



Vidhyayana - ISSN 2454-8596

An International Multidisciplinary Peer-Reviewed E-Journal

www.vidhyayanaejournal.org

Indexed in: Crossref, ROAD & Google Scholar

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Assessing the Sustainability of Packaged Drinking Water in India

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Abstract:

The expansion of the Indian packaged drinking water industry has raised concerns about its sustainability regarding environmental, social, and economic impacts. The research examines three dimensions of sustainability: economic, ecological, and social. Factors driving growth in the sector include health concerns, inadequacy of public water distribution networks, and convenience demand. However, it contributes to environmental degradation, resource depletion, and social issues. The study analyzes the industry's impact on groundwater



extraction, plastic pollution, energy consumption, and waste management. It also examines the social implications of the industry, including access to clean drinking water, health effects, and community involvement. Furthermore, the study assesses the financial effects of the industry, including cost-benefit analysis, customer behavior, and market developments. The study concludes that the industry's sustainability can be enhanced by adopting sustainable practices, implementing government policies, raising consumer awareness, and embracing a circular economy. The study highlights the need for collaboration among policymakers, industry stakeholders, and consumers to ensure the long-term sustainability of India's packaged drinking water industry.

Keywords: Packaged drinking water, Sustainability, Environmental impact, Social impact, Economic impact, India

Introduction

The rapid growth of the Indian economy in recent years has stimulated interest in how economic growth can be decoupled from the depletion of natural resources and other impacts on the environment. It is in this context that the present study investigates the sustainability of the rapidly expanding Indian packaged drinking water sector. Packaged water is still a relatively small industry, but it is growing rapidly with an annual growth rate of 40% — the highest growth rate ever experienced by any sector in independent India. It is possibly the fastest-growing industry in the world. Despite its small size, we believe that the packaged water industry in India provides a very interesting example of the emergent conflict between market-driven growth and sustainability. This research examines the sustainability concerns surrounding India's packaged water industry, focusing on the three key pillars of sustainability: economic viability, environmental stewardship, and social responsibility. The first section briefly details the evolution of the Indian packaged water industry, while the second section discusses the problems of sustainable development practices and introduces the three dimensions of modern concepts of sustainability. The next section uses this sustainability framework to discuss the possible development and regulation of the Indian packaged water



industry in a manner that may lead to more sustainable outcomes. The final section concludes and points to areas for further research.

Background and Significance

Water is a fundamental natural resource for human survival and provides a host of ecosystem services. While access to safe and clean drinking water is recognized as a fundamental right, the rapid growth of populations and urbanization have created competing demands for this limited resource, resulting in increased pressure on global water supplies. The scarcity of safe drinking water disproportionately affects people in developing countries. To tackle this issue, the United Nations has set a goal to ensure universal access to clean water and sanitation by 2030, as part of the Sustainable Development Goals. India, like many other developing nations, faces significant challenges in providing its citizens with access to safe and clean drinking water. A recent study identified the three largest factors influencing the lack of access to water among all developing countries. These three factors were insufficient income or inadequate budget allocation, an increase in population or migration towards polluted and unserved areas, and inappropriate governance structures or financing mechanisms. Providing safe, clean, and potable drinking water from piped water supply systems in such a scenario is difficult because of the massive infusion of capital, long gestation periods, and difficulty in management and quality control of the water supply systems.

A recent source of safe drinking water supplied through an industrial-scale prefabricated bottled water packaged drinking water plant through polyethylene terephthalate bottles filled with UV or RO treated water on payment has been very popular. The sale of packaged drinking water has been rapidly expanding. This industry, which has been enjoying easy environmental clearances and without any requirement of public consultation, is allowed to extract groundwater against a fee to meet demand and supply. Knowing the scarcity value of water over a period, sometimes the extraction fee for groundwater is substantial, but this fee is widely seen as inadequate given the potential consequences of groundwater mining. This category of water supply is exclusive and caters only to those who can afford to pay for the resource. Although the business is seen as very sustainable by the business unit and others in the supply



chain, there are multiple issues such as the potentially negative environmental externalities associated with extracting high volumes of water from natural resources by the producers. A realization of these issues has prompted questions concerning the sustainability of this model of providing potable drinking water related to the extraction of groundwater, management of water resources, and its components that are enunciated in the Sustainable Development Goals when assessed from the lens of supplying safe and clean drinking water to all.

Water Scarcity in India

Millions of people in India are impacted by the urgent problem of water scarcity. There are severe drinking water shortages in thousands of cities and villages, making the situation critical. Numerous water sources are tainted by household and industrial waste, which makes the situation even worse. The inefficiency of India's water management initiatives has resulted in a substantial disparity between supply and demand. The alarming rate of decline in groundwater levels is a pressing concern in India, primarily due to the overexploitation of the nation's water resources. A significant contributor to this crisis is the agricultural sector, which accounts for a substantial portion of the country's water usage, thereby exacerbating the groundwater depletion. India's water resources are facing immense pressure due to inefficient irrigation systems and the cultivation of water-intensive crops. Furthermore, climate change is exacerbating the country's water scarcity issue, posing a significant threat to the nation's water security and sustainability. The nation's water cycle has been upset by altered precipitation patterns and an increase in the frequency of droughts and floods, which has resulted in scarcity in many areas.

A multifaceted approach is necessary to handle the situation. This entails investing in water harvesting and recycling technologies, encouraging water conservation, and putting effective water management techniques into action. Raising awareness of the value of conserving water and encouraging behavioral change in both individuals and communities are also necessary.

In the end, governments, civil society, and individuals must work together to address India's water scarcity issue. Together, we can guarantee future generations have access to safe and sustainable water.



Current Situation

India is grappling with a severe water crisis, with over 7,000 villages, 1,100 wards, and 220 talukas affected, particularly in Karnataka. The country's massive population of 17% of the global total, coupled with limited access to only 4% of the world's freshwater resources, exacerbates water stress and scarcity, making this crisis a pressing concern.

- **Water Availability:** In 2021, India's yearly per capita water availability fell to 1,486 cubic meters, falling short of the 1,700 cubic meter water stress threshold.
- **Groundwater Depletion:** India is the world's greatest user of groundwater with 70% of its groundwater being contaminated.
- **Health Impact:** 75% of people do not have access to drinking water, and approximately 200,000 people per year die from inadequate water safety.
- **Economic Impacts:** Water scarcity could reduce India's GDP by 6% by 2050, affecting livelihoods, industrial sectors, and food production.

With acute water shortages and the possibility of "Day Zero" in most cities, including Bengaluru, the situation is hopeless. To solve the situation, the Indian government initiated several programs, such as the Jal Shakti Abhiyan and the Atal Bhujal Yojana. Nevertheless, more work is necessary to ensure sustainable water management and conservation methods.

Causes of Water Scarcity

Similarly, there are two general ways in which we might define the reasons for water scarcity:

Natural Causes

- **Low Rainfall:** The monsoon season, which can be erratic and varied, brings India the majority of its rainfall.
- **Geographical Factors:** The availability and distribution of water may be impacted by India's varied topography, which includes mountains, valleys, and plateaus.
- **Climate Change:** Rising global temperatures and shifting rainfall patterns are likely to disrupt the availability and purity of water resources.



Anthropogenic Causes

- Over-Exploitation of Groundwater: As a result of excessive groundwater use in India, water tables are dropping, and land is subsiding.
- Ineffective Irrigation Systems: Water waste and decreased water availability might result from ineffective irrigation systems and procedures.
- Urbanization and Population Growth: India's urbanization and population growth are driving up water demand and straining the country's water supplies.
- Agricultural Practices: The cultivation of water-intensive crops like rice and sugarcane can put significant pressure on available water resources.
- Industrial Water Pollution: Water sources can become unusable due to pollution from industrial processes like the production of chemicals and textiles.
- Lack of Water Conservation: The issue may be made worse by inadequate water conservation measures and a lack of knowledge about water scarcity.
- Inadequate Water Infrastructure: Water waste and decreased availability can result from inadequate water infrastructure, which includes distribution networks and storage facilities.
- Corruption and Mismanagement: In certain places, corruption and poor management of water resources can exacerbate scarcity by causing an uneven distribution of water.

Packaged Drinking Water Industry in India

Growing health concerns, insufficient public water distribution networks, and rising demand for easy and safe drinking water are all contributing factors to India's developing packaged drinking water market. The industry is projected to experience robust expansion, with a forecasted compound annual growth rate of 13% between 2024 and 2030, resulting in a significant valuation increase from approximately \$3.79 billion in 2023 to around \$8.92 billion by 2030.

Key Drivers:

- Growing Health Awareness: The need for safe and pure drinking water is being driven by consumers' growing health consciousness.



- Inadequate Public Water Distribution: Alternative sources of clean drinking water are now required due to inadequate public water distribution infrastructure and systems.
- Growing Convenience Demand: Packaged drinking water is a popular option among customers due to its mobility and convenience.

Market Segmentation:

- Purified Water: In 2023, this product had the biggest market share of almost 40.0%, driven by customer demand for clean, safe drinking water.
- Mineral Water: Driven by demand from the tourism sector and urban upper-class groups, this sector is anticipated to expand at a rate of 25–35% annually.
- Sparkling Water: Due to customer desire for healthier substitutes for sugary drinks, this industry is predicted to develop at the quickest rate of 7.4% between 2024 and 2030.
- Bisleri: With a 40.02% market share, this is the top brand among national players.
- With a 28.3% market share, Coca-Cola is the second-largest player.
- Aquafina: A well-known brand among customers that provides options for drinking water that has been purified.

Distribution Channels:

- Off-trade: Driven by the increasing convenience of choosing preferred brands of bottled water at retail establishments, off-trade had the biggest revenue share of 85.6% in 2023.
- On-trade: This sector is anticipated to expand due to growing health and cleanliness concerns, as well as the opening of pubs, clubs, and outdoor activities at hotels and resorts.

Multinational firms control the majority of the market, with Bisleri leading the national businesses with a 40.02% market share.

Regulatory Framework

Numerous laws, rules, and standards control the regulatory environment for India's packaged drinking water sector. Some of the most important regulatory frameworks are as follows:



1. In India, the regulation of packaged drinking water is overseen by the Food Safety and Standards Act, enacted in 2006, which establishes guidelines for its manufacture, distribution, and retail.
2. Food Safety and Standards (Packaging and Labeling) Regulations, 2011: These rules outline how packaged drinking water must be packaged and labeled.
3. Bureau of Indian Standards (BIS) Standards: IS 14543:2004, which outlines the specifications for packaged drinking water, is one of the BIS's established standards for packaged drinking water.
4. Environmental Protection Act, 1986: This law governs the environmental aspects of drinking water packaging, such as pollution prevention and waste management.
5. The Water (Prevention and Control of Pollution) Act of 1974: This law controls water source pollution and mandates that producers of packaged drinking water get approval from the State Pollution Control Board.
6. Packaging Waste Management Rules, 2019: These guidelines govern how makers of packaged drinking water handle the packaging waste they produce.

In India, the Food Safety and Standards Authority of India (FSSAI) is in charge of enforcing regulations regarding the standards and safety of bottled drinking water.

1. The Central Pollution Control Board (CPCB) is in charge of overseeing waste management and pollution control, among other environmental issues of packaged drinking water.
2. The Water (Prevention and Control of Pollution) Act of 1974 must be enforced by State Pollution Control Boards (SPCBs), which are in charge of controlling pollution in water sources.

Compliance Requirements:

1. FSSAI license: In order to operate, producers of packaged drinking water must acquire an FSSAI license.
2. SPCB registration: In order to receive approval for waste management and pollution control, makers of packaged drinking water must register with the SPCB.



3. Adherence to BIS requirements: Producers of packaged drinking water are required to adhere to BIS requirements.
4. Labeling and Packaging Requirements: Manufacturers of packaged drinking water are required to adhere to the labeling and packaging guidelines established by the BIS and FSSAI.

Environmental Impact of Packaged Drinking Water

India's packaged drinking water market has expanded rapidly in recent years due to rising demand for pure and safe drinking water. Nonetheless, this business has substantial and varied effects on the environment. The production of plastic garbage is one of the most important effects of bottled drinking water on the environment. Plastic bottle, cap, and label production, use, and disposal all contribute to littering, marine pollution, and wildlife harm. An estimated 15,000 tons of plastic garbage are produced daily in India, with the packaged drinking water sector accounting for a sizable amount of this waste.

Groundwater extraction is another important way that packaged drinking water affects the environment. Due to its heavy reliance on groundwater, the sector may experience saltwater intrusion, land subsidence, and declining water tables. Communities and local ecosystems that depend on these water sources may suffer greatly as a result.

Significant amounts of energy are also needed for the manufacture, shipping, and storage of packaged drinking water, all of which contribute to greenhouse gas emissions and climate change. Emissions and air pollutants are produced during the transportation of packaged drinking water from production plants to distribution hubs and retail locations.

Additionally, the sector uses raw resources and energy to make packaging materials like plastic bottles and caps, which contributes to pollution and resource depletion. Bottles and packaging materials are among the packaged drinking water trash that is frequently not properly disposed of, which results in litter, pollution, and damage to wildlife.



Plastic Pollution

According to estimations, the carbon footprint of packaged drinking water might be up to 1,400 times more than that of tap water. The energy needed to manufacture, ship, and store packaged drinking water is the cause of this. In India, plastic pollution from bottled drinking water is a serious problem. Although the nation's bottled water business is expanding, it is also producing a significant amount of plastic garbage. This garbage contaminates our water sources in addition to polluting the environment.

With millions of plastic bottles being used and discarded every day, the bottled water sector is a major contributor to India's daily production of over 15,000 tons of plastic garbage.

These bottles can take hundreds of years to break down if improperly disposed of.

Energy Consumption

- The manufacturing of PET bottles, water treatment procedures, and transportation all contribute to the packaged drinking water industry's high energy use.
- Energy Footprint: One liter of bottled water requires about 7.08 MJ of energy to produce, making it a significant energy footprint. A breakdown of Energy Consumption statistics is given below:
- Material manufacture: The manufacture of materials, particularly PET resin, accounts for 61% of energy usage.
- Operations: Procedures like water purification and bottling account for 17% of energy use.
- Energy generating: Energy generating accounts for 16% of total energy usage.
- Actual Product: The actual product accounts for just 6% of energy consumption.

Consumer Behavior and Awareness

Due to shifting customer preferences and behavior, the bottled drinking water industry in India has grown significantly in recent years. Packaged drinking water is viewed as a safe and healthful substitute for tap water by Indian customers, who are growing more health concerned.



Another important factor affecting how consumers behave when purchasing packaged drinking water is convenience. Customers are searching for portable and handy beverage options due to their hectic lifestyles and growing mobility. Packaged drinking water, which is widely accessible and reasonably priced, is a wonderful fit for this purpose. Another important factor influencing how consumers behave toward packaged drinking water is brand loyalty. Given that Bisleri and Aquafina are two of the most well-known packaged drinking water brands in India, consumers tend to remain with well-known brands.

Regarding packaging preferences, consumers typically favor smaller packing sizes, including 500ml and 1L bottles, because they are handier for everyday use. Packaged drinking water is becoming more widely available to customers through retail establishments, vending machines, and internet platforms. Demographically, middle-class, educated, and urban consumers especially those between the ages of 25 and 45 have the biggest demand for packaged drinking water. Psychologically, packaged drinking water is more popular than other beverages among customers who place a high value on price, convenience, health and wellness.

In conclusion, several factors, such as convenience, cost, brand loyalty, and health concerns, influence Indian consumers' purchasing decisions about bottled drinking water. Manufacturers and marketers must concentrate on comprehending these consumer preferences and behaviors as the market expands to create items that satisfy their demands and efficient marketing plans. Researchers used an online survey with over 100 respondents to learn more about customer behavior. The results are as follows:

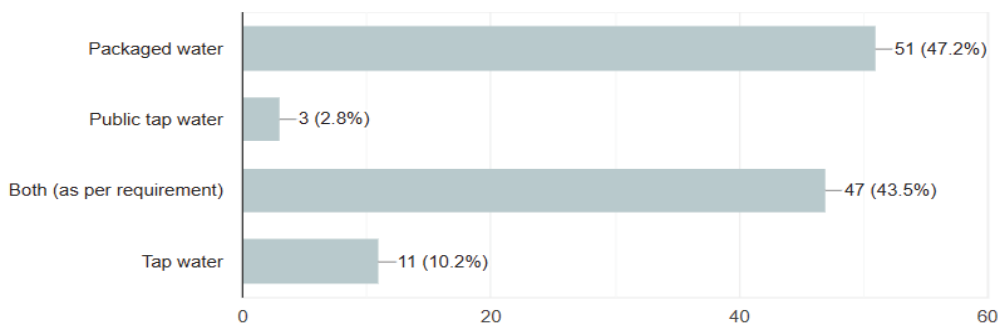


Fig:01 Preference of drinking water medium (108 responses)

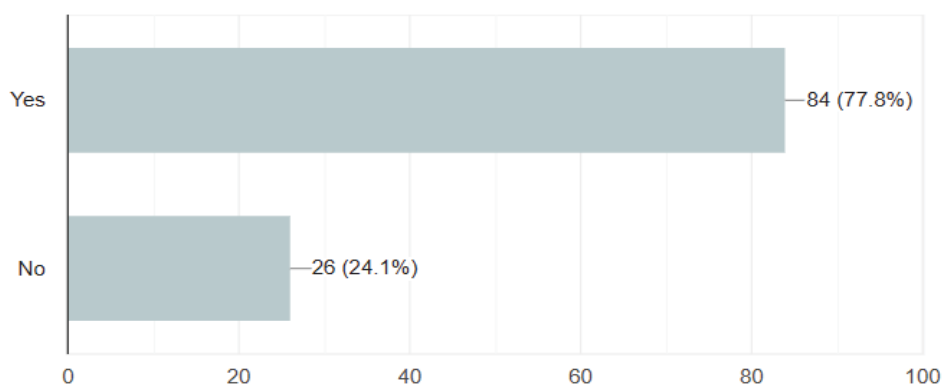


Fig:02 Dynamics of use of RO system in homes or office

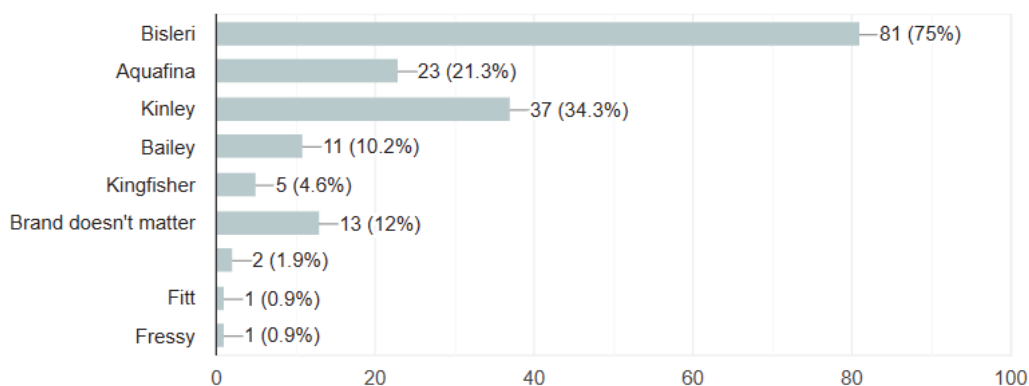


Fig:03 Dynamics of Brand selected by respondents

Conclusion and Future Directions

Although packaged drinking water is a fantastic example of a marketing approach to sell water that is readily available in nature, some legitimate issues support the industry's explosive growth, and as a result of this industry's expansion, plastic trash is also rapidly growing. Here, plastic is present everywhere in the form of microplastics in the oceans, blood vessels, air, and food and we either directly or indirectly consume it, which contributes to several health problems, including cancer and other lifestyle diseases.



According to a study that was published in the journal Nature, India is accountable for 20% (one-fifth) of the global plastic pollution problem. Around 5.8 million tonnes of plastic are burned annually in the nation, and an additional 3.5 million tonnes are released into the environment as waste, affecting the land, air, and water. India's yearly contribution to plastic pollution is 9.3 million tonnes, which is significantly more than earlier estimates and far higher than that of countries like China (2.8 million tonnes), Nigeria (3.5 million tonnes), and Indonesia (3.4 million tonnes). India's packaged drinking water sector is confronted with serious sustainability issues, such as resource depletion, social effects, and environmental degradation. Adopting sustainable habits, such as cutting back on plastic waste, conserving water, and utilizing renewable energy sources, is crucial to addressing these issues. To guarantee the industry's sustainability, the government should enact and enforce stronger laws and regulations. Furthermore, educating and informing consumers about the negative environmental effects of packaged drinking water might promote sustainable consumption habits. Additionally, the industry ought to spend money on the study and creation of novel, environmentally responsible solutions, including packaging made of biodegradable materials.

Reducing waste and the industry's environmental impact can also be achieved through a circular economy strategy that prioritizes material reuse and recycling. Promoting sustainability in India's packaged drinking water sector requires cooperation and stakeholder participation from the government, business community, non-governmental organizations, and consumers. There are some suggestions enlisted below to overcome the sustainability issues attached to packaged drinking water,

- Adopt Sustainable Practices: Use renewable energy sources, reduce plastic waste, and preserve water.
- Government Policy and Regulation: To guarantee sustainability, create and implement stronger policies and regulations.
- Education and Consumer Awareness: Promote sustainable consumption habits by increasing knowledge of the effects on the environment.
- Creative and Sustainable Solutions: Make investments in the study and creation of biodegradable packaging and other sustainable solutions.



Vidhyayana - ISSN 2454-8596

An International Multidisciplinary Peer-Reviewed E-Journal

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Indexed in: Crossref, ROAD & Google Scholar

- Circular Economy Approach: To cut down on waste and lessen the impact on the environment, emphasize material reuse and recycling.
- Cooperation and Stakeholder Engagement: Encourage sustainability by bringing together consumers, businesses, NGOs, and the government.



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