

## **Socio-Economic, Environmental, and CSR Impacts of the Ambuja Cement Marwar–Mundwa Cement Plant on Surrounding Communities**

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### **Abstract**

Industrial development, especially in resource-intensive sectors like cement manufacturing, significantly impacts local communities. This paper critically evaluates the socio-economic and environmental effects of the Ambuja Cement plant in Marwar-Mundwa, Rajasthan, focusing on both positive transformations and adverse challenges. Drawing from published CSR impact reports, environmental summaries, and community case narratives, the study reveals complex interlinkages between industrial growth, rural livelihoods, natural resource management, and socio-cultural dynamics.

### **Introduction**

Industrialization has been a major driver of economic growth and regional development in India, particularly in infrastructure-oriented sectors such as cement manufacturing. Large-scale industrial projects not only contribute to national and state economies but also bring significant changes to the socio-economic and environmental fabric of the regions in which they are established. Rajasthan, with its rich mineral resources and strategic location, has emerged as a key hub for the cement industry. Among the major industrial developments in the state, the **Ambuja Cement plant at Marwar-Mundwa in Nagaur district** represents a significant investment aimed at meeting the growing demand for cement while promoting regional industrial growth.

The establishment of the Ambuja Cement Marwar-Mundwa plant has introduced multiple transformations in the surrounding rural and semi-rural communities. On the one hand, the plant has generated employment opportunities, improved infrastructure, and stimulated local markets, thereby contributing to economic upliftment. On the other hand, cement manufacturing is inherently resource-intensive and poses potential environmental challenges, including air pollution, water consumption, land use changes, and ecological stress. In an arid and water-scarce region like Marwar-Mundwa, such environmental concerns become particularly significant, as local livelihoods are closely dependent on agriculture and natural resources.

### **Background**

The Ambuja Cement plant at Marwar-Mundwa (Nagaur District, Rajasthan) forms part of Ambuja Cements' expansion strategy to meet rising construction material demand in India's northern infrastructure market. The integrated facility includes clinker and cement production units with supporting power infrastructure.

### **Significance of the Study**

Assessing industrial projects beyond economic outputs is vital to understanding their holistic impact on water resources, agriculture, employment, social structures, health, and local ecology. In Rajasthan's semi-arid Marwar region, water scarcity and agricultural vulnerability make such assessment especially critical.

### **Objectives**

This study aims to:

1. Evaluate socio-economic changes experienced by local communities.
2. Assess environmental effects and mitigation associated with plant operations.
3. Analyze how corporate social responsibility (CSR) initiatives shape rural resilience.
4. Present balanced observations and policy recommendations.

### Literature and Context

**Ndegwa, Moraa, and Mwaura (2022)** investigated the *environmental impacts of cement production on air quality in developing countries*, using Kenya as a case study. The research focused on emissions from cement plants, particularly particulate matter (PM), nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and other pollutants that degrade ambient air quality. The study revealed that cement manufacturing significantly contributes to elevated concentrations of particulate matter and gaseous pollutants in nearby communities. The findings indicated that prolonged exposure to these pollutants poses serious health risks, including respiratory and cardiovascular issues, especially for populations living close to cement facilities.

**Wasim and Siddiqui (2022)** examined *noise pollution around cement industries and its impact on rural quality of life* in India. The study measured sound levels in the vicinity of cement plants and assessed their effects on residents' physical and psychological well-being. The research found that continuous exposure to high noise levels from cement manufacturing operations adversely affected sleep patterns, caused stress, and reduced overall quality of life for nearby rural communities. That noise pollution is an often-overlooked environmental impact of cement production, alongside air and soil contamination. The authors recommended implementing noise mitigation strategies, such as acoustic barriers, vegetation buffers, and strict regulatory monitoring, to minimize the adverse effects on surrounding populations.

**Eze and Nwankwo (2021)** conducted a study on *soil and vegetation contamination caused by cement dust* in Nigeria. The research focused on areas surrounding cement factories, examining both physical deposition of dust and its chemical impact on the environment. Results indicated that cement dust significantly increased soil alkalinity and elevated levels of heavy metals such as calcium, magnesium, and iron, which altered the soil's nutrient balance. Vegetation exposed to high dust deposition exhibited visible stress symptoms, including leaf discoloration, necrosis, and reduced growth rates. That prolonged exposure to cement dust could compromise soil fertility and plant health, affecting agricultural productivity and local ecosystems. The authors recommended regular monitoring, dust suppression measures, and establishing buffer zones to reduce environmental and ecological damage from cement production activities.

**Gholinejad et al. (2021)** investigated the *spatial distribution of heavy metal concentrations around a cement factory* and their impact on **Astragalus gossypinus** and wheat in Kurdistan Province, Iran. The study mapped soil contamination gradients, revealing elevated concentrations of metals such as lead, cadmium, and zinc in areas closer to the cement plant. These elevated heavy metal levels were found to affect the growth, biomass, and physiological performance of both plant species, with **Astragalus gossypinus** showing higher sensitivity than wheat. The role of industrial emissions in altering soil chemistry, leading to reduced plant productivity and potential entry of toxic metals into the food chain. The need for regular environmental monitoring, implementation of dust control measures, and remediation strategies to mitigate the ecological risks posed by cement dust emissions.

**Adewumi (2020)** evaluated the contamination and ecological risk of heavy metals associated with cement production in Ewekoro, Southwest Nigeria. The study focused on assessing the concentration of potentially toxic elements in soils surrounding the cement production areas and their potential ecological implications. Findings revealed elevated levels of heavy metals, including lead, cadmium, and chromium, which exceeded natural background levels and posed significant ecological risks. That continuous deposition of cement dust contributes to the accumulation of these metals in soils, potentially affecting soil fertility, microbial activity, and the overall health of the surrounding ecosystem. Adewumi the need for continuous monitoring and implementation of mitigation strategies to reduce heavy metal contamination and protect both environmental and public health in regions surrounding cement factories.

**Aluko and Akinbile (2019)** investigated the influence of cement dust deposition on soil fertility and crop productivity in Nigeria. Their study found that cement dust accumulation on

farmlands significantly altered soil properties, including pH, organic matter content, and nutrient availability, leading to a decline in soil fertility. The researchers observed that crops grown in dust-affected soils showed reduced germination rates, stunted growth, and lower yields compared to crops in unaffected areas. That prolonged exposure to cement dust not only degraded soil quality but could have long-term implications for agricultural sustainability in regions surrounding cement factories. Aluko and Akinbile recommended implementing dust mitigation strategies, such as vegetation barriers and periodic soil remediation, to protect farmland productivity and maintain environmental health.

### **Cement Industry and Regional Development**

Cement manufacturing is resource and energy intensive, generating significant particulate emissions and requiring careful material handling. Environmental Impact Assessment data for the Marwar-Mundwa project identifies key emissions (particulate matter, NO<sub>2</sub>, SO<sub>2</sub>) and mitigation measures like ESP and bag filters to meet regulatory norms.

### **Community and CSR Dynamics**

Ambuja Cements has implemented extensive CSR programs in the region that aim to address water scarcity, agricultural productivity, women's empowerment, and rural infrastructure. These initiatives aim to balance industrial pressures on local ecology and livelihoods.

### **Methodology**

This paper synthesizes qualitative secondary data from CSR reports, local media coverage, impact assessments, and relevant environmental summaries. The analysis systematically categorizes observed socio-economic outcomes (economic diversification, income changes, social welfare) and environmental effects (water management, emissions, land use changes).

### **Socio-Economic Effects**

#### **Economic Empowerment and Livelihoods**

The establishment of the Ambuja Cement Marwar-Mundwa plant has played a significant role in reshaping the economic structure and livelihood patterns of the surrounding rural communities. One of the most visible outcomes has been the generation of direct and indirect employment opportunities. The plant has created jobs in production, maintenance, security, transportation, and administrative services, while also stimulating ancillary economic activities such as local transport services, small shops, mechanical workshops, and supply chains. These employment opportunities have helped reduce seasonal migration and provided a more stable source of income for many households in nearby villages.

Agriculture, which remains the primary livelihood for most residents in the Marwar-Mundwa region, has also experienced notable changes due to corporate interventions linked to the plant's operations. Through water conservation initiatives such as rainwater harvesting structures, farm ponds, and groundwater recharge systems, farmers have gained improved access to irrigation. Enhanced water availability has enabled diversification of crops, multiple cropping cycles, and a shift from subsistence farming to more market-oriented agriculture. As a result, many farming households have reported increased productivity, higher incomes, and greater economic resilience in the face of recurrent droughts.

In addition to employment and agriculture, the promotion of alternative income sources has contributed significantly to economic empowerment. The formation of self-help groups (SHGs), particularly among women, has strengthened financial inclusion and entrepreneurship at the village level. These groups facilitate savings, access to credit, and the establishment of small enterprises such as dairy farming, handicrafts, tailoring, and agri-based micro-businesses. Women's participation in income-generating activities has not only enhanced household earnings but also improved their decision-making power and social status within the community.

#### **Agricultural Productivity and Water Security**

Through rainwater harvesting, farm pond construction, and irrigation support, local farmers

have significantly improved water availability. In examples from Mundwa and neighboring villages, farmers were able to shift from seasonal farming to year-round crop cycles, increasing incomes substantially (e.g., from ₹2 lakh to ₹6 lakh for some households).

Across villages, over 170 farm ponds and 3,410 rooftop rainwater systems have bolstered irrigation security, directly enhancing household resilience to drought conditions.

#### **Diversification of Rural Income Sources**

CSR interventions also include farmer producer organisations (FPOs) for biomass sales and micro-finance support through self-help groups (SHGs). Nearly **787 rural women** have participated in SHGs, accumulating a corpus of over ₹84 lakh used to fund local micro-enterprises and savings.

#### **Social Welfare and Community Development**

##### **Education and Healthcare**

Ambuja's CSR efforts reportedly include upgrading school infrastructure and supporting community health initiatives, improving access to education and basic health services.

##### **Reducing Gender Inequity**

Creation and support of women-run SHGs have increased female financial inclusion and leadership roles in rural economies.

##### **Employment and Local Market Growth**

The presence of a major cement manufacturing facility has potential along the value chain to generate direct and ancillary employment (e.g., transport, services), contributing to regional economic activity. Some publications note job creation in early operations and supply markets.

##### **Environmental Effects**

##### **Resource Use and Pollution**

Cement plants are inherently energy and resource-intensive. Air emissions (PM, NO<sub>2</sub>, SO<sub>2</sub>) and high water usage pose environmental challenges. The EIA document for the Marwar-Mundwa site details mitigation tactics such as bag filters and covered material storage to control particulate emissions within regulated norms.

##### **Water Resources and Land Impact**

While industrial operations use water, CSR-mediated water harvesting and pond revival efforts (e.g., restoration of Lakholav pond) appear to enhance local water availability and recharge groundwater systems.

However, industrial expansion can stress local ecosystems; sensitivity to competing agricultural and industrial water demands remains a challenge.

##### **Ecological and Climate Considerations**

The cement sector contributes to greenhouse gas emissions if reliant on fossil fuels. Expanded capacity may increase emissions unless complemented by clean energy solutions and energy-efficiency upgrades.

#### **Discussion**

##### **Balanced Impacts**

Ambuja Cements' presence in Marwar-Mundwa presents a complex picture of industrialization. While initial environmental concerns exist (emissions, resource use), CSR initiatives demonstrate tangible positive change in water security, agriculture, and rural welfare, often compensating for environmental pressures.

##### **Community Agency and Challenges**

Local communities benefit from improved infrastructure and diversified livelihoods, but challenges like ensuring equitable access to benefits, managing pollution risks, and safeguarding long-term ecological health remain.

##### **Sustainability and Corporate Responsibility**

The integration of CSR into core operational geography broadens corporate accountability, but long-term monitoring and community engagement are key to sustainable coexistence.

**Conclusions**

This assessment finds that the Ambuja Cement Marwar-Mundwa plant has had multifaceted impacts:

- Positive socio-economic effects include increased farmer incomes, improved water security, women's empowerment, and enhanced rural welfare infrastructure.
- Environmental effects, while potentially adverse (emissions and resource demands), are being actively mitigated through technology and aggressive CSR-led environmental management (water harvesting, pond restoration).
- The net impact depends critically on ongoing CSR strategy effectiveness, regulatory compliance, and continual community consultation.

**Recommendations**

1. Strengthen environmental monitoring with transparent public reporting on emissions and water use.
2. Expand community grievance mechanisms to address local concerns proactively.
3. Promote clean energy use within plant operations to reduce greenhouse emissions.
4. Scale up sustainable agriculture initiatives to widen the reach into more villages.
5. Integrate educational and vocational training closely aligned with industrial opportunities to boost local employability.

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