

# LEAN TECHNIQUES IN A VEGETABLE OIL REFINERY FOR SUSTAINABLE PRODUCTION

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## 1 INTRODUCTION

Lean manufacturing has emerged as a pivotal strategy for enhancing production efficiency and competitiveness in various industries. Originating from Toyota's production system, Lean techniques focus on waste reduction, process optimization, and continuous improvement. This paper explores the application of Lean techniques in the vegetable oil refinery plant of ALIA Golestan Company, Iran. The study aims to assess the feasibility of Lean implementation, identify areas for improvement, and evaluate the impact on production efficiency, capacity, and waste reduction. The research is particularly relevant given the limited literature on Lean applications in the vegetable oil industry, offering valuable insights for future improvements in the sector.

## 2 MATERIAL AND METHODS

The study was conducted at ALIA Golestan Company's vegetable oil refinery plant, which faced inefficiencies due to outdated technology, manual processes, and a lack of Lean practices. The research employed a combination of Lean tools, including Value Stream Mapping (VSM), 5S, Kaizen events, JIDOKA, and Poka-Yoke, to identify and eliminate waste. A break-even analysis was conducted to evaluate the financial impact of Lean implementation over three years before and one year after the project. Key Performance Indicators (KPIs) such as scrap rate, yield rate, cycle time, and production capacity were used to measure operational efficiency. The project also involved upgrading equipment, including the replacement of old centrifuges with modern GEA units, and implementing automation to reduce manual intervention.

## 3 RESULTS

Implementing Lean techniques led to significant improvements in operational and financial performance. Production capacity increased by 900%, from 666,660 litres per month to 6,666,660 litres per month. The scrap rate decreased by 63.85%, while the yield rate improved by 13.17%. Cycle time was reduced by 80%, enhancing the plant's ability to meet customer demand efficiently. Financially, the project resulted in an 1,189% increase in profit and an 850% increase in revenue, despite a 5% reduction in the price per litre of oil. Variable costs per litre decreased by 3%, contributing to overall cost efficiency. The break-even analysis confirmed the project's financial sustainability, with a significant reduction in the critical production quantity required to cover costs.

## 4 CONCLUSIONS

The study demonstrates the transformative potential of Lean techniques in the vegetable oil refinery industry. By implementing Lean tools such as 5S, Kaizen, and VSM, ALIA Golestan Company achieved remarkable improvements in production efficiency, waste reduction, and financial performance. The project highlights the importance of continuous improvement, equipment modernization, and employee engagement in driving operational excellence. Future recommendations include investing in employee training, enhancing supplier collaboration, and adopting data analytics for further optimization. The findings underscore the applicability of Lean principles in the vegetable oil industry, offering a framework for other companies seeking to improve their production processes and competitiveness.

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