also committed to community service, innovation, and the use of technology. It harnesses renewable solar energy resources and has mechanisms for air and water purification. Rainwater harvesting and natural and organic farming are also practiced. Additionally, the community supports small-scale industries and rural populations. It provides cost-effective medical facilities and free medical camps for the rural population. These aspects reflect Dayalbagh's dedication to supporting its people and the nearby population, creating a mutually beneficial relationship. This belt lying in the city of Taj Mahal (Agra) is popularly referred to as the “Eco Village” [28], and the temperature is usually 3 degrees lower as compared to other parts of the city in summers, where the heat impact is up to 48–49 degrees Celsius.

Considering the related past research work, Tomičić and Schatten [29] used an agent-based modeling framework to simulate multiple resources simultaneously, tested on a Croatian eco-village. It demonstrated the framework's effectiveness in extending self-sustainability through photovoltaic modules and propane generators. The results showed improved energy management and highlighted the potential for further exploration in battery usage patterns. Innovation is crucial to achieving

sustainability from all angles, including the economic, social, environmental, and personal. Innovation can also be triggered by a change in perspective, the discovery of new information, or even a different approach to an issue (soft innovation). Hardwired innovation is mostly driven by technology. Educational institutions can innovate, according to Dayalbagh's theory, by developing new learning organizations and pathways that offer opportunities for experiential learning, teaching-learning techniques, synthesis, analysis, and skill development, as well as innovative technological interventions. This leads to the creation of new information, creative curriculum design, and opportunities for student mobility. Fostering innovative thinking is strongly recommended for reasons related to energy, economy, and the environment. A combination of these concepts leads to cost-effective innovation that will evolve continuously and dynamically for the foreseeable future.

In 1992, Former President of India R. Venkataraman visited Dayalbagh and quoted that—"When one comes into this atmosphere, one finds he is in a totally different climate and environment from the usual things he meets in ordinary life. There is sanctity about this place. There is an educational atmosphere in this place. A research aroma surrounds this entire place. And above all, a spirit of service and dedication permeates the whole. It is indeed fortunate that all of you have such a rare combination of all that is best in life for you."

This quote highlights the unique and exceptional atmosphere of Dayalbagh. The speaker begins by noting that entering Dayalbagh feels like stepping into a completely different environment compared to everyday life. This difference is characterized by a sense of sanctity, suggesting that the place has a holy or sacred quality that sets it apart. Alongside this, there is a "research aroma," indicating that the pursuit of knowledge and scientific inquiry is pervasive and deeply integrated into the fabric of the place. Furthermore, the spirit of service and dedication is highlighted as a core value at Dayalbagh. The community is described as being driven by a commitment to helping others and contributing selflessly to the greater good. The former president expresses his admiration for the rare combination of sanctity, education, research, and service found at Dayalbagh. He acknowledges that it is indeed fortunate for those who are part of this community to experience such a holistic and enriching environment, which embodies the best aspects of life.

In 1984, Mrs. Sarla Grewal, secretary, Ministry of Education and Culture, quoted that—"Dayalbagh is engaged in carrying out significant broad-based educational experiments by providing an academic atmosphere in agricultural, rural, and industrial complexes, oriented to specific conditions and needs, and providing suitable social services, work experience, national integration, and vocational training programs along with academic curriculum. The system of education aims at excellence without jeopardizing relevance. It inculcates the dignity of manual labor and encourages initiative and creative work. It has an interdisciplinary approach, and it aims at building up an integrated personality of well-adjusted men."

In this quote, the speaker described Dayalbagh as a broad roof undertaking educational experiment that integrates academic learning with practical and vocational training. This includes specialized programs in agriculture, rural development, and industrial activities tailored to meet specific local conditions and needs. The educational system at Dayalbagh is designed to provide not just academic

knowledge but also essential social services, work experience, and opportunities for national integration. It offers vocational training alongside the traditional academic curriculum, ensuring that students gain practical skills and hands-on experience. The aim of such an educational system is to achieve excellence without losing relevance to the real world. It promotes the dignity of manual labor, encouraging students to take initiative and engage in creative work. The interdisciplinary approach fosters holistic development, focusing on building well-rounded individuals with integrated personalities. In essence, the quote highlights Dayalbagh's commitment to developing well-adjusted, capable individuals through an education system that blends academic rigor with practical experience, creativity, and social responsibility. This comprehensive approach ensures that students are not only knowledgeable but also skilled, socially aware, and ready to contribute positively to society.

Through awareness of the freedom and democratic values, awareness of duties and obligations to society, respect for the rights of others, empowering underprivileged sections of society, and approaching the last, the least, the lowest, and the lost so as to make sure the contribution to national development. The Dayalbagh philosophy has the following ideologies related to some core focus issues:

3.1.1. Introduction and adoption Sigma SixQ approach

“The vision of the Founder of Dayalbagh and this Technical College, His Holiness Sir Sahabji Maharaj, was to bring up institutions to serve as models to all those working for the uplift of humanity, whose alumni will be healthy and hardworking, not shirk from manual labor,” said Most Revered Prof. Prem Saran Satsangi, speaking to the crowd at the Annual Prize Distribution Function of Dayalbagh Educational Institute (DEI).

The community's SIGMA SIXQ [5] framework weaves six essential threads together and focuses on increasing quality (Q) of life. The aggregate of these six (Sigma) is bigger than the sum of their parts. Following are the six key areas to ensure social, environmental, and economic sustainability:

- Agriculture and dairy practices
- Air quality
- Education and healthcare
- Innovation, including renewable energy generation and usage
- Quality and Values
- Water quality

3.1.2. Agro-ecology cum precision farming and agricultural research

Dayalbagh has implemented an innovative approach combining agroecology with precision farming to promote sustainable agriculture and address local challenges effectively. Agroecology emphasizes ecological principles in agriculture, such as biodiversity, soil health, and minimal chemical inputs, to enhance resilience and sustainability. Precision farming, on the other hand, utilizes modern technology like sensors, drones, and data analytics to optimize crop production efficiency, resource use, and environmental impact. Leal Filho et al. [30] reviewed agroecology's progress over the past 20 years in promoting sustainable agriculture

and reconnecting farmers with consumers, disrupted by industrial agriculture and the Green Revolution. It examines barriers such as industrial practices and the COVID-19 pandemic, explores agroecology's potential in urban settings, and emphasizes the importance of educating future professionals.

This integrated method minimizes environmental harm while helping farmers in Dayalbagh obtain higher yields. Agroecology ensures better soils and crops by implementing organic farming practices and decreasing dependence on synthetic fertilizers and pesticides. Precision farming techniques allow for exact irrigation, fertilization, and pest management based on real-time data. Together, these efforts preserve energy and water resources while also lowering carbon emissions and enhancing the quality of the air and water. Additionally, via improving local food security, fostering sustainable livelihoods, and protecting biodiversity, this paradigm fosters community resilience. It serves as a sustainable development model that aligns with global goals such as zero hunger (SDG 2) and responsible consumption and production (SDG 12), making Dayalbagh a notable example of integrating traditional ecological knowledge with modern agricultural technology for sustainable development.

The area was formerly thought to be wasteland and featured ravines, low mounds, spots of rocks and stones, alkaline soil, sand dunes, and patches of weeds and reeds. Since 1942, the 'Grow More Food' effort has been steadily transforming the unproductive and uneven barren lands into cultivated fields. Over 1531 acres of agricultural land are being used to raise cereals, pulses, oil seeds, vegetables, fruits, cash crops (potatoes, sugarcane, etc.), and fodder in the Dayalbagh area. Agricultural practices are centered on organic agricultural methods that conserve and enhance soil, making them environmentally benign.

Here, agricultural techniques from the past and present are combined. Dayalbagh's Gaushala wastes are used to augment agriculture in order to meet its manure needs. Chemical compounds such as insecticides, fungicides, weedicides, and chemical fertilizers are not employed in the performance of various agricultural operations. Dayalbagh's agricultural output is sufficient to support the needs of the locals and pilgrims who arrive for a short time.

The academicians at the institute are dedicated to agricultural research, especially dairy farming, as are the specialists from Dayalbagh. To increase their agricultural output and activity, rural farmers are also given free consultation services and advice. Keeping in mind the long-term fertility of the soil and crop quality, the agricultural work in Dayalbagh fields is supported by the use of 100% natural fertilizers and pesticides without the use of artificial chemicals. The institute established Anupam Upvan, a field for growing food and vegetables, in addition to its botanical gardens spread across multiple places. A number of agricultural and dairy technology courses encourage the next generation to pursue jobs in agriculture and explore opportunities for research. This promotes strengthening of our roots that are inherited in the actual rural environment of India. Such innovations will eventually bring improvements in agricultural activities, and farmers can be trained to produce natural and good-quality output.

3.1.3. Dairy farming

In Dayalbagh, dairy farming is an example of an integrated, sustainable strategy meant to uplift the local community and encourage environmental conservation. To supply the villagers' milk needs, Dayalbagh has its own cow yard with roughly 1,200 heads of cattle. The company's internal feed requirements are satisfied year-round. Animal dung is recycled and used as manure in fields. The dairy produces pasteurized milk and other milk products using state-of-the-art machinery. Additionally, some goods are sent outside of the country. The dairy farm also uses RFID technology for effective health monitoring of the milching units. It has also joined hands with the Dayalbagh University dairy students to deliver quality output in dairy and, at the same time, give real pragmatic experience and interest among the students towards agribusiness. Farmers prioritize the well-being and health of dairy animals, ensuring they receive proper nutrition, veterinary care, and living conditions conducive to their health and productivity.

On the basis of the case study, Darwai et al. [31] proven the positive results in small-scale dairy farms after effective implementation of resources, manpower, herds, alternate revenue, and infrastructure management with the help of technology and AI. Organic agricultural practices and the concepts of agroecology are integrated into Dayalbagh's farming practices. Techniques like precision farming are used to maximize waste management, feed efficiency, and water utilization. In addition to saving resources, this lessens the environmental impact of dairy farms. Dayalbagh dairy farming ensures food security by supplying fresh milk and dairy products for local consumption, supports local economies, and creates job opportunities. All of these factors contribute to the community's resilience. Dayalbagh's ongoing learning and research programs support farmers in implementing best practices in animal husbandry, sustainable agriculture, and dairy management, guaranteeing innovation and continuous progress in dairy farming methods. The students of dairy vocational courses in Dayalbagh Educational Institute (deemed to be university) get hands-on exposure by witnessing and doing by themselves towards understanding and research work.

3.1.4. Energy generation and supplies

Dayalbagh manages power supply and energy generation using a combination of efficient distribution networks, sustainable and self-sufficient community-led projects, and renewable energy sources. Dayalbagh places a strong emphasis on the use of renewable energy sources, such as solar electricity, for community and university power usage. To harvest solar energy and lessen its dependency on fossil fuels and carbon emissions, the community has made investments in solar farms and panels. It intends to give the neighboring hamlet free access to excess energy output. Micro-grid systems, which combine conventional electrical networks with renewable energy sources, are part of Dayalbagh's energy infrastructure. These microgrids provide improved control of varying energy demands and more effective power distribution within the neighborhood. Efforts to improve energy efficiency play a crucial role in Dayalbagh's energy management strategy. This includes initiatives such as LED lighting, energy-efficient appliances, and awareness programs to promote responsible energy consumption among residents. The community actively

participates in energy management through initiatives like energy conservation campaigns and community-owned renewable energy projects. This collaborative approach ensures that energy decisions align with the community's values and sustainability goals.

Dayalbagh's energy supply and generation methods are continually improved by constant research and innovation in energy technologies and management techniques. This entails investigating fresh approaches to renewable energy and enhancing the dependability and effectiveness of the current infrastructure. Tube wells are used to supply the water. Groundwater levels have been maintained through the usage of rainwater collection systems. Additionally, the society has a backup generation facility of its own to guarantee continuous supply of electricity. The use of solar power is also growing in popularity. In addition to being installed for street lighting in certain areas, solar-powered lights have also been installed in public spaces both inside and outside the community. Solar power units have been put in every institutional building. To further reduce power consumption, LED lights are utilized as much as possible. Overall, Dayalbagh's approach to energy generation and power supply exemplifies a commitment to sustainability, resilience, and community empowerment through innovative use of renewable energy sources and efficient energy management practices.

3.1.5. Towards environment: Air-water quality and waste treatment

Regarding the environmental sustainability component, the DEI campus has been named one of the nation's sustainable campuses by the Ministry of New and Renewable Energy. Paperless communication is made possible by the majority of information exchange being done digitally. The policies and action plan for environmental conservation and sustainable development of the Indian government are in line with this kind of lifestyle. Additionally, the institute is able to create electricity using highly efficient solar power and is able to distribute the generated electricity to nearby rural communities. Dayalbagh is the recognized international NGO that oversees SPHEEHA, which is dedicated to preserving nature, heritage, and a healthy environment. In essence, it includes initiatives for countryside conservation, trash management, and renewable energy sources. The Dayalbagh philosophy is a strong believer in simple life and elevated thinking, which is expressed in its stringent prohibition against the use of air conditioners (ACs) in all 1200 families due to the negative effects on the environment. Hanging sprinklers are utilized to maintain a cool environment and to automatically clean the leaves, allowing for an unhindered and fresh supply of oxygen to reach the pores. The deployment of massive air purifiers is a testament to Dayalbagh's dedication to enhancing air quality. These devices assist in removing air pollutants like particle matter and hazardous gases by often using cutting-edge filtering technology. Giant air purifiers improve people's health and well-being and lessen the negative environmental effects of urban activity by lowering air pollution levels.

Urban green spaces (UGSs) have the potential to ameliorate climate change, slow runoff, enhance infiltration, reduce air pollution, and prevent soil erosion in fast urbanizing places like Tijuana, Mexico [32]. Dayalbagh uses purification systems and water treatment facilities to make sure that drinking water satisfies safety

requirements. These systems provide households with clean and safe drinking water by eliminating pollutants and pathogens via the use of filtration, disinfection, and other technologies. The neighborhood supports environmentally friendly methods of managing water resources, such as collecting rainfall and replenishing groundwater. Rainwater harvesting systems reduce reliance on municipal water supplies and encourage water conservation by collecting and storing rainwater for a variety of applications. Before wastewater is released back into the environment, efforts are made to properly treat it. In order to reduce their negative effects on the environment and preserve the quality of the water in nearby bodies of water, wastewater treatment plants or systems help eliminate pollutants and toxins from wastewater. The sewage system and rubbish disposal are operational. Every community home separates its garbage into groups based on whether it is biodegradable (kitchen trash) or not. Reputable wastewater treatment plants exist. Pure water is used to irrigate the crops. With each person producing over 200 kilograms of organic solid waste annually, organic garbage makes up the majority of household trash in Dayalbagh. Other sources include garbage from dairy sheds and items like yard litter. After sorting, residents classify their waste into groups that are biodegradable and non-biodegradable. Non-biodegradable waste is sent to recycling facilities; biodegradable waste is gathered and transported directly to composting sites. By taking these steps, we hope to protect aquatic ecosystems and guarantee that clean water is available for human use as well as ecological well-being.

3.1.6. Community uplifting activities

Dayalbagh highlights the importance of education as the foundation of communal growth. It has educational institutions such as colleges, universities, and career centers that offer locals and communities nearby high-quality education. These schools prioritize the whole person, encouraging both academic achievement and a values-based education. The town places a high priority on healthcare, offering citizens accessible and reasonably priced medical treatment through its hospitals, clinics, and wellness facilities. Free medical care once every two weeks, health camps, awareness campaigns, and preventive healthcare activities are arranged for the village residents in the vicinity to encourage wellness and the avoidance of illness. Through a variety of spiritual and cultural events, Dayalbagh commemorates its rich cultural legacy. Religious meetings, cultural events, and festivals unite the community and promote the preservation of cultural customs. Programs for social welfare and uplift are deeply ingrained in the community. Initiatives include providing support to marginalized groups, empowering women through skill development programs, and organizing community service projects to address local needs.

Bandhu et al. [33] highlighted the need for adaptation measures to protect tribal communities from climate change, preserving their natural environment, addressing educational requirements, and other opportunities. It stresses the importance of understanding climate vulnerability and improving tribal and community capacity to design sustainable livelihoods. The community initiatives of Dayalbagh demonstrate a comprehensive strategy for sustainable development, with a focus on social welfare, healthcare, education, and environmental stewardship. These programs

support a vibrant community dedicated to improving people's quality of life, uniting people, and positively impacting society. The community kitchen, Bhandar Ghar, provides Dayalbagh locals and pilgrims with lunch and dinner. In the fields of Dayalbagh, volunteers ranging in age from 18 to 90 years old devote their altruistic labor to the cultivation and production of wheat, rice, lentils, mustard oil, vegetables, including potatoes and onions, and other raw materials. Established kiosks that provide reasonably priced snacks prepared by residents during their duty shifts and staffed by volunteers may be found in every Dayalbagh colony. In order to ensure economic sustainability and affordability for all, community-produced products are also made available at lower prices without sacrificing quality. In the agricultural lands, community members consistently provide selfless service during daily morning and evening services. It is also a component of a spiritual act in which thousands of people, ranging in age from three to over eighty, from various castes and socioeconomic backgrounds, collaborate with one another. Through these initiatives, the message of equality and unpaid, devoted, and faithful service to the demands of the Almighty Supreme Father is propagated. The unselfish labor in the fields conveys the idea of an independent community that toils in 50-degree weather to provide for everyone's needs, even its own hunger. Children visit these farm fields on a regular basis, where they receive recreational exposure, engage in health and self-defense drills, and learn the values of "better worldliness" from an early age.

3.1.7. Creation of green belt

Dayalbagh is declared a green belt due to its deliberate efforts and policies aimed at preserving and enhancing its natural environment, biodiversity, and overall sustainability. Dayalbagh prioritizes the creation and maintenance of green spaces such as parks, gardens, and tree-lined avenues. These areas not only beautify the locality but also contribute to improved air quality, biodiversity conservation, and climate resilience. The community in Dayalbagh practices sustainable land management and conservation efforts. This includes tree planting drives, water conservation measures, and organic farming practices that minimize environmental impact and promote ecological balance. Urban planning in Dayalbagh incorporates green building principles, efficient waste management systems, and sustainable infrastructure practices. These initiatives aim to reduce the environmental footprint and enhance the overall livability of the area. Residents actively participate in environmental initiatives and awareness campaigns. The significance of Beijing's First Green Belt in maintaining urban ecological balance has been demonstrated as how its adaptability to political and socio-economic changes ensured continued relevance. Despite challenges like funding shortages, the green belt played a crucial role in addressing environmental issues and shaping urban development, emphasizing its importance in long-term urban planning [34].

A sense of environmental care and responsibility is fostered in the community by community-led initiatives including clean-up drives, recycling programs, and environmental education workshops. Dayalbagh's laws and policies are meant to encourage green projects and environmental sustainability. This involves following green building guidelines, providing incentives for eco-friendly activities, and enforcing zoning laws that give priority to green areas. It is forbidden for anyone to

touch a tree in order to cut it down. The Dayalbagh registered religious community association retains the authority to take any action against any person discovered engaging in such behavior, including rescinding their license to dwell there. The construction of greenbelts has been a crucial part of Dayalbagh's land use planning. These include agricultural and farming areas, timber planting areas, and a tree corridor that stretches the entire length of the Yamuna River bank. There are still some areas of uneven topography, even though the majority of the uneven land has been leveled and turned into well-formed green fields. This land is used for cultivating trees like amla, crops like taramira, and certain lumber plantations. Additionally, a citrus orchard has been established here. There are two more plants in the area: prosopis and acacia. Dayalbagh's status as a green belt is a testament to its dedication to protecting the environment, encouraging sustainable development methods, and striking a healthy balance between environmental preservation and urban growth. These efforts contribute to making Dayalbagh a model of sustainable living and a pleasant, green environment for its residents and visitors alike.

3.1.8. Transportation

Dayalbagh's transportation system emphasizes sustainability and community inclusion by combining contemporary infrastructure with traditional ways of transportation. In Dayalbagh, bicycles and cycle rickshaws are popular forms of transportation. These non-motorized choices lessen traffic congestion and carbon emissions while encouraging environmentally responsible commuting. Dayalbagh has seen a surge in favor of electric cars (EVs) in recent years. Bicycles and electric rickshaws are growing in popularity as they provide a quiet, clean form of transportation that supports environmental sustainability objectives. Dayalbagh's neighboring communities are connected by shared autorickshaws and minibuses, offering inhabitants easy and reasonably priced transportation alternatives. These public transportation options are essential for promoting connection and mobility within the area. The most common forms of mobility in the region are bicycles and cycle rickshaws, and efforts are being undertaken to reduce the amount of fossil fuel-powered vehicles in the neighborhood to lessen air pollution and traffic congestion. In the Dayalbagh colony, rickshaws and electric cars are the modes of transportation. Inside the colonies, personal vehicles and two-wheelers are prohibited. Parking is available at the entry in a separate area.

The potential of e-transportation is seen as a sustainable alternative to conventional fuels in India. It focuses on youth attitudes and behaviors towards electric vehicles (EVs), highlighting their interest in e-transportation. In context of Bhopal, the research underscores the need to align transportation policies with youth preferences to address environmental impacts and promote sustainable urban development. It also notes economic and infrastructural challenges in adopting EVs [35]. Carpooling and ride-sharing programs are actively encouraged by the community in order to minimize the use of individual vehicles and increase resource efficiency. This neighborhood-focused strategy promotes environmentally friendly driving habits and a feeling of shared accountability for lessening the impact on the environment. Improvements to Dayalbagh's bike lanes, pedestrian walkways, and road connectivity are the main goals of ongoing infrastructure development projects.

The community's overall transportation infrastructure quality, accessibility, and safety are all intended to be improved by these upgrades. In conclusion, Dayalbagh's transportation system demonstrates a dedication to environmentally responsible mobility options by fusing conventional modes with cutting-edge inventions like electric cars and neighborhood-based programs to encourage eco-friendly transportation habits and improve the standard of living for locals.

3.1.9. Security concerns

Fabrègue and Bogoni [36] emphasized the need for robust security measures in smart cities to address privacy, information, and security concerns. It critiques current remedies as inadequate and proposes tactical improvements. The study highlights how increasing security issues in smart cities, as seen in Italy and Switzerland, pose risks of several problems. Dayalbagh residents are dedicated to simple living, high thinking, and hard work. To maintain safety and well-being, security tasks are managed through a combination of community engagement, technological advancements and proactive measures. Dayalbagh residents actively participate in neighborhood watch programs and community patrols. Residents work together to identify and promptly address potential security threats. In order to improve monitoring, CCTV cameras and surveillance systems are strategically installed. Residents are assigned camera surveillance duties (mostly for women) and patrolling strict duties during the night, rotating shifts (for men between the ages of 15 and 70). Real-time surveillance is made possible by technological technologies, which also aid law enforcement in preserving public safety. Entry into Dayalbagh's sensitive and residential sections is controlled via visitor management procedures and controlled access points. This promotes resident and communal facility safety by thwarting illegal access. Entrance gates with biometric authentication have been built, allowing entrance for those with identity cards issued to Dayalbagh religious members worldwide. Only after a proper card scan and picture detection by the camera do the entry gates open. Every domestic assistant and employee who enters the building is watched. Residents and staff are taught emergency response protocols through training programs and drills. Continuous awareness campaigns and workshops educate residents about personal safety measures, cyber security, and crime prevention techniques. Empowering the community with knowledge fosters a culture of vigilance and proactive security practices. Dayalbagh's comprehensive approach to security combines community engagement, technological solutions, and effective partnerships with law enforcement to create a safe and secure environment for its residents and visitors.

3.2. Practical implications

Considering the Dayalbagh model, the practical implications are derived if effective implementation of the eco-village concept is made.

Reduction of Carbon Emissions: Eco-villages within urban areas foster sustainable living by incorporating renewable energy sources, such as solar or wind power, reducing dependency on fossil fuels. These communities also prioritize waste reduction through practices like recycling, composting, and efficient resource use, significantly cutting down carbon emissions. This approach helps cities mitigate their

environmental impact while supporting global efforts to combat climate change.

Balanced Economic Growth: Eco-villages promote controlled industrialization that aligns economic development with environmental conservation. By limiting industrial activities and incorporating sustainable practices, these communities ensure that economic growth does not come at the expense of the environment. This balance minimizes pollution and ecological degradation, fostering long-term sustainability and resilience.

Model for Sustainable Living: Eco-villages serve as living laboratories for sustainable practices, providing education and awareness to both residents and neighboring communities. They demonstrate how to live in harmony with nature, emphasizing climate resilience through adaptive strategies like sustainable agriculture, water conservation, and energy efficiency. These villages act as a blueprint for other urban areas seeking to adopt similar sustainable practices.

Enhanced Urban Biodiversity: The integration of green spaces, local food production, and eco-friendly infrastructure within eco-villages enhances urban biodiversity. These areas support diverse plant and animal life, contributing to improved air quality and public health. Green spaces also offer recreational areas that promote physical and mental well-being, making cities more livable and resilient to environmental changes.

Holistic Community Development: Eco-villages emphasize a comprehensive approach to community development, integrating environmental stewardship with social and economic well-being. Education, healthcare, and cultural enrichment are key components of the Dayalbagh model, ensuring that residents not only live sustainably but also thrive in a supportive, cohesive community. This holistic development approach fosters a high quality of life while advancing broader sustainability goals.

Flexible Climate Policies: In an era of unpredictability, climate policies must be adaptive, allowing for quick modifications in response to unforeseen environmental, economic, or geopolitical changes. This flexibility ensures that sustainability goals remain achievable even when facing unexpected disruptions like shifting political alliances or environmental catastrophes.

Diversified Energy Sources: Relying on a broad mix of renewable energy—solar, wind, geothermal—can shield communities from energy crises caused by war or political instability. By reducing dependence on fossil fuels, nations can maintain energy security and resilience, even amid global tensions or supply chain disruptions.

Strengthened Local Supply Chains: Strengthening local production and supply chains reduces reliance on global networks that can be disrupted by pandemics, wars, or trade barriers. Localized systems enhance food security, resource availability, and economic stability, allowing communities to remain resilient in the face of global uncertainties.

Monetary and Fiscal Preparedness: Economic policies should focus on building robust reserves and sustainable debt levels to buffer against global financial instability. This preparedness ensures that essential sustainability projects continue even during economic downturns, protecting long-term environmental and social goals from the impact of monetary crises.

Pandemic-Resilient Infrastructure: Future infrastructure must be designed with public health in mind, incorporating features that support remote work, social distancing, and rapid response to health emergencies. This includes integrating digital technology and flexible design elements that maintain functionality and minimize disruptions during pandemics like COVID-19.

4. Conclusion

Introducing eco-village concepts in urban areas aligns with the Sustainable Development Goals (SDGs) by addressing multiple challenges simultaneously. By promoting eco-villages within cities, communities can significantly reduce carbon emissions through sustainable practices such as renewable energy use, waste reduction, and efficient resource management. Controlled industrialization within eco-villages ensures that economic growth is balanced with environmental conservation, minimizing pollution and ecological footprint. Additionally, these villages can serve as models for sustainable living, educating residents and neighboring communities about eco-friendly practices and resilience to climate change. By integrating green spaces, local food production, and eco-friendly infrastructure, eco-villages enhance urban biodiversity, improve air quality, and promote health and well-being. Ultimately, embracing the eco-village concept in urban planning fosters inclusive, resilient communities that contribute positively to global sustainability goals while mitigating the adverse impacts of urbanization on the environment and society. Dayalbagh has evolved into a centre of great spiritual, academic, ecological, and moral values, offering consolation, satisfaction, calmness, and enlightenment to its residents and visitors, who flock in droves in search of inner and outer peace. The Dayalbagh philosophy articulates to live and promote an eco-village type of life, but it can be clearly noted from society's perspective that actual rural life implies living in a healthy natural environment as an eco-village without having the focus of converting the rural life to urban life. The Dayalbagh philosophy sets an example and ideal model for a country like India, that we at urban societies should adopt the qualities of fresh environments like villages and must also include the elements of education, infrastructure, innovation, technology, and giving help to improve the lifestyle and make efforts for environmental protection. Dayalbagh exemplifies a remarkable model of sustainable development and community prosperity through its eco-village concept. By integrating principles of ecological stewardship, social cohesion, and economic resilience, Dayalbagh showcases how local communities can thrive while maintaining harmony with nature and promoting a better quality of life for all residents. The eco-village approach in Dayalbagh emphasizes sustainable agriculture, renewable energy adoption, and efficient resource management, contributing to environmental conservation and climate resilience. Moreover, the community's commitment to education, healthcare, and cultural enrichment fosters holistic development and social well-being. As a role model for the world, Dayalbagh demonstrates that through collective action, innovation, and a strong sense of community, sustainable development goals can be achieved, offering valuable lessons and inspiration for creating a more inclusive, equitable, and sustainable future globally.

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