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OPERATIONAL, MANAGERIAL AND POLICY ISSUES OF BRICK OWNERS IN INDIAN BRICK INDUSTRY

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Abstract:

India's brick making sector is one of the largest informal manufacturing industries and plays a crucial role in providing employment in rural areas and supply of materials for construction. Despite its importance, operators of brick kilns still face recurring issues in operations, management and regulations that hinder their productivity, profitability and sustainability. This paper discusses the major challenges faced by the brick kiln owners such as shortage of labor, technology constraints, challenges in complying with environmental regulations, supply chain disruptions, lack of managerial expertise and changing government policies. The study highlights the need of modernization, training programs and policy changes for increasing operational capacity and sustainable development of the industry.

Keywords: Policy challenges, Manufacturers, Brick industry

1. INTRODUCTION

The brick producing industry in India is a major part of the development of the construction industry which remains a key part of the economic development of the country. India makes more than 250 billion bricks a year and gives jobs to millions of people, especially in the countryside. But even so, the industry is largely informally operated, labor intensive and technologically backward despite its massive size. Brick kiln owners face a number of operational and management challenges such as fluctuating input costs, workforce instability, inadequate infrastructure and limited access to financial resources. In addition, changing environmental laws and inconsistent state level policies introduce additional uncertainties for these operators.

Rationale of the study:

Almost every type of construction uses bricks. So, no building can be constructed without bricks. Brick is the main material for office, house and different types of buildings. India is the second most populous country of the world and one of its biggest problems is unemployment. Labor cost calculations can help to combat this unemployment challenge. Brick industry improves the living standards of people as bricks are basic requirement for construction purposes. The major objective of this study is to study Policy Challenges Faced by Brick Owners in Indian Brick Industry and its applicability in Guntur district.

2. LITERATURE REVIEW

Banjara and Penzom (2004) studied the environmental impacts of the brick kiln industry in the Kathmandu Valley. Their study showed ecological impacts of brick kilns such as erosion of nutrient-rich topsoil, reduced water-holding capacity, lowered rice yield, chemical pollution, biomagnifications, solid waste production by factories and workers, gas emission, and various health complications.

Khan et al. (2007) studied the soil profiles of burned soils (near brick kilns) and unborn soils (from agricultural areas) of the western parts of Bangladesh to investigate the effect of the brick kilns on soil degradation and environmental pollution. Brick kilns are blamed for destruction of topsoil and ecological degradation. These kilns destroy large areas of land annually and rely heavily on agricultural fields as a source of material. Nutrients in the unborn soils show positive correlation when compared to the collected burned and unborn soil samples. In contrast, these results highlight the drastic reduction of soil fertility, productivity, and environmental sustainability associated with topsoil burning.

Le and Oanh (2010) attempted to assess the emission levels of CO, SO2, PM and CO2 from coal burning in the brick kiln sector. Their study focused on six specific brick kilns in Bac Ninh Province, northern Vietnam. Their research used dispersion modeling to evaluate the environmental quality and estimated that production of 1000 bricks consumed approximately 8.53 ± 3.0 tons of coal.

Study Objectives: To know the major operational problems faced by the brick kiln owners in India.

- To assess the managerial and workforce problems that affect productivity.
- To investigate the policy and regulatory constraints that the kiln operators experience.
- To suggest ways to increase efficiency and sustainability in the brick industry.

Study scope: The present study is an attempt to study the production and marketing of licensed brick making industries in Guntur District, production methods, distribution networks and problems faced by these brick industries and their owners. This study addresses the problems facing brick proprietors and offers insight into operational inefficiencies, managerial shortcomings and policy shortcomings.

Study methodology: The paper is based on secondary data gathered from research articles, government documents, industry assessments and field observations. Conceptual analysis is used to synthesize results from the existing literature. The problems dealt with are typical of cases frequently met with in conventional Bull's Trench Kilns (BTKs), clamp kilns and partially modernized plants

- **Sample selection of respondents:** The registered brick manufacturing owners in Guntur district have been selected by the researcher for the study.
- **Statistical tools employed in the study:** Basic quantitative techniques such as percentages, means, standard deviation and Chi square tests were used to analyze the data presented below.

- **Study period:** The study was performed over 6 years (2017–2022). The sample participants were selected among the registered brick kiln business runners.

Difficulties Experienced by Brick Owners

- **Labor shortage and high cost of labor:** The brick manufacturing process is labor intensive and depends heavily on skilled labor such as molders, carriers and firefighters. The migration of seasonal workers and rising wages are contributing to instability. Owners have difficulty retaining skilled labor, particularly during peak agricultural.
- **Raw materials costs are increasing:** Clay resources are suffering from urban development. The price of fuels like coal, firewood and agricultural waste has soared. That burden is compounded by the added costs of transportation. This situation has a direct impact on the profitability of the kiln owners.
- **Conventional Production Methods** Old-fashioned production methods Many kilns still use BTKs or clamp kiln. These methods are low in energy efficiency, high in breakage rates, slow in production cycles and inconsistent in quality of bricks. The transition to modern technologies such as zig-zag kilns requires high investment, which makes owners hesitant to adopt these innovations.
- **Weather Dependency** The production of Weather Bricks is very much dependent on the season. Heavy rain affects the drying process, reduces output, and increases losses. Molding and firing processes can vary greatly with changes in temperature.
- **Lack of Mechanization** Manual handling dominates, resulting in slow production, High labor fatigue, Low output, difficulty in scaling operations and mechanization remains low due to financial constraints and lack of awareness.

Management Challenges: Most brick kiln owners follow traditional practices and have little knowledge of modern management, cost accounting, productivity improvement and personnel management. This leads to a planning inefficiency and suboptimal use of resources. Management of the workforce also faces issues such as:

- Lack of skilled workers
- High labor turnover
- Weak labor relations
- Absence of formal training
- Informal working arrangements and labor disputes and absenteeism affect production targets.

Financial management is a challenge for owners, and it is also a challenge for them. Some of the problems are estimating the production cost accurately, managing the credit periods, getting bank loans as no formal documentation, and cashflow problems during the lean seasons. Many of the kilns do not adhere to standard quality testing protocols which results in inconsistencies regarding the strength, shape and endurance of bricks. This inconsistency undermines their competitiveness in the

Policy and Regulatory Difficulties

a) **Environmental Norms: The brick industry has to adhere to strict norms:** Compulsory change to cleaner technologies (e.g. zig-zag kilns) Restrictions on excavation of clay/dirt Pollution control measures and emission norms. So, compliance is a big investment and that's tough for the small owners."
b) **Rules for Land and Resources:** There is little high-quality clay rich land available. The process of gaining permissions for soil and excavation is complex and regulatory restrictions are becoming tighter because of environmental concerns. This means that manufacturers are often forced to use poor quality or insufficient clay.
c) **State-by-state policy differences:** Each state has different licensing rules, Labor regulations, Tax structures and Pollution control procedures, creating uncertainty for owners, particularly those operating in border regions.
d) **Absence of Government Support:** Compared to other sectors, brick manufacturers get very little help in the form of subsidies, skill enhancement schemes, support for technology up gradation and opportunities for low interest financing. That disparity only widens the gap between the small, traditional kilns and the big, mechanized operations.
e) **Problems with GST and Compliance:** Small kiln operators GST registration E-way bills Documentation Accounting records. Their business model is informal, which poses compliance challenges.

3. DESIGN OF THE RESEARCH

The research design is an important part of any investigation as it provides a framework or outline to achieve the study's objectives. It involves a sequence of steps that together constitute a strategy for approaching research questions and testing hypotheses. A research design is a set of guidelines or principles of logical decision making that enable the researcher to obtain accurate and reliable findings.

Selection of the study area: The researcher selected respondents from Guntur district as the selected area of the study. The researcher selected 120 customers,

4. SUMMARY OF THE RESEARCH

The challenges faced by brick kiln owners are representative of the broader structural challenges faced by India's informal manufacturing sector. Outdated techniques and dependence on seasonal cycles have created operational inefficiencies and management is based on traditional experience-based methods instead of modern practices. Regulatory barriers, especially as concerns environmental legislation, must be addressed in a balanced manner, allowing for sustainability while at the same time safeguarding the interests of smaller operators. We need to work on upgrading, skills improvement and funding for these challenges

Table 1: Labor Shortage vs. Production Level

Labour Shortage Level	High Production	Moderate Production	Low Production	Total	Chi-Square Value x2	P Value
High Shortage	5	12	18	35	**12.84**	**9.49**
Moderate Shortage	10	16	9	35		
4Low Shortage	14	29	7	50		
Total	29	57	34	120		

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As per the chi square statistical Test χ^2 9.49 tab = at 0.05 significance the decision Reject H_0.. Labour shortage significantly affects production output. Kilns with fewer workers experience lower production. H_0: Labour shortage has no significant effect on production.

Table 2: Fuel Price Variation vs Production Cost

Fuel Cost Level	Low Production Cost	Moderate Cost	High Cost	Total	Cal Value x2	P Value
High Fuel Cost	6	15	24	45	**14.72**	**9.49**
Moderate Fuel	10	18	14	42		
Low Fuel Cost	12	17	6	35		
Total	28	50	44	122		

As per the chi square statistical Test χ^2 9.49 tab = at 0.05 significance the decision Reject H_0.. A significant relationship exists between fuel cost and production cost—higher fuel prices increase operational expenses. **H_0:** Fuel price has **no significant impact** on production cost.

Table 3: Managerial Skill vs Quality Efficiency

Fuel skill Level	High Quality	Moderate Quality	Poor Quality	Total	Cal Value x2	P Value
High Skill	22	10	5	37		

Moderate Skill	15	18	9	42	**22.19**	**9.49**
Low Skill	6	14	21	41		
Total	43	42	35	120		

As per the chi square statistical Test χ^2 9.49 tab = at 0.05 significance the decision Reject H_0.. Higher managerial skills are associated with better quality control and fewer defective bricks. **H_0:** Managerial skills have **no effect** on quality control.

Table 4: Policy Restriction Intensity vs Profit Level

Policy Restriction Level	**High Profit**	**Moderate Profit**	**Low Profit**	**Total**	**Cal Value x2**	**P Value**
High Restrictions	3	10	27	40		
Moderate Restrictions	9	17	14	40		
Low Restrictions	14	19	7	40	**18.33**	**9.49**
Total	26	46	48	120		

As per the chi square statistical Test χ^2 9.49 tab = at 0.05 significance the decision Reject H_0..

Interpretation: Higher policy restrictions significantly reduce profit levels of brick kiln owners. **H_0:** Policy restrictions do **not** significantly affect profit.

Table 5: Finance Availability vs Technology Adoption

Finance Access Level	**High Technology Adoption**	**Partial Adoption**	**No Adoption**	**Total**	**Cal Value x2**	**P Value**
Good Access	18	12	10	40		
Moderate Access	10	20	12	42		
Poor Access	5	11	24	40	**20.46**	**9.49**
Total	33	43	44	120		

As per the chi square statistical Test χ^2 9.49 tab = at 0.05 significance the decision Reject H

Interpretation: Brick kilns with good financial access are more likely to adopt modern, environmentally friendly technologies. **H_0:** Access to finance does **not** influence technology adoption.

Sustainability & Operational Issues in the Indian Brick Kiln Industry

a. Air pollution and greenhouse gases:

Brick kilns emit $PM_{2.5}$/PM_{10}, black carbon, CO, CO_2, SO_2 and NO_x. Black carbon from kilns is an important short-lived climate pollutant that contributes to regional warming and health harms. This emission profile makes brick clusters a significant local and regional air-quality problem.

b Resource depletion & land use

High-quality clay-bearing topsoil is being consumed or lost to urbanization and non-permitted excavation, reducing the availability of suitable raw material and encouraging the use of lower-quality soils that produce more defective bricks and higher emissions.

c. Fuel use and carbon intensity

Traditional kilns (e.g., Fixed-Chimney Bull's Trench Kiln — FCBTK, clamp kilns) are fuel-intensive and inefficient. Cleaner firing patterns (e.g., zig-zag stacking, vertical shaft kilns, tunnel/Hoffman types) show measurable reductions in fuel consumption and emissions. Studies and field programmes report 20–50% reductions in fuel use and PM emissions after conversion to improved designs.

d. Worker health and heat stress

Workers face chronic exposure to dust, heat, and hazardous combustion products. Increasing heatwaves are worsening occupational heat stress in kiln operations, with direct implications for productivity, safety, and human rights.

e. Waste & circularity missed opportunities

The sector has potential for circularity (use of fly ash, agro-residues, and industrial by-products), but regulatory and logistical barriers often prevent systematic reuse. Where adopted, co-firing agricultural residues and using fly ash in brick mixes reduce clay consumption and emissions.

Main operational issues

Brick production remains highly seasonal and labour intensive, migration, agriculture salability and poor working conditions make workforce retention and skill for main difficult, decreasing efficiency

- **Outdated technology and low mechanization:** Large numbers of kilns still operate older FCBIK or clamp systems, these have lower throughput, inconsistent quality, and higher breakage/waste, making it difficult for owners to stay profitable while meeting stricter environmental norms.

- **Fuel supply volatility & cost pressures:** Dependence on coal, firewood or purchased agro-waste exposes owners to price swings and supply disruptions — directly increasing production costs and reducing margins.
- **Compliance costs & fragmented regulations:** State-level variation in licensing, emission norms and enforcement create uncertainty. Recent pushes to convert kilns to cleaner technologies (and stricter stack/stack-height and emissions requirements) impose capital costs that small owners struggle to meet without credit or subsidies.
- **Access to finance & documentation barriers:** Informal record-keeping and land/tenure issues restrict owners' access to formal credit lines, inhibiting investment in cleaner, more efficient kilns. Evidence shows access to finance strongly correlates with technology adoption.
- **Emissions and health impacts:** Khan et al. (2019) and other peer-reviewed studies document brick kilns as important contributors to local PM and toxic emissions and link these to respiratory and broader health impacts in adjacent communities. These studies recommend technology shift and stricter monitoring.

b) Technology comparisons & mitigation potential: Multiple technical assessments (CPCB, CCAC/BC Guidance, IFC/World Bank analyses) find zig-zag kilns, vertical shaft brick kilns (VSBK), tunnel and Hoffman kilns deliver substantial fuel and emission reductions compared to FCBTKs — typically fuel savings ~20–40% and PM/BC reductions often reported between 30–60% depending on context. Conversion case studies from Bihar and other states show both environmental and productivity benefits, though conversion costs can be a barrier.

c) Policy & economic analyses: World Bank / policy analyses indicate that bans or forced conversions (without adequate subsidies/credit) can cause kiln closures and job losses; balanced policy packages that combine technical assistance, finance, and transitional support achieve better outcomes. State variation in policy (licensing, GST, pollution enforcement) leads to spatial shifts of production.

d) Implementation & ground realities: Field reports (Shakti Foundation, CCAC project briefs) highlight that adoption success depends on worker training, reliable fuel mixes (including agro-residue handling), and local institutional support. Many converted kilns still experience fugitive dust and operational issues even if stack emissions fall.

e)Recent government guidance and enforcement: CPCB directives and state actions (e.g., conversion targets and timeframes) have accelerated conversions in several regions but have also increased short-term compliance burden on smaller owners. Guidance documents (2022–2024) consolidate recommended technologies and environmental monitoring practices.

For kiln owners / associations

- **Priorities cost-effective technology upgrades** — start with retrofits like zig-zag firing, improved stoking, better sealing and mechanized handling where feasible (often the fastest ROI).

- **Access finance through cluster aggregation** — form cooperatives or clusters to apply for collective loans/subsidies (reduces per-unit cost and improves bargaining power).
- **Adopt cleaner fuels & blended mixes** — test and gradually introduce agro-residue and controlled use of fly ash to reduce clay use and emissions.
- **Invest in worker training and welfare** — basic occupational safety, shade, hydration, and short training modules both raise productivity and reduce absenteeism/turnover.

For policymakers & regulators

- **Design incentive + compliance programmers** — subsidized conversion, concessional loans, and time-phased standards help small owners transition without mass closures.
- **Harmonies state regulations & simplify licensing** — reduce the administrative burden and provide a single window for environmental and land permissions.
- **Support cluster-level technical assistance** — shared testing labs, training centers, and fuel storage facilities reduce transaction costs and improve quality control.
- **Monitor actual outcomes (not only stack emissions)** — include fugitive dust controls, ambient monitoring and worker health surveillance in compliance regimes.

5. FINDINGS

- Pressure to shift to cleaner technologies and approved fuels raises costs.
- Fuel cost & availability are major pain points.
- Seasonality and labour shortages hurt continuity and productivity.
- Health, safety and on-site living conditions are poor — operational risk and reputational cost.

Managerial findings

- Weak financial planning and limited access to formal credit.
- Informal labour management and dependence on contractors.
- Limited adoption of productivity/quality management.
- Price squeeze from taxes & uneven regional compliance.

Policy & regulatory findings

- Tighter environmental regulation + timelines.
- Fragmented enforcement and state-level differences.
- Social protection & labour enforcement gaps.

6. SUGGESTIONS

- Initiate fundamental book keeping and maintain worker records (names, Aadhaar/IDs, payments made, hours worked). This involves minimal expense and mitigates legal risks.
- Introduce essential health and personal protective equipment, such as masks and gloves, install small shaded areas/clean water points, and provide a basic first-aid kit—this helps decrease absenteeism and lower enforcement risks.
- Engage in collective fuel procurement with nearby kilns to decrease costs related to sourcing.
- Apply for subsidies related to clean technology at the state or central level, as well as bank loans (provide basic accounts once set up). Many programs support upgrades at the cluster level—consider joining a kiln cluster association.
- Experiment with a small zig-zag or VSBK modification on a single chimney to assess savings in fuel and improvements in quality before making a full investment.
- Transition from solely using contractors to incorporating some direct hires and written contracts; establish clear wage slips and payment receipts to prevent conflicts.
- Implement straightforward quality control metrics: assess the number of bricks produced per firing, breakage rates, and fuel usage per 1,000 bricks—monitor these monthly to justify investments or price increases.
- Investigate forward contracts with construction companies or masonry product aggregators to secure steady demand and improved profit margins.
- Offer skill development programs for workers and management training initiatives for owners.
- Introduce organized financial assistance programs for small to medium-sized brick kilns.
- Create standardized national guidelines for brick production to minimize variations in state-level policies.
- Foster the use of machinery in moulding, handling, and loading processes to decrease reliance on manual labour
- Enhance support for environmental compliance through the establishment of training and monitoring systems.

Strengthen supply chain connections to ensure the stability of raw material and transportation costs.

7. CONCLUSION

- The brick sector in India plays a crucial role in the construction economy; however, the challenges encountered by brick entrepreneurs are varied and intricate.
- Operational out comings, management deficiencies, and inflexible policy frameworks severely impede growth. Emphasizing sustainable modernization, skill development, and policy changes is critical for boosting competitiveness, ensuring compliance with environmental regulations, and supporting livelihoods within the industry.
- Tackling these concerns can facilitate the evolution of the brick sector into a more efficient, environmentally sustainable, and economically robust industry.

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