ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue VI, June 2026

Optimizing the Sustainable Supply Chain for Eco-Friendly Bricks

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DOI: https://doi.org/10.51583/IJLTEMAS.2026.150700018

Received: 15 June 2026; Accepted: 25 July 2026; Published: 06 August 2026

ABSTRACT

Around the world, bricks are a common building and construction material. Conventional bricks have a high embodied energy and a significant carbon footprint because they are made from clay that has been fired at a high temperature in a kiln or from concrete made with ordinary Portland cement (OPC). The natural resources needed to produce traditional bricks are already in short supply in many parts of the world. The manufacturing of bricks from waste materials has been the subject of much research for the sake of sustainable development and environmental protection. The usage of ecological bricks as a sustainable civil building solution is the subject of this paper. Recycled or renewable resources, such as construction debris, municipal waste, polluting construction waste are used to make ecological bricks. This paper reviews the latest research on bricks made from waste resources. Numerous waste materials have been investigated for use in brick production using various techniques. More research and development is required for the widespread manufacturing and use of bricks made from waste materials. This includes not only technical, economic, and environmental factors, but also standardization, government policy, and public education regarding trash recycling and sustainable development.

INTRODUCTION

Construction plays a key role in urban and economic development, but it is also responsible for a significant environmental impact. Among the problems related to the building sector are the extraction of natural resources, waste production, greenhouse gas emissions, and excessive energy use. To lessen this impact and encourage more responsible growth, there has been an increase in interest in using more sustainable building techniques in recent decades. Policies and recommendations that promote ethical waste management, promote recycling and reclamation, and reduce the adverse environmental effects of demolition activities have been developed by governments, environmental organizations, and the building industry. Today's sustainable development scenarios demand for the use of construction waste to be investigated in several fields, such as enhancing soil strength and using it to build green buildings. Fly ash, mine tailings, slags, construction and demolition (C&D) waste, wood sawdust, cotton waste, limestone powder, paper production residue, petroleum effluent treatment plant sludge, kraft pulp production residue, cigarette butts, waste tea, rice husk ash, crumb rubber, and cement kiln dust are just a few of the many waste materials that have been the subject of research. Bricks have been made from waste materials using a variety of techniques.

Utilizing these kinds of unwanted waste materials will help to minimize the negative impacts of destruction; however, the potential wastes can only be recycled and used if the newly developed lightweight brick's properties and content of environmental pollutants meet the necessary standards and requirements and comply with relevant laws. Lastly, it is intended that our study will help spread awareness about ecological bricks and promote their use in civil construction, promoting a more responsible and sustainable sector that respects natural resources and offers healthy and comfortable settings for building users.

REVIEW OF LITERATURE

(Sousa, 2020) The thermal and acoustic performance of structures is another area where ecological bricks excel. These materials' composition and physical properties improve thermal insulation, which lessens the demand for

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artificial air conditioning systems and helping to reduce energy use. Furthermore, ecological bricks' high density offers superior acoustic insulation, enhancing construction acoustic comfort.

(Fernandes et al., 2019) Given the use of natural resources, the release of air pollutants, and the production of trash, the production of building materials is an activity with a significant potential for environmental effect. The pursuit of sustainable substitutes in the field of civil building has becoming more pertinent with the goal of lessening negative effects and encouraging environmental preservation. In this regard, ecological bricks have emerged as a strong and encouraging choice, helping to reduce the negative effects on the environment during production.

(Oliveira & colleagues, 2019) In order to lessen environmental effects and create more energy-efficient buildings, the use of sustainable materials in civil construction has grown in importance. Because of their resilience and sustainability, ecological bricks have sparked interest in this context.

Objectives of the Study

- To analysis awareness about ecological bricks.
- To promote ecological bricks in civil construction.
- To give suggestions for improvement.

RESEARCH METHODOLOGY

A Research methodology involves specific techniques that are adopted in the research process to collect, assemble and evaluate data. It defines these tools that are used to gather relevant information in a specific in research study. The Systematic random sampling technique has been used. To fulfil the requirement of the study, the data were collected from primary and secondary sources. In order to analyze how spread awareness about ecological bricks 120 respondents through structured questionnaire were selected. Secondary date was collected from internal sources like official records, websites, journals, and published papers. For analyzing the data, statistical tools, percentage analysis is used.

Gent Waste Bricks

The Gent Waste Bricks is a lime-cured brick made from recycled municipal waste, specifically developed for use on the facade of the new Design Museum Gent extension in the city of Ghent in Belgium. The brick is made from local waste to meet the client’s brief to lower the embodied carbon used in the project’s construction.

Source: www.architectureanddesign.com.au

These bricks contain 63% waste, and are cured rather than fired. The lime captures CO2 from the atmosphere during the curing, sequestering carbon over the life of the building. The brick also delivers the required strength and resilience to stand up to external conditions. The manufacturing process and the use of locally sourced recycled materials produce a brick, which contains a third of the embodied carbon of a clay brick over a 60-year lifecycle.

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Fly Ash Bricks

Source: www.architectureanddesign.com.au

Manufactured from fly ash, an industrial waste created in thermal power plants as a by-product, fly ash bricks are lighter than clay bricks, have more compressive strength, and are made in a more environment-friendly way on hydraulic machines. Their smooth surface eliminates the need for plastering the wall, reducing construction costs.

Fly ash bricks achieve their green credentials by preventing the fly ash waste from being dumped in landfills. Even the manufacturing process, which involves compaction, curing and drying has a low carbon footprint, with no reliance on fossil fuels.

Fly ash bricks absorb less heat, have high durability and low permeability, and offer resistance to fire. The low porosity of these bricks reduces water absorption, minimising dampness on walls. These bricks can be used in both load-bearing and non-load-bearing wall applications, and are particularly recommended for high rise buildings thanks to their lightweight characteristics.

K-BRIQ

Source: www.architectureanddesign.com.au

The highly polluting construction waste is now being recycled back into construction sites in the form of the K-BRIQ, an innovative brick test-launched in August 2019 following 10 years of research at the Heriot-Watt University in Scotland.

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Based on circular economy principles, K-BRIQ by Scottish clean tech company Kenoteq seeks to address the demand-supply gap for bricks in the UK market and reduce the reliance on imports. With EU regulations requiring 70% of all construction and demolition waste to be recycled (and none sent to landfill), there is a glut of recycled material available for use, creating opportunities for innovations such as K-BRIQ.

Containing at least 90% recycled construction waste – the highest for any brick – K-BRIQ uses a low-carbon production process that does not require high temperature firing, virgin cement or high volumes of clay. A resource-efficient construction brick made from inert recycled materials, K-BRIQ is recommended as a green replacement for traditional bricks and blocks in exterior and interior environments.

K-BRIQ has a carbon footprint less than 5% of a traditional clay brick, and offers comparable strength and a high thermal mass. The brick is available in a range of 13 stock colours, all made from recycled pigments. K-BRIQ is being commercially launched this year with the company targeting a total delivery of 3 million bricks.

Analysis and Interpretation

Table 1. Table showing the Age of the Respondents

S. No	Age	No. of. Respondents	Percentage (%)
1	25 to 34 years	75	62.5
2	35 to 44 years	33	27.5
3	45 to 55 years	12	10
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 62.5% of the respondents are between the age group of 25 to 34 years, 27.5% of respondents are 35 to 44 years, 10% of the respondents are between the age group of 45 to 55 years**.**

Table 2. Table showing the Gender of the Respondents

S. No	Gender	No. of. Respondents	Percentage (%)
1	Female	25	20.8
2	Male	95	79.2
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 79.2% of the respondents are male respondents and 20.8% of the respondents are female respondents.

Table 3. Table showing the Occupation of the Respondents

S. No	Occupation	No. of. Respondents	Percentage (%)
1	Private employee	56	46.7

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue VI, June 2026

2	Government employee	21	17.5
3	Professionals	18	15
4	Business	25	20.8
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 46.7 % of the respondents are private employee, 20.8% of the respondents are Business, 17.5% of respondents are Government employee and 15% of the respondents are doing Professionals.

Table 4. Table showing the Monthly Income of the Respondents

S. No	Income	No. of. Respondents	Percentage (%)
1	Below Rs.50,000	12	10
2	Rs.50,001 – Rs.60,000	23	19
3	Rs.60,001 – Rs.70,000	30	25
4	Above Rs.70,000	55	46
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 46% of the respondent's monthly income is Above Rs.70,000, 25% of the respondent's monthly income is Rs.60,001 – Rs.70,000, 19% of the respondent's monthly income is between Rs.50,001 – Rs.60,000 and 10% of the respondent's monthly income is Below Rs.50,000.

Table 5. Table showing the Insurance Awareness of the Respondents

S. No	Awareness	No. of. Respondents	Percentage (%)
1	Yes	85	70.8
2	No	35	29.2
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 70.8% of the respondents are aware about eco-logical bricks and 29.2% of the respondents are not aware about eco-logical.

Table 6. Table showing the Sources of Awareness of the Respondents

S. No	Source of Awareness	No. of. Respondents	Percentage (%)
1	Engineer	85	70.8
2	Advertisement	15	12.5

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue VI, June 2026

3	Friends / Family	20	16.7
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 70.8% of the respondents are aware about eco-logical bricks through engineer and 16.5% of the respondents are aware about eco-logical through friends/family 12.5% of the respondents are aware about eco-logical through advertisement.

Table 7. Table showing the Preferences towards eco-logical bricks

S. No	Bricks	No. of. Respondents	Percentage (%)
1	Gent waste bricks	40	33.3
2	Fly ash bricks	45	37.5
3	K-BRIQ	35	29.2
Total		120	100

Source: Primary Data

The above table shows that out of 120 respondents taken for the study, 37.5% of the respondents prefer fly ash bricks and 33.3% of the respondents prefer Gent waste bricks, 29.2% of the respondents prefer K-BRIQ.

SUGGESTIONS

To enhance the effectiveness and sustainability of ecological bricks, the new material innovation like plastic waste, agro-waste and industrial by-products and use energy efficiency in production and enhanced strength and durability in cost reduction and encourage government subsidies to improved design and adaptability for different climates to promote green certifications and regulations that encourage sustainable solution for modern construction.

CONCLUSION

Eco-friendly bricks, also known as ecological or sustainable bricks, offer a promising solution for reducing the environmental impact of construction. They are made from recycled materials, require less energy for production, and often provide better insulation, leading to energy efficiency in buildings. Additionally, these bricks help in reducing carbon emissions and promoting sustainable development.

In conclusion, ecological bricks present a viable alternative to conventional bricks, supporting environmental conservation while maintaining strength and durability. As the demand for sustainable construction grows, adopting eco-bricks can contribute to a greener and more sustainable future.

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ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue VI, June 2026

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