iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** III **Month of publication:** March 2026

DOI: https://doi.org/10.22214/ijraset.2026.78658

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

Development of Eco-Brick Using Industrial and Agricultural By-Products

Gokul Maharaj D[1], Gokulraj M[2], Rajarajan D[3], Sivapriyan R[4]
Department of Civil Engineering BE Kumaraguru College of Technology, Coimbatore - 641049

Abstract: ***Housing shortages in many developing countries have stimulated efforts to develop construction methods that use cheap and durable local materials. It is essential to develop technologies that use minimal resources because of the increasing shortage of energy and raw materials. Traditionally produced in a cottage industry setting, fired clay brick production plays a major role in the informal economy of such countries. On the other hand, in many countries, electricity is often supplied by coal-powered generators. In the power stations, approximately 80-90% of the ash formed from burnt coal is carried out of the furnace, then extracted from the flue gas and is known as fly ash.***

Large quantities of fly ash produced as a by-product of coal based power stations have been viewed as serious environmental problems. Rice husk is the by-product of the rice milling industry. Saw dust is the by-product of cutting, grinding, drilling, sanding and other pulverizing wood or other material with saw or other tool.

The proposed study involves the experimental investigation of effect of rice husk ash and saw dust on the properties of fly ash bricks. The main aim is to compare the fly ash bricks over conventional clay bricks, so for this purpose percentage of saw dust and rice husk can be increased by weight and with the help of laboratory tests it will be briefly studied.

I. INTRODUCTION

The rapid growth of industrialization and urbanization has led to an increase in the demand for construction materials, especially conventional clay bricks. However, the large-scale production of these bricks causes significant environmental problems such as depletion of topsoil, deforestation, and high carbon emissions during firing. At the same time, a large quantity of industrial and agricultural wastes such as fly ash, rice husk ash, sugarcane bagasse ash, and quarry dust remain underutilized and often cause pollution when disposed of improperly.

In this context, the development of eco-friendly bricks (eco bricks) using waste materials offers a sustainable solution to both waste management and construction needs. Eco bricks utilize industrial and agricultural by-products as partial or complete replacements for traditional raw materials, thereby reducing environmental impact and promoting the concept of sustainable development. These bricks are lightweight, cost-effective, and have good strength and durability comparable to conventional bricks. The present project focuses on developing eco bricks by incorporating various industrial and agricultural wastes in appropriate proportions and evaluating their physical and mechanical properties such as compressive strength, water absorption, and density.

II. LITERATURE SURVEY

The disposal of saw dust and rice husk has always been by incineration or open air burning, this has hazardous effect on the air and environment at large. They can be recycled for use in construction industry without producing any harm to human and environment. Research has shown that they can be used as a binder replacement. This paper highlights the optimal material that can be added to concrete for optimum strength. Sawdust and Rice husk mixed with bone powder was added to replace cement in relative percentage of 5, 10, 15 and 20%. The result shows that rice husk and sawdust are alternative binder that can replace cement to some extent but there is reduction in strength as well. Rice husk ash and sawdust are good materials that can supplement cement to some extent but the percentage of sawdust recommended should not be more than 10 percent while the rice husk ash is permissible to 15% of cement. This mixture is permitted for lightweight structures.

All materials used for the practical are local materials and they are readily available and they can also reduce the cost of producing concrete when implemented. There has been no issue of hazardous emission generated from this material when used for construction. The mode of disposing rice husk ash and sawdust has been by open air burning which has harmful effect on the people and environment at large but with its implementation in lightweight structure, it will help in providing clean and safe environment. Reported that addition of RHA can decreases the plasticity of soil and shifted the high plasticity silt to moderate plasticity silt.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

III. SCOPE OF THE PROJECT

The scope of this project involves the experimental evaluation and performance analysis of cementitious materials containing saw dust ash and rice husk ash as partial replacements for ordinary Portland cement. The major areas covered include:

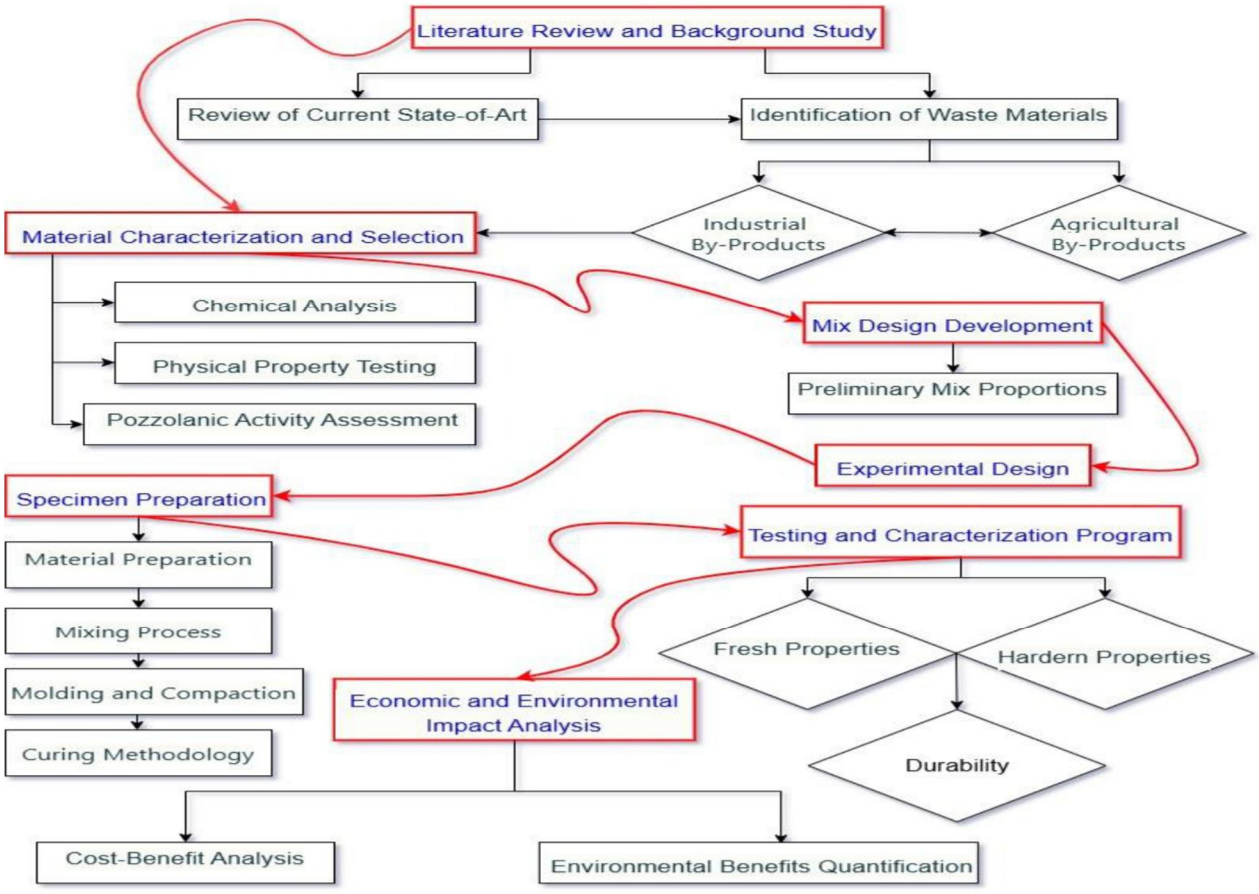
1) Collection and preparation of saw dust ash and rice husk ash through controlled burning.
2) Determination of physical and chemical properties of SDA and RHA.
3) Preparation of mix proportions with varying percentages of ash (e.g., 5%, 10%, 15%, and 20%) replacing cement.
4) Casting and curing of specimens such as bricks or concrete cubes for testing.
5) Evaluation of mechanical properties like compressive strength, water absorption, and durability.
6) Comparison of results with conventional cement bricks or concrete.

The findings of this study will help determine the optimum replacement level of saw dust ash and rice husk ash for achieving desirable strength and performance. It will also demonstrate the feasibility of using these waste materials in large-scale construction applications, thereby supporting sustainable development, resource conservation, and eco-friendly construction practices.

A. Objectives

1) To investigate the potential of industrial and agricultural by-products as raw materials in brick production
2) To manufacture eco-friendly bricks using binder (OPC), industrial and agricultural by-products.
3) To analyze the mechanical and physical properties of the eco bricks.
4) To identify the optimum mix ratio for strength, durability, and cost efficiency.
5) To compare the performance of eco-friendly bricks with conventional clay bricks

IV. METHODOLOGY



©IJRASET: All Rights are Reserved

In this project, OPC 43 grade cement, Fly ash, Saw Dust and Rice Husk Ash are used to manufacturing the Eco-Brick. The Bricks are cast in 190 × 90 × 90 mm size, demolded after 24 hours, and cured for 7,14 and 28 days.
Various tests are conducted such as Standard Consistency Test, Initial Setting Time, Final Setting Time, Specific Gravity Test, Compression Test, Water Absorption Test..

Stipulations for Eco-Brick Preparation	
Type of material	Eco-brick using Rice Husk Ash (RHA) and Saw Dust Ash (RDA)
Binder material	OPC 43
Brick size	190 x 90 x 90 mm
Batching method	Volume batching
Method of mixing	Hand mixing
Method of casting	Manual placing in brick moulds
Compaction method	Hand compaction
Curing method	Water curing for 7, 14, and 28 days
Degree of supervision	Good

1) Test data for materials

Cement used:		OPC 43 grade Water curing for 7, 14, and 28 days
Specific gravity of cement:		3.0
Specific gravity of fly Ash :		2.24
Specific gravity of M Sand :		2.53
Water absorption		
Saw Dust Ash	:	4 times of dry weight
Rice Husk Ash	:	1.4 times of dry weight

2) Mix Proportions:

Materials	
Fly Ash	55%
Cement	15%
Fine Aggregate	20%
Rice Husk Ash	5%
Saw Dust Ash	5%

B. Calculation proportion

Volume of Fly ash	1400g
Volume of Cement	350g
Volume of Fine Aggregate	500g
Volume of Rice Husk Ash	100g
Volume of Saw Dust Ash	150g

Ratio: 11:3:4:1:1

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

1) Standard Consistency Test

The standard consistency test of cement is carried out to determine the minimum amount of water required to prepare a cement paste of normal or standard consistency.

This test ensures that the cement paste has proper workability and plasticity for further testing and practical use.



2) Setting Time of cement

- Initial Setting Time:
  The time between adding water to cement and when the paste starts losing its plasticity.
  For Ordinary Portland Cement, it should be not less than 30 minutes.
- Final Setting Time:
  The time between adding water to cement and when the paste completely loses plasticity and becomes hard.
  It should be not more than 10 hours (600 minutes).



3) Specific Gravity Test

Specific gravity is the ratio of the density (or weight) of a material to the density of water at a specified temperature.



©IJRASET: All Rights are Reserved

4) Casting of Brick

After Calculating mix design and taking material in proportion we are conducted mixing of material process and casting of Eco-Brick size 190 x 90 x 90 mm.





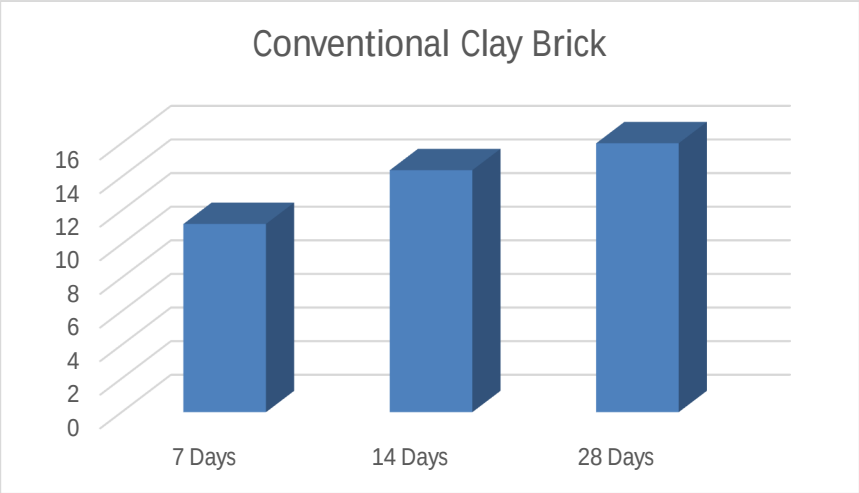
V. COMPRESSIVE TEST ON BRICK

Compressive strength of Eco-Brick is tested using a Compression Testing Machine as per Bureau of Indian Standards Guidelines. Brick mould (190mm × 90mm × 90mm) are cured for 7 and 14 days and then loaded until failure.



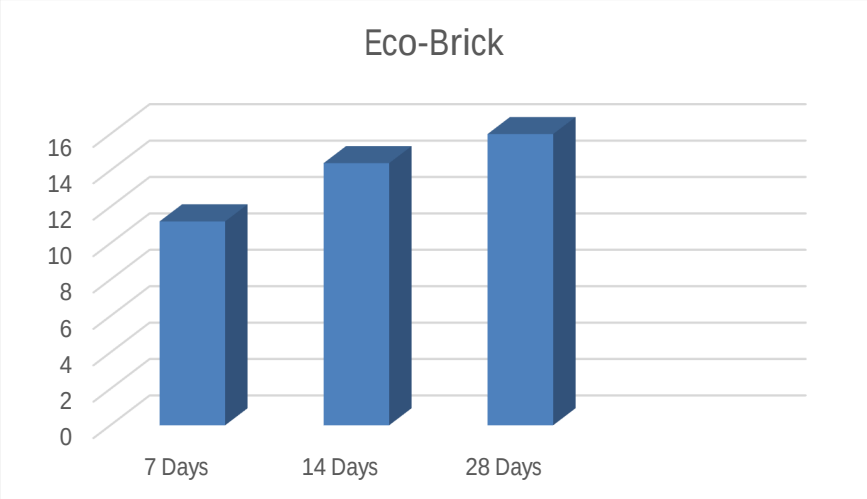
Compressive strength of conventional clay brick

Curing	Compressive Strength (N/mm^2)
7 days	7.35
14 days	9.45
28 days	10.5



Compressive strength of Eco-Brick

Curing	**Compressive Strength(N/mm^2)**
7 days	11.2
14 days	14.4
28 days	16



VI. COST ESTIMATING

MATERIAL	PERCENTAGE	WT/KG	₹ RATE/KG	PRICE
Fly Ash	55%	1.4	3.1	4.34
Cement	15%	0.35	6.6	2.31
Fine Aggregate	20%	0.5	1	0.5
Rice Husk Ash	5%	0.1	2	0.2
Saw Dust Ash	5%	0.15	3.5	0.52
Total Cost				8.65(Include Labor Charge

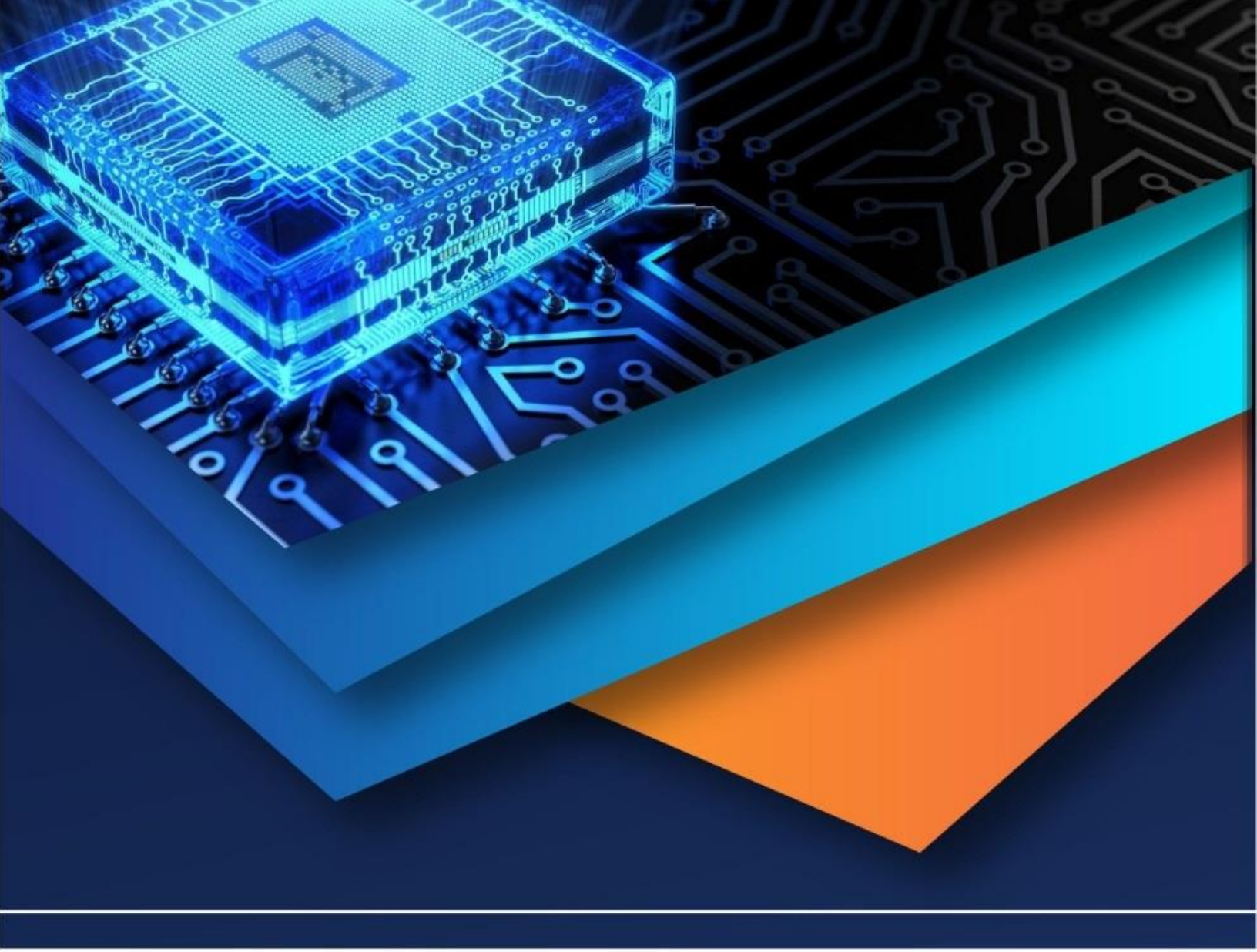
VII. CONCLUSION

The study focused on the development of eco-bricks using industrial and agricultural by-products such as fly ash, rice husk ash, and saw dust ash with cement as a binding material. The bricks were prepared, cured, and tested to evaluate their mechanical and physical properties. The experimental results indicate that the eco-bricks possess satisfactory strength and performance when compared with conventional clay bricks

The utilization of waste materials in brick production helps reduce environmental pollution, conserve natural resources, and promote sustainable construction practices. Therefore, eco-bricks made with these materials can be considered a cost-effective and environmentally friendly alternative to traditional bricks for construction purposes.

REFERENCES

[1] A.U. ELINWA & S.P. EJEH concluded that sawdust waste incineration fly ash can react with CH released by cement clinker hydration to produce secondary C-S-H gel inside the cement paste which improves the microstructure of cement paste matrix.
[2] SURENDER MALIK, BHAVANA ARORA , (July-2015IJIRCST) The brick having rice husk ash as an admixture shows lower compressive strength and higher percentage of water absorption when compared to the conventional clay bricks.
[3] PRASANTA GHOSH, BRATI BASU, SULAGNO BANERJEE concludes that Addition of pozzolanic material like fly ash, rice hunk ash, metakaolin, saw dust ash improves its strength properties.
[4] NAVDEEP SINGH & NITISH KUMAR SHARMA(2020-IJMPERD) shows that the RHA and SDA has the potential to be used for the partial replacement of the cement when used in the concentration ranging from 5 to 10% due to cementing and pozzolana properties.
[5] SENTHILKUMAR V. (2023) studied bricks with fly ash and sugarcane by-products, observing strength improvements with partial replacement.
[6] OLAIYA (2025) developed sandcrete bricks using sawdust ash and banana leaf ash, achieving 4.28 MPa compressive strength with reduced CO_2 emissions.
[7] NAGARAJU T.V. & BAHRAMI A. (2024) showed that using rice husk ash in geopolymer bricks reduces embodied CO_2 and improves compressive strength depending on curing and activator molarity.
[8] DOGAN-SAGLAMTIMUR N. & BILGIL A. (2021) demonstrated that industrial ash in clay bricks improves sustainability, though firing temperature strongly influences durability and shrinkage.
[9] ABBASS M. & HUSSAIN I. (2025) reported that geopolymer bricks made with rice husk and sugarcane bagasse showed good mechanical strength and long-term durability.
[10] KUMAR P. (2024) investigated bricks incorporating coconut shell ash and found that partial replacement of cement improved thermal insulation while maintaining adequate compressive strength.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)