

The Foundation of India's Development Strategy is Sustainable Development

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ABSTRACT

Human advancements and technology are changing nature to suit human demands. We are gradually losing the beauty of the environment, and even the air is becoming polluted. Breathing will become challenging for living things. The article's primary goal is to preserve nature's unique spirit and individuality while simultaneously shielding it from human abuse. In India, with its rich cultural diversity, indigenous ecological knowledge and biodiversity are intricately linked. Indigenous knowledge contributes to sustainable development by offering new models that are ecologically and socially sound. It helps in local flora and fauna management, water harvesting, agriculture, cultivation of medicinal plants, and the protection of sacred groves. Conserving biodiversity supports cultural integrity and leads to the preservation of genetic resources. During the ancient age, mankind practiced in such a way that the environment might be safe and enjoyable; they felt that the entire planet was one family. The early human civilization regarded nature as Devas, creating lifestyles in a sequence and protecting nature. We are currently dealing with a slew of environmental issues, and these issues can be mitigated by reintroducing these historical practices and ideas. Respect for nature, ecological equilibrium, and sustainability have all been highlighted in ancient Indian literature. Women had access to education and vocational training, demonstrating the progressive attitude towards gender equality, while the Vedas highlighted the value of the environment. The necessity of sustainability is demonstrated in this article in several areas, including educational methodologies, chemical evolution, water management, and environmental preservation. When individuals lend their assistance to create a sustainable India, we will be able to attain sustainability.

Keywords: Ancient practices, Environment protection, Teaching, Water management, Green Chemistry.

INTRODUCTION

Sustainable Development:

Sustainable development means meeting the needs of the present without compromising the ability of future generations to meet their own needs for food, water, energy, and other vital resources. United Nations provided goals to 193 countries for sustainable development in many fields within the year 2030. Some goals are mentioned below:

- 1) No poverty
- 2) Zero hunger
- 3) Quality education
- 4) Gender equality
- 5) Affordable and clean energy
- 6) Good health
- 7) Decent work and economic growth
- 8) Clean water and sanitation

- 9) Life on land
- 10) Peace justice and strong institutions

The essay highlights the sustainability concepts that have been developed in ancient Indian literature as it examines the idea of ecological sustainability in India over time. The ancient principles of sustainability in India provide valuable guidance for addressing current environmental issues. By incorporating these principles into modern-day practices and policies, India can work towards a more sustainable and environmentally conscious future. Ancient Indian literature holds a vast amount of knowledge about the environment and its conservation. The Vedas, puranic, Jain, and Buddhist traditions have long-established principles of ecological harmony.

Indigenous knowledge is a valuable source of empirical knowledge about natural systems that has been accumulated by tribal ethnic groups. This knowledge, also known as traditional environmental knowledge, has been passed down through generations and is adapted to the needs of local communities. In India, with its rich cultural diversity, indigenous ecological knowledge and biodiversity are intricately linked. Indigenous knowledge contributes to sustainable development by offering new models that are ecologically and socially sound. It helps in local flora and fauna management, water harvesting, agriculture, cultivation of medicinal plants, and the protection of sacred groves. Conserving biodiversity supports cultural integrity and leads to the preservation of genetic resources. Unfortunately, the erosion of indigenous knowledge is a growing concern due to various factors such as globalization, changing lifestyles, and the modernization of education systems. One way to address this is by raising public awareness and encouraging pride in these age-old customs [1].

RESEARCH FRAMEWORK

This study is guided by a structured research framework that focuses on understanding the intersection between traditional knowledge and modern sustainability practices. The primary objective is to explore how ancient Indian ecological principles can contribute to addressing contemporary environmental challenges. The study further seeks to analyze the effectiveness of current sustainability strategies and identify gaps in policy implementation and practical application.

The research is centered around three key questions. First, it investigates how traditional ecological knowledge can inform and enhance modern sustainability frameworks in India. Second, it examines the limitations and challenges associated with current sustainability approaches, particularly in terms of environmental governance and resource management. Third, it explores how an integrated approach combining traditional wisdom and modern innovation can improve policy effectiveness and long-term sustainability outcomes. By addressing these questions, the study aims to contribute to a more comprehensive understanding of sustainable development in the Indian context.

The conceptual framework proposed in this study is based on the integration of three key components: traditional knowledge systems, modern technological innovations, and policy and governance mechanisms. Traditional knowledge provides the ethical foundation and sustainable practices necessary for environmental conservation, while modern technology contributes efficiency, scalability, and innovation. Policy and governance act as the connecting link that enables the effective implementation of these elements.

The framework suggests that sustainable development can only be achieved when these components function in a coordinated and complementary manner. Traditional ecological ethics promote responsible resource use, modern technologies enhance productivity and reduce environmental impact, and policy interventions ensure regulation and accountability. The interaction of these elements leads to improved environmental outcomes, economic stability, and social well-being, thereby contributing to the achievement of sustainable development goals.

METHODOLOGY

The study adopts a qualitative and analytical research design, which is particularly suitable for examining conceptual and theoretical relationships between traditional knowledge and modern sustainability practices. A systematic literature review forms the core of the methodology, focusing on peer-reviewed journal articles,

government reports, and international publications from 2020 to 2025. This ensures that the analysis is grounded in recent and relevant academic discourse.

In addition to the literature review, a thematic analysis approach is used to identify key patterns and recurring themes related to sustainability, environmental management, and innovation. The study also employs a comparative analytical framework to evaluate differences and similarities between traditional ecological practices and modern technological solutions. Case studies in areas such as water resource management and green chemistry are incorporated to provide empirical depth and practical insights. This multi-method approach enhances the reliability and scientific rigor of the research.

LITERATURE REVIEW (UPDATED AND CRITICAL ANALYSIS)

Recent academic literature highlights the increasing importance of integrating traditional ecological knowledge into modern sustainability frameworks. Scholars have emphasized that indigenous knowledge systems are highly adaptive, context-specific, and environmentally sustainable, making them valuable resources for addressing climate change and resource management challenges. At the same time, advancements in technology and the emergence of circular economy models have opened new avenues for reducing environmental impact and promoting sustainable industrial practices. Despite these developments, several critical gaps remain in the existing body of research. Many studies focus either on traditional practices or modern technologies in isolation, without exploring their potential integration. Additionally, there is a lack of empirical validation for many traditional practices, which limits their acceptance in formal policy frameworks. Furthermore, challenges related to governance, institutional capacity, and public awareness continue to hinder the effective implementation of sustainability strategies. This study addresses these gaps by adopting a comparative and integrative approach that combines cultural, scientific, and policy perspectives.

Ancient Indian Practices in Sustainability

Ancient Indian literature played a significant role in contributing to the understanding of the environment. The Vedic, Puranic, Jain, and Buddhist traditions established the principles of ecological harmony centuries ago. The Vedas, which are the earliest Hindu scriptures, attach great importance to environmental protection and purity. The Rigvedic Gods and Goddesses, like Indra, Agni, Varuna, and Saraswati, were associated with different aspects of nature. They worshiped not only trees like Tulsi, Neem, Pipal, and Sal but also mountains, land/soil, water, rivers, animals, and birds. Millions of Indians still recite Sanskrit mantras daily to revere their rivers, mountains, trees, animals, and the Earth. The principles of Lord Buddha and Vardhman Mahavir also emphasized the protection of the environment. The book "Arthashastra" by Kautilya stressed the importance of protecting and managing forests and gardens. The Mauryan empire, particularly under Ashoka, focused on a clean environment and the preservation of wildlife. The Gupta period they have marked significant developments in the understanding and influence of the environment. The tradition of sacred groves, where trees were protected for their religious and ecological significance, was common in ancient India. Ancient Indian society had a philosophy of environmental management and preservation, with moral and ethical guidelines in place. This ancient knowledge can still be relevant today in solving modern environmental problems. The principles of Buddhism and Jainism also highlighted the importance of compassion, non-violence, and harmony with nature. Ancient Indian literature, including the Vedas, Brahmanas, Upanishads, and Smritis, provided guidelines and moral injunctions for the preservation and protection of the environment. It emphasized the duty of mankind to protect and respect nature and had a profound understanding of the ecological and ethical aspects of the environment. Through their wisdom and teachings, ancient Indian literature shaped the environmental consciousness and ethical practices of society, providing a rich historical and philosophical foundation for environmental awareness and conservation [2,28].

Indian History in Environmental Protection:

Ancient principles of ecological sustainability:

Modern civilization may learn a lot from the ecological sustainability concepts of antiquity and use them as a guide to build a more sustainable future. Programs for education and awareness are one approach to incorporate

these ideas into contemporary culture. People can be inspired to adopt sustainable habits in their daily lives and develop a deeper appreciation for the environment by learning about the value of sustainability and the knowledge that has been passed down from past civilizations. To further encourage ecological sustainability, laws and regulations can be created and put into effect by the government. These regulations may be designed to lessen waste and pollution, support renewable energy sources, and preserve and protect natural resources. We can make sure that the advancement of contemporary civilization is in line with the environment by introducing antiquated ideas into these regulations. Businesses can also contribute to a more sustainable future by deploying eco-friendly technologies, fostering ethical and responsible production, and adopting sustainable practices like lowering carbon emissions. By employing these techniques and making a sincere effort on all fronts, we can establish a more harmonious and healthful relationship with the environment [3].

Applying ancient ideas of sustainability to certain present environmental concerns in India:

India is currently dealing with several environmental problems that need immediate action. Air and water pollution, deforestation, biodiversity loss, and climate change are a few of the main problems. The age-old ideas of sustainability can offer insightful analysis and useful solutions to deal with these issues.

Air pollution:

In many Indian cities, air pollution is a serious issue. Prehistoric Indian sustainability theories place a strong emphasis on preserving a balanced interaction with the natural world. India may strive to lower air pollution and enhance air quality by embracing sustainable practices like encouraging renewable energy sources, lowering dependency on fossil fuels, and tightening rules on industrial emissions.

Water pollution:

An important worry in many of India's rivers and aquatic bodies is water pollution. Water pollution in India can be reduced by enacting stronger laws governing the disposal of industrial waste, encouraging water conservation, and making investments in infrastructure for wastewater treatment.

Deforestation:

An important environmental problem in India is deforestation, which results in habitat loss and detrimental effects on biodiversity. Traditional Indian ideas of sustainability promote the preservation and protection of forests. To combat deforestation and safeguard biodiversity, India should support afforestation projects, enact stronger laws against illicit logging, and involve local people in sustainable forest management techniques.

Moreover, extreme weather events and rising temperatures are two more negative repercussions of climate change that India is facing. Understanding ecological interdependence and living in harmony with the environment is central to ancient ideas of sustainability. India can help lower greenhouse gas emissions and lessen the effects of climate change by implementing sustainable practices, such as supporting renewable energy, addressing climate change, and promoting sustainable agriculture. It emphasizes the need to remember and follow these ancient principles for a sustainable future [4].

India's ancient traditions in ecological sustainability:

The principles of sustainability found in ancient Indian literature can inform and inspire environmental policies and practices in modern society in several ways.

Firstly, the emphasis on harmony with nature reminds us of the importance of living in balance with the environment. This can guide policies that prioritize the conservation and protection of natural resources, as well as practices that promote sustainable use of those resources.

Secondly, the reverence for nature and recognition of the interconnectedness of all living beings can inspire a sense of responsibility towards the environment. This can lead to policies and practices that prioritize the well-being of ecosystems and biodiversity.

Thirdly, the practices of conservation of flora and fauna, as well as the tradition of sacred groves and sacred plants, can inform policies on forest conservation and preservation of important ecological areas. This can include measures to protect and restore habitats, as well as support for traditional practices of forest management.

Fourthly, the principles of non-violence and equality found in Buddhism and Jainism can guide policies and practices that promote animal welfare and the reduction of harm to wildlife. This can include measures to combat illegal wildlife trade, protect endangered species, and promote sustainable practices in agriculture and fishing.

In general, modern civilization can create environmental policies and practices that give priority to sustainability, conservation, and respect for the natural world by incorporating the wisdom of ancient Indian literature. These ideas can point us in the direction of a more sustainable and peaceful interaction with the environment [5].

Environmental protection in India has historically been influenced by cultural and religious practices that promote respect for nature. The concept of sacred groves, for example, has played a significant role in conserving biodiversity by protecting forest areas from exploitation. Similarly, traditional beliefs that associate natural elements with spiritual significance have contributed to a conservation-oriented mindset.

However, the rapid pace of industrialization and urbanization has weakened these traditional practices, leading to increased environmental degradation. Modern environmental challenges such as air pollution, deforestation, and climate change require more structured and enforceable solutions. While traditional values can foster environmental awareness and ethical behavior, they must be supported by strong legal frameworks, technological interventions, and institutional mechanisms to achieve meaningful and long-term impact.

Innovation

The study focuses on the factors that lead to innovation in sustainable development (SD) initiatives as well as its obstacles. The results demonstrate the advantages of innovation in SD projects, such as the creation of fresh approaches, the adoption of novel management techniques, the heightened enthusiasm and dedication of project participants, the enhancement of quality, the acquisition of competitive advantages, the involvement and cooperation of stakeholders, and the contentment of project stakeholders. Nevertheless, several obstacles may stand in the way of realizing these advantages, including reluctance to innovate, stakeholder demands, client pressure, a variety of project environments, volatile and dynamic markets, project structure and features, adherence to shared objectives, and management support and dedication to innovation. For innovation to be implemented in SD projects effectively, certain obstacles must be overcome.

Overcoming reluctance to innovate in sustainable development initiatives:

It can be difficult to overcome innovation resistance in sustainable development initiatives, but project teams can use a number of techniques:

Develop a culture of innovation: Create an environment at work where creativity is valued and supported. This can be achieved by encouraging candid dialogue, welcoming fresh perspectives, and offering rewards for creative thinking.

Address stakeholders' concerns: Determine and comprehend the main stakeholders' worries and opposition. To allay these worries and give concise justifications for the advantages and significance of the suggested innovation in the framework of sustainable development, communicate openly and honestly.

Provide education and training: Provide educational materials and training courses to project team members to help them better comprehend the invention and its possible advantages. Expanding understanding and fostering trust in the novel technique, can lessen resistance.

Foster collaboration: Encourage stakeholders and the project team to work together and participate. Include them actively in decision-making, solicit their opinions, and involve them in the creative process. Establishing trust and boosting support for the invention can be achieved through this cooperative method.

Pilot and iterate: Begin with smaller pilot projects or trials to test and refine the invention before going full-scale. This iterative approach allows for adjustments and enhancements based on feedback and lessons learned, lowering resistance and improving success chances.

Provide leadership and support: Strong project management is essential for fostering innovation and overcoming resistance. Leaders must actively promote and champion the innovation, communicate its significance, and give the resources, authority, and support required to ensure its effective implementation.

Monitor and evaluate: Monitor and evaluate the progress and impact of the invention regularly. This enables the early identification of any hurdles or challenges and allows for adjustments to be made. The regular evaluation also demonstrates accountability and gives facts to back up the innovation's benefits.

In general, overcoming resistance to innovation in sustainable development initiatives calls for a planned and cooperative strategy that involves all relevant parties and cultivates an innovative culture. Project teams can raise the likelihood of overcoming resistance and successfully implementing innovation in sustainable development projects by addressing concerns, offering instruction and training, encouraging collaboration, piloting and iterating, offering leadership and support, and monitoring and evaluating [6].

Promoting innovation in sustainable development projects:

Adaptability: Project teams must adopt a flexible mindset and be ready to adjust to the ever-changing project environment. This entails being open to novel concepts and technological advancements and being prepared to adjust project plans and tactics as necessary.

Cultural Intelligence: Project teams should develop cultural intelligence in varied project environments. Improve collaboration and the production of creative ideas, this entails cultivating an awareness of and respect for various cultures, values, and working styles.

Collaboration: It is important for project teams to actively encourage teamwork and knowledge exchange. Regular team meetings, cross-functional training sessions, and the creation of a welcoming environment that promotes idea-sharing can all help achieve this.

Risk Management: To recognize and reduce possible risks and uncertainties related to the changing project environment, project teams should set up efficient risk management procedures. This will create an environment that is more favorable for innovation by reducing the possibility of negative effects on project timetables and outcomes.

By putting these tactics into practice, teams and project managers may successfully communicate needs to stakeholders, handle pressure from clients, and negotiate the complex and dynamic project environment to foster innovation in sustainable development initiatives [7].

Water Management System:

This article discusses the sustainable development of water resources in India. It highlights the challenges faced by India, despite having vast water resources, such as droughts, famines, and water quality constraints. The article provides an overview of India's river basin systems, hydrogeological systems, and the utilization of groundwater. It also discusses the environmental pollution caused by water resources in India. The article concludes by emphasizing the need for actions to ensure the sustainable development of water resources in the country.

Main challenges faced by India in achieving sustainable water resource development:

India faces several challenges in achieving sustainable water resource development. One of the main challenges is the uneven distribution of rainfall, both seasonally and regionally. The concentration of rain during the monsoon season and the lack of rainfall during the non-rainy months result in a scarcity of water in many parts of the country.

Another challenge is the inadequate water resource budgeting and planning. There is a lack of coordination and planning at the national level, leading to a mismatch between demand and availability of water resources. This, in turn, leads to frequent famines in certain regions and floods in others.

The unsustainable use of water resources, particularly in the agriculture sector, is also a major challenge. Farmers often receive water at a cost well below the cost of supply, leading to inefficient water use. Increasing the efficiency of water use in agriculture, industry, and domestic supply is crucial for sustainable water resource development.

Water pollution is another challenge that needs to be addressed. Pollution of surface water and groundwater sources is a significant problem in many parts of India. Efforts should be made to control and prevent water pollution to ensure the long-term sustainability of water resources.

Finally, the impact of climate change on water resources is a growing concern. Changes in rainfall patterns and increasing temperatures can have significant implications for water availability and agriculture. It is important to develop strategies and plans to adapt to the effects of climate change and to manage water resources effectively in the face of changing climatic conditions.

In conclusion, achieving sustainable water resource development in India requires addressing challenges such as uneven rainfall distribution, inadequate planning and budgeting, inefficient water use, water pollution, and the impact of climate change. Integrated and coordinated efforts are needed to ensure the long-term sustainability and availability of water resources in the country [8].

Distribution of rainfall in different regions of India for agriculture and other activities:

The distribution of rainfall in different regions of India has a significant impact on water availability for agriculture and other activities. India experiences two main monsoon seasons: the southwest monsoon and the northeast monsoon.

In regions that receive heavy rainfall during the monsoon season, such as the western coast and the outer slopes of the Himalayas, water availability is generally high, and agricultural activities can benefit from abundant water resources. Conversely, regions with low annual rainfall, such as the northwestern parts of India and certain limited tracts in the rest of the peninsula, face water scarcity issues.

The variability in rainfall across the country also affects water availability. In areas with high variability of annual rainfall, such as regions prone to droughts, water resources may become scarce during periods of low rainfall. On the other hand, regions with low variability in rainfall have a more stable water supply, making them less vulnerable to droughts.

This distribution of rainfall has implications for agriculture and other activities. In regions with low rainfall and high variability, farmers face challenges in agriculture due to water scarcity. Crop failure and loss of income are common in these areas. In contrast, regions with high and reliable rainfall can support a vibrant agricultural sector. Apart from agriculture, other activities such as drinking water supply, industrial operations, and hydropower generation also depend on rainfall and water availability. In regions with low rainfall, these activities may face water shortages and impact economic and social development.

Overall, the distribution of rainfall in different regions of India plays a crucial role in determining water availability for agriculture and various other activities. It is essential to manage and utilize water resources effectively, considering the specific conditions and challenges of each region, to ensure a sustainable water supply for the country [9].

Challenges in addressing environmental water pollution:

India faces several key challenges in addressing environmental pollution in its water resources. These challenges include:

Untreated industrial and domestic wastewater: A significant amount of untreated industrial and domestic wastewater is being discharged into water bodies, leading to water pollution. This poses a threat to the quality of drinking water sources, as well as the health of aquatic ecosystems.

Agricultural runoff: The excessive use of fertilizers, pesticides, and other chemicals in agriculture results in runoff that contaminates surface and groundwater. This agricultural runoff contributes to water pollution and affects the health of both humans and aquatic life.

Inadequate waste management: Improper waste management practices, including the disposal of solid waste and hazardous materials, contribute to water pollution. Dumping waste directly into water bodies or improper landfill management can lead to the leaching of pollutants into groundwater sources.

Depleting groundwater resources: Over-extraction of groundwater for agricultural, industrial, and domestic purposes has led to a depletion of groundwater sources. This has resulted in increased concentrations of pollutants in the remaining groundwater, reducing its quality [8,24].

Potential solutions to address these challenges:

Strengthening wastewater treatment:

Industries and municipalities should establish and enforce stricter regulations regarding the treatment of wastewater before discharge. The implementation of effective wastewater treatment plants will help reduce the pollution load entering water bodies.

Promoting sustainable agricultural practices:

Encouraging farmers to adopt sustainable agricultural practices, such as integrated pest management, organic farming, and efficient irrigation techniques, can help reduce the use of harmful chemicals and minimize agricultural runoff.

Improving waste management systems:

Implementing comprehensive waste management systems, including proper segregation, recycling, and treatment of solid and hazardous waste, will help minimize the pollution of water bodies. This includes the construction and management of sanitary landfills to prevent leaching into groundwater sources.

Implementing groundwater management and recharge measures:

Strict regulations should be imposed on groundwater extraction, along with the promotion of rainwater harvesting and groundwater recharge techniques. These measures can help replenish groundwater sources and prevent contamination.

Raising public awareness and participation:

Educating the public about water pollution and its consequences is crucial in promoting responsible water resource management. Active involvement of the community, NGOs, and other stakeholders in monitoring and conservation efforts can lead to more sustainable practices. By addressing these challenges and implementing potential solutions, India can work towards ensuring the sustainability and quality of its water resources, benefiting both human well-being and environmental health [10].

Water resource management is one of the most critical challenges facing India today. The country experiences significant variability in rainfall, both spatially and temporally, leading to water scarcity in some regions and flooding in others. Traditional water management systems, such as rainwater harvesting and community-based resource management, were highly sustainable and adapted to local environmental conditions. These systems emphasized conservation, efficient use, and community participation.

In contrast, modern water management approaches rely heavily on large-scale infrastructure such as dams, reservoirs, and centralized distribution systems. While these methods have improved water accessibility and agricultural productivity, they have also contributed to issues such as groundwater depletion, ecological imbalance, and inefficient resource utilization. A comparative analysis suggests that integrating traditional practices with modern technologies can provide a more balanced and sustainable solution. For instance, combining rainwater harvesting with advanced water treatment and distribution systems can enhance both sustainability and efficiency.

Teaching Methods of Ancient India:

India's traditional educational system stood apart from those in other nations due to its distinct features. There were two categories of education in the system: Buddhist and Vedic. Self-control, character development, social awareness, personality development, and the preservation of culture for the next generation were the goals of education. Gurukuls were residential schools in ancient India where students lived together as equals and studied under the guru. Sanskrit was the language of instruction in Vedic culture, whereas Pali was the language of Buddhism. Women have equal access to school and training for careers. Teachers were highly revered in Indian society and played a vital role in leading students from ignorance to knowledge. The emphasis of the educational system was on mental control, emancipation, and equal education for men and women. Among the teaching strategies used were narrative, memorization, practical exercises, critical analysis, seminars, and Q&A sessions. During this period, renowned educational institutions included Vikramshila, Takshashila, Nalanda, and Vallabhi [11].

The essential elements of ancient India's Vedic and Buddhist educational systems:

The main focuses of the Vedic and Buddhist educational systems in ancient India were social awareness, personality development, self-control, character development, dissemination of purity, and young culture preservation. The study of the Vedas, Vedangas, Upanishads, darshans, Purans, and Trakshastra was part of the Vedic educational system. Women were additionally given access to training in the arts, music, dancing, and housekeeping. During this time, vocational education was offered at no cost. Sanskrit was the language of instruction in Vedic education. However, Pali was the language of instruction in the Buddhist educational system. The three Pitakas were the study's subjects. Buddhist education placed a strong emphasis on cultivating spiritual consciousness and the teachings of the Buddha. Both systems included a variety of teaching strategies, such as question-and-answer sessions, critical analysis, memorization, storytelling, and practical exercises. The majority of the education was given in residential schools called "gurukuls" or "ashrams," where pupils lived close to their teachers. These Gurukuls encouraged pupils to feel equal regardless of their socioeconomic status [12].

Promoting gender equality and providing education opportunities for women:

Ancient India's educational system was vital in advancing gender equality and giving women access to higher education. Women were granted equal rights to education and teaching in ancient India. Girls would get instruction in domestic science at home, which was regarded as the primary educational institution. Alongside their husbands, women actively took part in ceremonies and rituals. Girls' education was prioritized on par with boys', and many of them attained high educational levels. "Brahman Vadini" was their moniker, and some of them even rose to the rank of "Rishika". Women wrote hymns, and Apala, Homasha, Shashpati, Ghoshla, Mamata, and Lopamudra were among the prominent Vedic academics. Women were regarded as devis and played a significant role in the preservation and transmission of knowledge. An emphasis on the intellectual and spiritual growth of women was placed on the ancient Indian educational system, which understood the value of giving women access to education. Considering how advanced it was at the time, the ancient Indian society's emphasis on gender equality in education helped women advance and gain more influence in general [13].

Main ideas and values of education in ancient India:

The primary goals of the education system in ancient India were to liberate people by transferring knowledge and enabling them to reach spiritual enlightenment. These goals included spiritual development, self-control, character development, social awareness, personality development, and the preservation of culture. The

management of the mind was one of the main tenets of education in ancient India. The Vedas stressed that the mind is the source of both bondage and freedom. Therefore, the goal of education in ancient India was to teach people how to manage their ideas and emotions. By encouraging discipline, focus, and mental clarity, the concept of mind control aided in people's entire growth. In ancient India, social consciousness and cultural preservation were also prioritized in education. Social standards, traditions, and rituals were taught to the students, along with the significance of social obligations. This schooling system sought to produce people who actively promoted societal welfare in addition to being conscious of their cultural background. In ancient India, personality development was also a goal of education. It focuses on fostering a person's intellectual, emotional, mental, and physical growth, among other things. This all-encompassing method of teaching was designed to produce people with well-rounded personalities who could succeed in a variety of fields [11].

Sustainable Development Approaches in Chemistry:

Green Chemistry has provided a framework for chemists and chemical engineers to contribute to global sustainability. American Chemical Society journals are a platform for sharing research results and understanding current problems. This Virtual Issue features selected articles on Green Chemistry from nine ACS journals, coinciding with the 2021 Green Chemistry & Engineering Conference. The articles highlight the importance of a systems approach in reducing environmental impact and promoting circular economies. The selected articles cover various topics, including renewable energy conversion, CO₂ capture and use, organic synthesis, biomass transformation, waste reduction, and water resources sustainability. These articles demonstrate advancements in catalysis, alternative solvents, chemical synthesis, and the design of chemicals with minimal hazard. The integration of life-cycle thinking, process metrics, and sustainability assessment is emphasized, as well as the need for further research in depolymerization, circular systems design, and machine learning. The goal is to develop sustainable solutions and promote circularity in the chemical industry [14,29].

The application of engineered nanohybrids contributes to addressing the energy-water-environment nexus:

The development and application of engineered nanohybrids can contribute to addressing the energy-water-environment nexus by providing multifunctional solutions that tackle challenges in these interconnected areas. Nanohybrids, which are materials composed of nanoscale components with different functionalities, offer unique properties and capabilities that can be harnessed to address sustainability issues. Here are some ways in which nanohybrids can contribute:

Energy Generation and Storage:

Nanohybrids can be designed to enhance energy harvesting and storage. For example, nanomaterials can be incorporated into solar cells to improve their efficiency in converting sunlight into electricity. Nanohybrids can also be used in energy storage devices, such as batteries and supercapacitors, to enhance their performance and increase their energy density.

Water Treatment and Desalination:

Nanohybrids can be utilized in water purification technologies to address water scarcity and contamination issues. Engineered nanomaterials can be designed to have high adsorption or catalytic properties, enabling efficient removal of pollutants and contaminants from water sources. Additionally, nanohybrids can be employed in desalination membranes to enhance their selectivity and efficiency in removing salt and other impurities from seawater.

Environmental Remediation:

Nanohybrids can contribute to remediation efforts by facilitating the degradation of pollutants and the remediation of contaminated sites. By incorporating nanoparticles with catalytic properties into the hybrid materials, nanohybrids can accelerate chemical reactions that break down harmful pollutants, such as persistent organic pollutants and heavy metals, contributing to environmental cleanup.

Sensing and Monitoring:

Nanohybrids can be used to develop sensors and monitoring devices for environmental applications. By incorporating nanomaterials with high sensitivity and selectivity, nanohybrids can enable the detection and quantification of pollutants, gases, and other environmental parameters. These sensors can provide real-time monitoring and early warning systems to help manage and mitigate environmental risks [14].

Potential advantages of bioenergy with carbon capture and storage (BECCS) in achieving net-negative emissions:

Bioenergy with carbon capture and storage (BECCS) offers several potential advantages in achieving net-negative emissions:

Carbon Removal:

BECCS involves the use of bioenergy (e.g., biomass) as a source of energy. When biomass is combusted for energy production, it releases carbon dioxide (CO₂) into the atmosphere. However, BECCS includes the capture and storage of this CO₂, effectively removing it from the atmosphere and preventing it from contributing to greenhouse gas emissions. This carbon removal capability makes BECCS a valuable tool for achieving net-negative emissions.

Renewable Energy Source:

The use of biomass as a source of energy in BECCS provides a renewable alternative to fossil fuels. Biomass can be derived from agricultural waste, forestry residues, or dedicated energy crops, which can be sustainably cultivated. Compared to fossil fuels, biomass is considered carbon-neutral since the CO₂ released during combustion is offset by the CO₂ absorbed during the growth of the biomass.

Carbon Sequestration:

The captured CO₂ from biomass combustion can be stored underground in geological formations, such as depleted oil and gas reservoirs or deep saline aquifers. This process, known as carbon sequestration, prevents the released CO₂ from re-entering the atmosphere. By permanently storing the captured CO₂, BECCS facilitates long-term carbon removal and helps mitigate climate change.

Circular Economy:

BECCS aligns with the principles of a circular economy by utilizing biomass, a renewable resource that can be continuously replenished through sustainable practices. It can also contribute to waste reduction by utilizing biomass from agricultural or forestry residues. This circular approach reduces reliance on finite fossil fuel resources and minimizes the environmental impact associated with their extraction and combustion.

Energy and Resource Efficiency:

By combining bioenergy production and carbon capture, BECCS offers the potential for greater energy and resource efficiency compared to traditional energy systems. The captured CO₂ can be utilized in industrial applications or enhanced oil recovery, thereby maximizing the value of the captured carbon and reducing emissions in other sectors [15].

Minimizing the environmental footprint and potential hazard in the lifecycle:

The design of chemicals and materials can focus on minimizing the overall environmental footprint and potential hazards while ensuring circularity in their lifecycle through various strategies and considerations.

One key approach is to prioritize the use of renewable and sustainable raw materials as feedstocks for chemical synthesis and manufacturing processes. By using biobased alternatives instead of fossil-fuel-derived materials,

the environmental impact can be significantly reduced. This includes exploring biomass-derived solvents and greener solvent selection protocols.

Lifecycle thinking is another important aspect. It involves considering the entire lifespan of a chemical or material, from production to disposal or recycling. By analyzing different stages of the lifecycle, opportunities for reducing waste, energy consumption, and environmental impacts can be identified. For example, designing chemicals and materials with the potential for recycling, reuse, or remanufacturing can contribute to circularity. Moreover, the safe and sustainable design of chemicals is crucial. This involves assessing and minimizing the potential hazards and risks associated with their use. By applying *in silico* methods, like molecular dynamic simulations, toxicological risks can be assessed. Mechanisms of interaction can be better understood, enabling the screening of a wider range of chemicals for safety. By developing more efficient, selective, and environmentally benign catalytic processes, the use of hazardous reagents and the generation of waste can be minimized. Exploring catalysis with earth-abundant metals, as well as utilizing renewable energy sources for energy-intensive reactions, are also important steps toward sustainability [16].

RESULT AND DISCUSSION

The analysis presented in this study highlights the importance of adopting an integrated approach to sustainable development. Traditional ecological knowledge offers valuable insights into sustainable living and resource management, while modern technologies provide the tools necessary for large-scale implementation and efficiency. However, the absence of effective integration between these two domains has limited their overall impact.

The findings suggest that sustainability is not solely a technological or economic issue but also a cultural and social one. Achieving long-term sustainability requires a shift in mindset, supported by education, awareness, and community participation. Furthermore, policy frameworks must be designed to facilitate collaboration between different stakeholders and ensure the effective implementation of sustainability initiatives. By bridging the gap between tradition and modernity, India can develop a more resilient and inclusive development strategy.

Sustainable Development Goals (SDG):

In India, the concept of sustainable development is multifaceted, exhibiting uneven advancements in various domains. With a particular emphasis on West Bengal, the study explores the successes and difficulties in environmental conservation and human development in India. The results of initiatives to reduce poverty in terms of human development have been conflicting; although some studies have shown progress, others have highlighted areas that still require attention. India has achieved progress in the areas of food security, good health, and high-quality education; yet, obstacles still exist, especially in light of the COVID-19 epidemic. Initiatives including women's empowerment, political involvement, and educational programs have demonstrated positive advancements in gender equality. Still, the epidemic has hindered progress in this domain as well. West Bengal has demonstrated progress in wetland conservation and sanitation when it comes to environmental protection, but there are still issues with access to clean water and employment generation. The study emphasizes that to effectively address sustainable development goals, people-centered policies, and a rights-based approach are required.

Achieving long-term sustainable results in India:

To address the remaining challenges in poverty alleviation and achieve long-term sustainable results in India, several measures can be taken:

Pro-poor policies:

The government should continue implementing pro-poor policies that focus on creating employment opportunities, improving education and healthcare facilities, and providing social safety nets for vulnerable populations. These policies should promote inclusive growth and ensure equitable distribution of resources.

Rural development:

Emphasize rural development by investing in agriculture, rural infrastructure, and skill development programs. This will help create livelihood opportunities in rural areas and reduce migration to urban areas in search of work.

Education and skilling:

Enhance the quality of education and skill development programs to equip individuals with the necessary skills for employment and entrepreneurship. Focus on vocational training and aligning education with industry requirements to improve employability.

Women empowerment:

Promote gender equality and women's empowerment by providing access to education, healthcare, and financial services. Encourage women's participation in decision-making processes and provide support for women-led enterprises. This will contribute to poverty reduction and sustainable development.

Strengthen social protection:

Strengthen social protection programs, such as the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) and targeted welfare schemes, to ensure the most vulnerable sections of society have access to basic needs like food, healthcare, and housing.

Sustainable development practices:

Emphasize sustainable development practices that protect the environment and natural resources. Encourage the adoption of renewable energy sources, promote sustainable agriculture, and implement effective waste management systems. This will contribute to long-term economic growth and reduce the negative impact of development on the environment.

Strengthen data collection and monitoring:

Enhance data collection and monitoring systems to track progress and address the specific needs of different regions and communities. This will help in identifying gaps, designing effective interventions, and evaluating the impact of poverty alleviation programs.

Public-private partnerships:

Foster collaboration between the government, private sector, and civil society organizations to leverage resources and expertise for poverty alleviation initiatives. Public-private partnerships can help channel investments into sectors that have a high potential for poverty reduction. Addressing the remaining challenges in poverty alleviation requires a multi-faceted approach that combines targeted interventions, sustainable development practices, and inclusive policies. It is crucial to prioritize long-term sustainable solutions that address the root causes of poverty and ensure inclusive growth for all sections of society [17,20,21].

Progression in areas like education, health, and gender equality:

To mitigate the impact of the COVID-19 pandemic on progress in areas like education, health, and gender equality, several measures can be taken:

Education:

Ensure access to remote learning opportunities for all students, including those from disadvantaged backgrounds, by providing necessary resources such as devices and internet connectivity. Develop innovative teaching methods that are suitable for online or blended learning. Provide support and resources for teachers to adapt to

online teaching and learning. Prioritize mental health and support services for students and teachers, addressing the emotional impact of the pandemic.

Bridge the learning gaps caused by school closures through additional remedial programs and catch-up initiatives. Invest in digital infrastructure and capacity building to enhance the resilience of the education system in future crises.

Health:

Strengthen healthcare systems, including increased funding, infrastructure development, and capacity building to effectively respond to future health emergencies. Prioritize public health measures such as vaccination programs, testing, contact tracing, and the implementation of safety protocols. Increase access to healthcare services, especially in remote and marginalized areas. Invest in research and development to develop better diagnostics, treatments, and vaccines for COVID-19 and future diseases. Enhance mental health support services to address the psychological impact of the pandemic on individuals and communities.

Gender Equality:

Implement policies and programs that address the specific challenges faced by women and girls during the pandemic, such as domestic violence, increased caregiving responsibilities, and economic disparities. Ensure equitable access to healthcare, education, and social services for women and girls, particularly those from marginalized communities. Promote women's participation in decision-making processes, including their representation in leadership roles in healthcare and policy-making. Provide economic support to women-owned businesses and promote women's economic empowerment. Raise awareness about gender-based violence and ensure the availability of support services. It is essential to adopt a multi-sectoral approach that involves collaboration between governments, civil society organizations, and international partners to mitigate the long-term impact of the pandemic and work towards building a more resilient and inclusive society [18].

Efforts of West Bengal to maintain environmental sustainability:

To improve access to clean water in West Bengal while maintaining environmental sustainability, the state can take several steps:

Invest in water infrastructure:

West Bengal should prioritize investments in water infrastructure, including the construction and maintenance of water treatment plants, reservoirs, and pipelines. This will ensure a reliable supply of clean water to people across the state.

Implement rainwater harvesting:

Encouraging the implementation of rainwater harvesting systems can help recharge groundwater and reduce dependence on external water sources. This sustainable approach can alleviate pressure on existing water resources and ensure long-term water availability.

Promote water conservation practices:

Public awareness campaigns can educate the population about the importance of water conservation in homes, industries, and agriculture. Encouraging responsible water usage, such as fixing leakages, adopting efficient irrigation techniques, and using water-saving appliances, can help conserve water resources.

Strengthen waste management systems:

Effective waste management is crucial for protecting water sources from pollution. Implementing proper waste segregation, recycling initiatives, and wastewater treatment plants will prevent contamination and contribute to maintaining water quality.

Develop eco-tourism initiatives:

West Bengal is known for its natural beauty, including the Sundarbans and the Darjeeling hills. Developing eco-friendly tourism initiatives can create employment opportunities in the hospitality industry while conserving natural resources and promoting environmental awareness.

Encourage eco-friendly industries and manufacturing:

The state can incentivize eco-friendly industries and support the development of green manufacturing practices. This approach will not only create jobs but also reduce the environmental impact of industrial activities.

By implementing these measures, West Bengal can improve access to clean water and create employment opportunities while ensuring the long-term sustainability of its environment [17,19].

CONCLUSION

Respect for nature, ecological equilibrium, and sustainability have all been highlighted in ancient Indian literature. This study demonstrates that sustainable development in India requires a balanced and integrated approach that combines traditional ecological wisdom with modern scientific and technological advancements. While ancient practices provide a strong ethical and philosophical foundation, modern innovations offer practical solutions for addressing complex environmental challenges. The integration of these elements, supported by effective policy and governance, is essential for achieving long-term sustainability.

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Conflict of interest

The authors declare that there is no conflict of interest publication of this research paper.

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