

A Study on Production Process and Customer Satisfaction Towards Kamath's Tile Works

Deeksha Nayak¹, Mrs. Akshatha Shetty²
^{1,2}Alva's College (Autonomous), Moodubidire

Abstract—The brick manufacturing industry plays an important role in the construction sector as bricks are widely used for building houses, offices, and other structures due to their strength and durability. The study aims to analyse the production process and customer satisfaction towards Kamath's Tile Works. It explains the stages of brick manufacturing such as raw material procurement, crushing, moulding, drying, firing, cooling, quality inspection, and storage. The study also focuses on customer satisfaction regarding quality, strength, price, delivery, and services. The research is based on primary and secondary data, and the data were analysed using percentage analysis and Chi-square test. The results show that proper production practices and quality control positively influence customer satisfaction. The study concludes that better quality and timely service lead to higher customer satisfaction and trust.

Index Terms—Brick Manufacturing, Production Process, Customer Satisfaction, Quality Control, Chi-square Analysis

I. INTRODUCTION

The brick manufacturing industry is one of the important industries in the construction sector. Bricks are widely used for building houses, offices, schools, factories, and other structures because they are strong, durable, and long lasting. Earlier, brick manufacturing was mainly done manually, but now many industries use machines and modern technology to improve production and maintain good quality bricks.

The manufacturing process of bricks includes different stages such as collecting clay, preparing raw materials, moulding, drying, firing, cooling, and storing. Different methods are used to make bricks according to the required size, shape, and quality. Proper manufacturing helps industries produce strong and good quality bricks for construction purposes.

Along with manufacturing, inventory management is also an important part of the brick manufacturing

industry. Inventory management means controlling and maintaining the stock of raw materials, finished bricks, fuel, and other materials used in production. A good inventory management system helps the industry avoid shortage of materials, reduce wastage, control storage costs, and ensure smooth production activities. Modern brick industries use machines, improved kiln systems, and inventory control methods to increase efficiency and productivity. Proper management of manufacturing and inventory activities helps industries improve product quality, reduce delays, and satisfy customer needs. Therefore, manufacturing process and inventory management system are very important for the successful operation of brick manufacturing industries.

A. OBJECTIVES OF THE STUDY

1. To study about the manufacturing process of bricks.
2. To identify the inventory management system used by bricks manufacturing industry.

B. NEED FOR THE STUDY

The brick manufacturing industry plays an important role in the construction sector as bricks are widely used for building houses, buildings, and other structures. Good quality bricks are essential for ensuring strength, durability, and safety of construction. Therefore, maintaining proper production processes and product quality is very important for industry growth and competitiveness.

This study helps to understand the production process followed in Kamath's Tile Works and how different stages of manufacturing affect the quality of bricks. It also helps to identify the level of customer satisfaction towards the company's products in terms of quality, strength, price, and delivery. The study further analyses how efficient production methods and quality control practices influence customer satisfaction, trust, and long-term business performance of the company.

II. REVIEW OF LITERATURE

1. Energy-Efficient Production of Clay Bricks Using Industrial Waste Materials – Alaa A. Shakir, Sivakumar Naganathan and Kamal Nasharuddin bin Mustapha (2013)

This study explained the use of industrial waste materials like fly ash and sewage sludge in brick manufacturing. It showed that these materials reduce energy use, production cost, and pollution while maintaining good brick quality and strength.

2. Traditional Manufacturing of Clay Brick in the Historical Buildings of Diyarbakir (Turkey) – Neslihan Dalkılıç and Adnan Nabikoğlu (2017)

This study explained the traditional method of clay brick manufacturing used in historical buildings. It described stages like clay preparation, hand molding, drying, and firing. The study concluded that traditional brick making is important for preserving historical structures.

3. Manufacturing of Bricks in the Past, in the Present and in the Future: A State-of-the-Art Review – Alaa Shakir and Ali Ahmed Mohammed (2013)

This paper reviewed traditional and modern brick manufacturing methods. It explained that traditional methods cause pollution and high energy use. The study suggested using eco-friendly and sustainable methods for future brick production.

4. Development of Eco-friendly Bricks for Sustainable Construction – Dr. Vishal Puri, Sathyam Kumar, Kushi Grover and Mukul Sharma (2022)

This study explained the production of eco-friendly bricks using waste materials like plastic and polythene. It showed that these bricks help reduce waste and save energy, but some bricks had lower strength than traditional bricks.

5. Environmental Sustainability of Bricks in an Emerging Economy: Current Environmental Hotspots and Mitigation Potentials for the Future – Kamrul Islam, Masaharu Motoshita and Shinsuke Murakami (2023)

This study discussed environmental problems caused by clay brick manufacturing such as pollution, carbon emissions, and land usage. The research suggested

using sustainable and eco-friendly brick production methods to reduce environmental damage.

III. RESEARCH METHODOLOGY

The study is descriptive research to understand the production process and customer satisfaction at Kamath's Tile Works.

a) Sources of Data

Primary Data

Primary data was collected through a structured questionnaire from the customers. Information was collected from respondents regarding customer satisfaction towards product quality, strength, price, delivery performance, and services of the company.

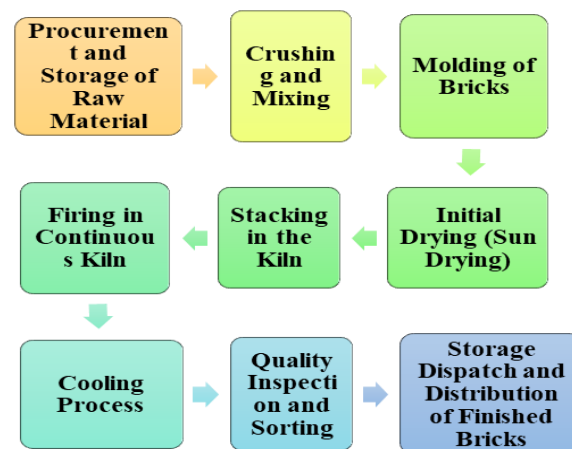
Secondary Data

Secondary data were collected from websites, and previous studies related to the brick manufacturing industry.

b) Statistical Tools Used

Chi-square test

IV MANUFACTURING PROCESS BRICKS



1. Procurement and storage of raw materials

The purchase and storage of raw materials. The brick manufacturing process starts with collecting raw materials like clay, sand, water, and other materials needed for making bricks. The materials are transported by vehicles and machines from nearby locations. Importance of good quality of clay: This is very essential as it will help in making strong and

durable bricks. The materials are collected and then stored appropriately in a safe space that protects them from dirt and moisture. Proper storage also helps avoid shortage of materials during production.

2. Crushing, Mixing

The clay that is stored is then transported to machines, in which large pieces of clay are ground into small pieces. In the process unwanted stones, roots and dust are removed. Some water is then added to the clay, and thoroughly mixed to soften and smooth it. This is known as tempering. Clay which is properly mixed and tempered will be easier to form into the desired shape and has better strength and quality.

3. Moulding of Bricks

In this stage, the prepared clay is shaped into bricks using machines. The clay is passed through the machine and formed into a long rectangular shape. After that, it is cut into standard brick sizes using cutting equipment. Machine moulding helps produce bricks with uniform size, proper shape, and smooth surfaces. This process also improves production speed and helps maintain the quality of the bricks.

4. Initial Drying (Sun Drying)

The wet bricks are then left in the open, in sun, to dry up after moulding. Drying the brick before firing in order to remove the water content from the brick. It is important to dry the bricks properly because if bricks are wet before they are heated, the bricks could crack or break from the heat. Using slow drying decreases change of shape and strength of bricks.

5. Stacking in the Kiln

When dried, the bricks are then carefully stacked within the kiln for burning. These spaces between bricks allow heat to flow equally. They help in adding uniformity of heat to all the bricks during firing with proper stacking and minimise the damage during firing.

6. Firing in Continuous Kiln

The bricks in this stage are heated to extremely high temperatures in a kiln to dry. Changes by heat hardness, strength and durability of bricks. The firing process also removes the remaining moisture in the bricks and giving them better colour and strength. One

of the commonly used methods is by using continuous kilns which are necessary to make large number of bricks in an efficient manner.

7. Cooling Process

After firing, the bricks are allowed to cool slowly inside the kiln. Slow cooling is important because sudden cooling may cause cracks or damage. Proper cooling helps maintain the strength, colour, and quality of the bricks.

8. Quality Inspection and Sorting

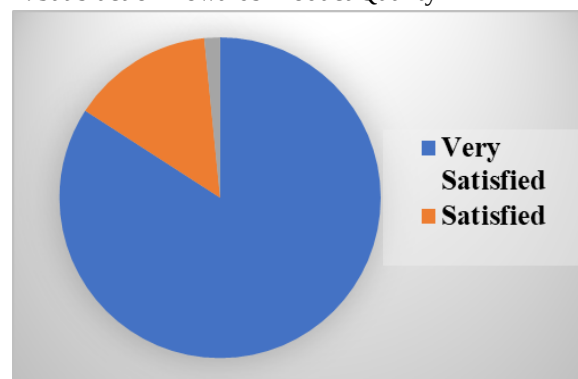
Bricks are carefully examined for their size, shape, colour and strength after their cooling. The broken or damaged bricks are sorted out from good quality bricks. This inspection process contributes to the quality of the product and to customers being supplied with strong and good bricks.

9. Storage, Dispatch and Distribution of Finished Bricks:

Finished bricks are stored and transported safely prior to sale. Good storage ensures bricks are protected from damage and ease of loading. Afterwards, the bricks are put into vehicles and delivered to customers and markets. Delicate handling during transportation minimizes breakage and timely delivery.

V. CUSTOMER SATISFACTION ANALYSIS

1. Satisfaction Towards Product Quality



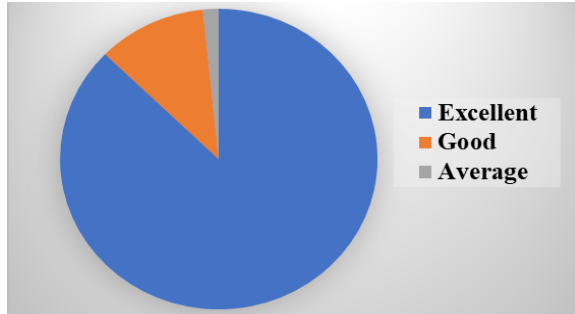
Analysis

The table shows that 84.13% of customers are very satisfied with the quality of bricks, which is the highest response. Around 14.29% of customers are satisfied and only 1.58% rated it as average. This shows a high level of customer satisfaction.

Interpretation

The data indicates that customers are highly satisfied with the quality of bricks provided by the company. The absence of dissatisfaction shows that the company maintains good quality standards and customer trust.

2. Strength and Durability of Clay Bricks



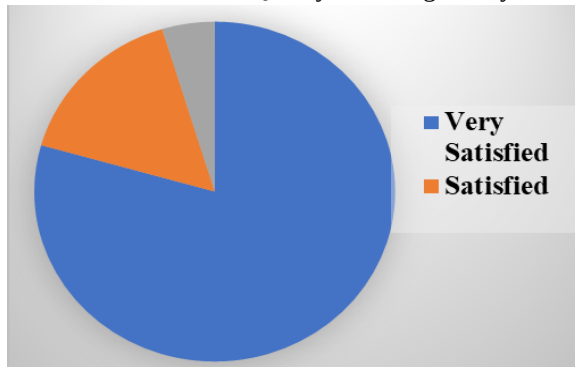
Analysis

The table shows that 87.3% of customers rated the strength and durability of clay bricks as excellent, which is the highest response. Around 11.1% of customers rated it as good and only 1.6% rated it as average. No customers rated it as poor. This indicates a high level of customer satisfaction.

Interpretation

The data indicates that customers are highly satisfied with the strength and durability of the clay bricks. The absence of poor responses shows that the company provides strong and durable bricks with consistent quality standards.

3. Satisfaction of Price Quality Matching of clay bricks



Analysis

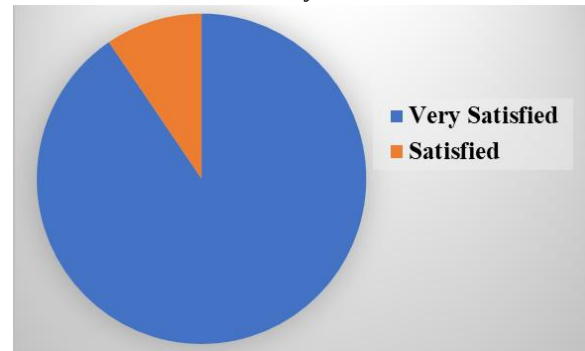
The table shows that 79.4% of customers are very satisfied with the price and quality matching of clay bricks, which is the highest response. Around 15.9% of customers are satisfied and only 4.7% rated it as

average. This shows that most customers are happy with the pricing and product quality.

Interpretation

The findings indicate that customers believe the clay bricks are reasonably priced for the quality offered. The high satisfaction level reflects positive customer opinion towards the company's pricing and product value.

4. Satisfaction with Delivery Time



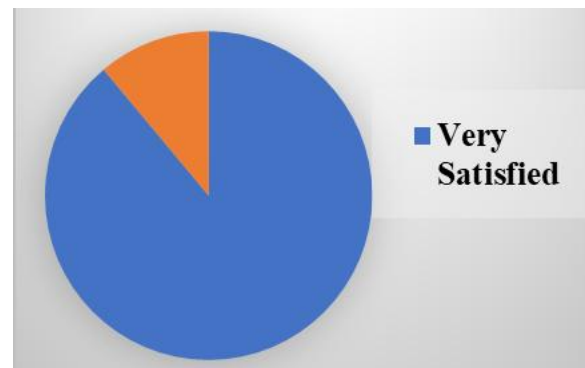
Analysis

The table shows that 90.5% of customers are very satisfied with the delivery time, which is the highest response. Around 9.5% of customers are satisfied with the delivery service. This indicates that the company provides timely delivery to customers.

Interpretation

The findings indicate that customers are happy with the delivery service provided by the company. The high satisfaction level shows that the company is effective in supplying bricks on time and meeting customer expectations.

5. Overall Customer Satisfaction Regarding Quality, Price and Services



Analysis

The table shows that 88.9% of customers are very satisfied with the quality, price, and services of clay bricks, which is the highest response. Around 11.1% of customers are satisfied with the overall performance of the company. This indicates a high level of customer satisfaction.

Interpretation

The findings indicate that customers are highly satisfied with the quality, pricing, and services provided by the company. The high satisfaction level reflects positive customer opinion and confidence towards the company's products and services.

VI. CHI-SQUARE TEST ANALYSIS

The Chi-square test was used to identify the relationship between product quality, price, and services with overall customer satisfaction regarding Kamath's Tile Works. The Chi-square test result shows a value of $\chi^2 = 34.58$ with Degrees of Freedom = 4, and the result is statistically significant as the p-value is less than 0.001 ($p < 0.05$). This indicates that there is a significant relationship between quality, price, and services with customer satisfaction. It shows that customers who are satisfied with the quality, price, and services of bricks are more likely to have overall satisfaction with the company. Overall, the findings suggest that better product quality, reasonable price, and good service lead to higher customer satisfaction and trust.

VII. DISCUSSION

The study shows that the brick manufacturing process in the company is properly planned and carried out in a systematic way. Each stage of production is managed carefully to ensure that good quality bricks are produced. The use of machines and proper working methods helps in improving production speed and maintaining uniform quality. From the customer satisfaction analysis, it is clear that most customers are happy with the quality, strength, price, and delivery of bricks. This shows that the company is able to meet customer needs in a proper way. Customers feel that the products are reliable and worth the price they pay. The Chi-square test also shows that there is a clear relationship between product quality and overall

customer satisfaction. This means that when customers are satisfied with the quality of bricks, they are also satisfied with price and services. Overall, the study shows that good production practices and quality control play an important role in increasing customer satisfaction and trust.

VIII. FINDINGS OF THE STUDY

- The brick manufacturing process is carried out in a systematic and well-organized manner at the company.
- Proper use of machines and controlled production methods help in producing uniform and good quality bricks.
- Most customers are satisfied with the strength, durability, and overall quality of the bricks.
- The company is able to maintain timely delivery, which increases customer trust and satisfaction.
- There is a clear positive relationship between product quality and overall customer satisfaction.

IX. SUGGESTIONS

- The company can further improve production efficiency by upgrading to more advanced and modern machinery.
- Regular monitoring of raw materials should be done to maintain consistent brick quality.
- The company should focus on improving storage and handling methods to reduce material wastage.
- Customer feedback should be collected more frequently to understand changing needs and expectations.
- The company can improve worker training programs to enhance production skills and reduce errors.

X. CONCLUSION

The study concludes that the company follows a well-organized and efficient brick manufacturing process. Proper handling of raw materials, machine usage, and quality checking helps in producing strong and durable bricks. Customer satisfaction analysis shows that most customers are satisfied with the quality, price, strength, and delivery of bricks. This clearly shows that the company is maintaining good standards in

both production and service. The Chi-square result also proves that there is a strong relationship between product quality and customer satisfaction. This means better quality leads to higher satisfaction and trust among customers. Overall, the company is performing well and maintaining good relationships with customers through quality products and services.

REFERENCES

- [1] A. Shakir, S. Naganathan, and K. N. B. Mustapha, "Energy-efficient production of clay bricks using industrial waste materials," *Construction and Building Materials*, vol. 38, pp. 345–353, 2013. doi: 10.1016/j.conbuildmat.2013.07.056.
- [2] N. Dalkılıç and A. Nabikoğlu, "Traditional manufacturing of clay brick in the historical buildings of Diyarbakir (Turkey)," *J. Building Engineering*, vol. 10, pp. 86–94, 2017. doi: 10.1016/j.jobbe.2017.05.004.
- [3] A. Shakir and A. A. Mohammed, "Manufacturing of bricks in the past, present and future: A state-of-the-art review," *Construction and Building Materials*, 2013. [Online]. Available: <https://www.sciencedirect.com/>
- [4] V. Puri, S. Kumar, K. Grover, and M. Sharma, "Development of eco-friendly bricks for sustainable construction," *Materials Today: Proceedings*, 2022. [Online]. Available: <https://www.sciencedirect.com/>
- [5] K. Islam, M. Motoshita, and S. Murakami, "Environmental sustainability of bricks in an emerging economy: Current environmental hotspots and mitigation potentials for the future," *J. Cleaner Production*, 2023. doi: 10.1016/j.jclepro.2023.
- [6] Encyclopaedia Britannica, "Brick (building material) – properties, types and uses," 2024. [Online]. Available: <https://www.britannica.com/technology/brick>
- [7] The Constructor, "Brick manufacturing process and uses in construction," 2023. [Online]. Available: <https://www.theconstructor.org/building/brick-manufacturing-process/>