



Author: Alberto L. Morfi Pagán  
 Advisor: Carlos González, Ph.D.  
 Department: Industrial and Systems Engineering

## Abstract

This abstract provides an overview of optimization strategies using Lean Manufacturing and DMAIC methodology to improve the production and delivery process of food trucks. Key factors for enhancing efficiency and profitability include a standardized menu, quality equipment, optimized layout, streamlined ordering process, and data-driven decision-making. Implementing these strategies helps identify and eliminate waste, reduce errors, and increase customer satisfaction. By optimizing the production and delivery process, food truck owners can meet customer needs, minimize waste, maximize efficiency, and achieve greater profitability in the competitive food truck industry.

## Introduction

Food trucks are a popular and growing trend in the food industry. However, the production and delivery process of a food truck can be complex and challenging. Optimization design strategies can help food truck owners improve the efficiency, profitability, and customer satisfaction of their businesses. Some key optimization design strategies include using a standardized menu, quality equipment, an optimized layout, a streamlined ordering process, and data-driven decision-making. By implementing these strategies, food truck owners can improve their chances of success in the competitive food industry.

## Background

This research study aims to contribute significantly to the understanding of food truck businesses in the food industry. It will explore and evaluate optimization design strategies, identifying challenges and opportunities for these businesses. The study will also investigate the implementation of Lean Manufacturing and DMAIC methodology in the food industry and assess their impact on waste reduction, error prevention, and service quality improvement. Furthermore, the research will provide recommendations and best practices for food truck businesses to enhance efficiency, profitability, and competitiveness while offering a superior and convenient dining experience to customers. The study's findings will be valuable to policymakers, entrepreneurs, and investors in the food industry, offering insights into the challenges and opportunities of food truck businesses and strategies to improve their performance.

## Problem

Food truck businesses face challenges in maintaining profitability and efficiency due to a lack of optimization design strategies and standardized approaches. This can lead to waste, errors, customer dissatisfaction, and decreased profitability. The competitive nature of the industry necessitates continuous improvement and innovation. Therefore, there is a crucial need for optimization design strategies and methodologies to enhance food truck production and delivery processes, ultimately increasing profitability and success in the market.

## Methodology

The project methodology focuses on enhancing the efficiency and profitability of food truck businesses. The process involves defining the problem, reviewing relevant literature, designing the research, collecting and analyzing data, making recommendations, and reporting findings. Data will be gathered from primary and secondary sources, and qualitative as well as statistical analysis will be conducted to draw conclusions. The methodology follows a structured approach consisting of several key steps. Firstly, the problem or opportunity for improvement is defined, along with establishing project goals and objectives and identifying stakeholders and customers affected by the process. Then, data is collected and measured to establish a baseline and understand the root cause of the problem. Statistical analysis techniques and various tools are employed to analyze the data and identify contributing factors. Subsequently, solutions are developed and implemented to improve the process, with different alternatives tested to determine effectiveness. Finally, controls are established to sustain the improvements over time, including standard operating procedures, employee training, and ongoing monitoring of the process to ensure the goals and objectives are met.

## Results and Discussion

The DMAIC methodology was applied in the project, and the results obtained are discussed as follows. In the Define phase, the Project Charter and a Process Map were utilized to establish the problem statement, goals, and measurable objectives of the project. Table 1 presents the information from the Project Charter, while Figure 2 depicts the Process Map. The Measure phase involved conducting a SIPOC analysis and using a VOC tool to identify customer requirements and understand process inputs and outputs (refer to Table 2). The analysis allowed for identifying areas of improvement in meeting customer expectations, emphasizing quick service, fresh food, and short wait times. Additionally, Table 3 highlights other customer priorities such as easy ordering, menu variety, and cleanliness. Moving on to the Analyze phase, a fishbone diagram was employed to identify root causes of inefficiencies, encompassing categories like People, Processes, Technology, and Environment (see Figure 3). In the Improve phase, Kaizen Events and various techniques were used to address specific issues, including streamlining production and delivery processes, reducing waste, and improving customer satisfaction and inventory management. Lastly, the Control phase focused on establishing metrics and control measures to sustain the improvements made. Control metrics encompassed customer satisfaction, food quality, delivery time, and inventory management, with regular monitoring and corrective action to ensure adherence to established metrics. By following this approach, the project aimed to maintain the enhanced efficiency and effectiveness of the food truck process.

Table 1

Project Charter	
<b>Project:</b>	<b>Optimization Design in the Production and Delivery Process of a Food Truck</b>
<b>Business Case:</b>	By implementing an optimization design strategy, food truck businesses can increase their efficiency, reduce waste, and improve their profitability. The project's results and recommendations will provide valuable insights for food truck business owners, policymakers, entrepreneurs, and investors in the food industry.
<b>Problem Statement:</b>	Despite the growing popularity and profitability of food trucks in the food industry, many food truck businesses struggle to maintain a consistent level of efficiency and customer satisfaction due to challenges such as inefficient equipment and layout, lack of standardized menu, and a disjointed ordering process. These challenges can result in increased waste, lower profits, and decreased customer loyalty.
<b>Goal:</b>	To optimize the production and delivery process of a food truck through the implementation of Lean Manufacturing and DMAIC methodology, in order to enhance the efficiency, profitability, and customer satisfaction of the business.
<b>Project Scope:</b>	This project will focus on the optimization of the production and delivery process of a food truck by implementing Lean Manufacturing and DMAIC methodology. The scope of the project will include the analysis of the current process, identification of areas of improvement, and the implementation of optimization design strategies such as a standardized menu, quality equipment, optimized layout, streamlined ordering process, and data-driven decision-making.

Figure 1

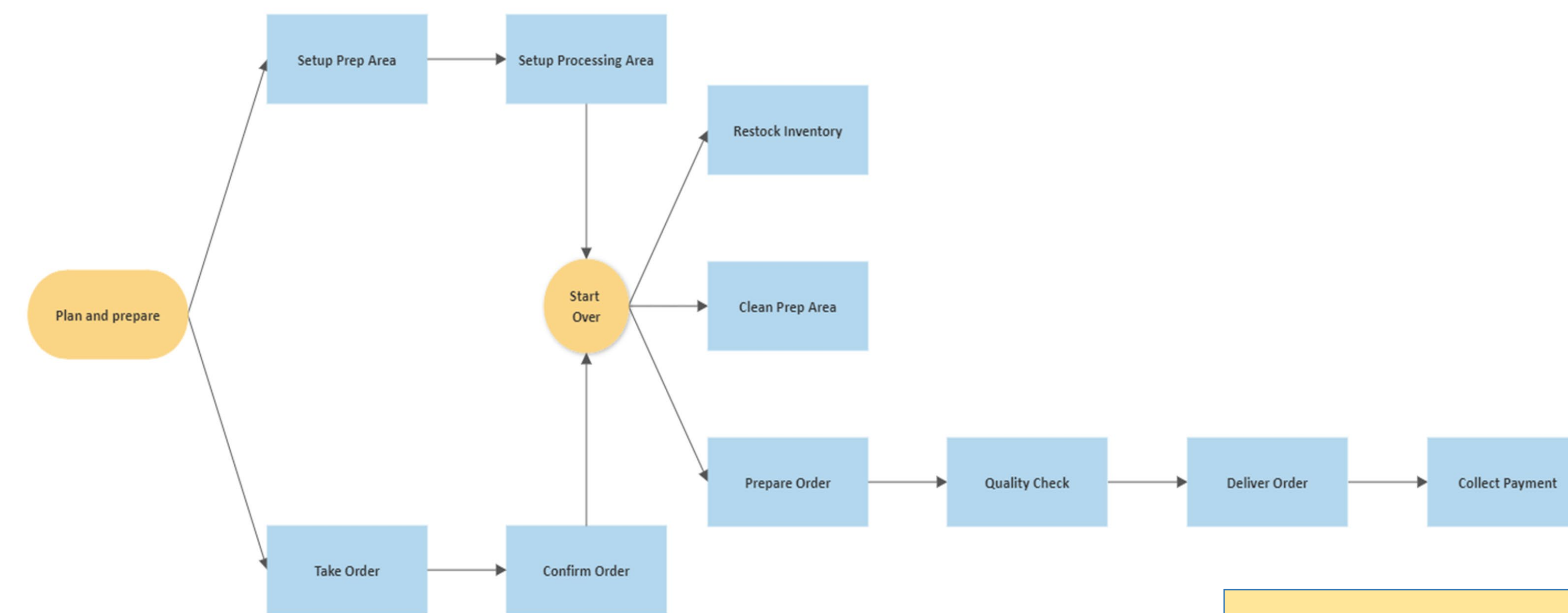


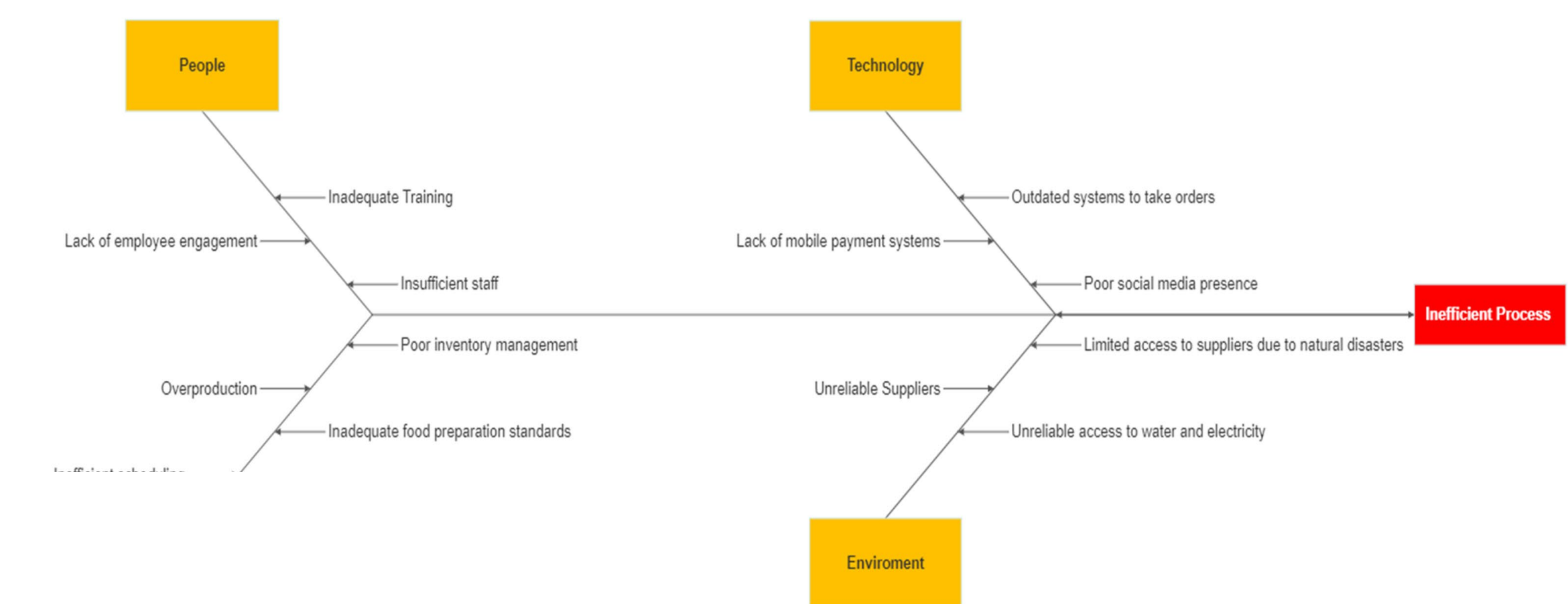
Table 2

Suppliers	Inputs	Processes	Outputs	Customers
Local Farmers and Producers	Fresh Ingredients	Plan menu and order ingredients	Freshly prepared food items	Individuals and group of people who are hungry and want to try local food in a different concept.
Food Distributors	Non-perishable goods	Set up the food truck and equipment	Satisfied customers	Local workers who want a quick and convenient lunch
Equipment Manufacturers	Kitchen Equipment	Take orders from customers - Online and On-Site	Revenue from sale	Tourists who want to try local food while exploring the city
	Food Packaging and Disposals	Check food quality	Waste from unused ingredients and packaging	
	Labor	Deliver food		
		Collect Payment		
		Clean up equipment and prep area		
		Restock Inventory		

Table 3

Customer	Needs and Requirements	Importance
Local Customers	Quick and effective service	High
Online Customers	Fresh and high-quality food	High
Tourists	Short wait time	High
	Easy ordering and payment process	Low
	Menu variety and options	Medium
	Clean and hygienic food truck	Medium
	Reasonable prices	High

Figure 2



## Conclusions

In conclusion, the optimization design project in the production and delivery process of a food truck was a success thanks to the implementation of various DMAIC tools and methodologies. The project team used a Voice of Customer (VOC) analysis to understand the needs and expectations of customers, and a SIPOC diagram to map out the entire process. A Fishbone diagram was also used to identify root causes of issues, and Kaizen events were implemented to optimize the process. As a result of these efforts, the food truck production and delivery processes were significantly improved, with faster delivery times, higher quality food, and improved customer satisfaction. Moreover, the process is being continuously monitored and controlled, ensuring that any deviations are addressed, and the process remains optimized. By using DMAIC methodologies and tools, the project team was able to not only identify and address process improvement opportunities but also to sustain the improvements made over time. The success of this project is a testament to the power of the DMAIC methodology and its ability to drive continuous improvement and operational excellence.

## References

- [1] Liker, J. K. (2004). The Toyota way: 14 management principles from the world's greatest manufacturer. McGraw-Hill Professional.
- [2] Womack, J. P., & Jones, D. T. (1996). Lean thinking: Banish waste and create wealth in your corporation. Simon and Schuster
- [3] Radziwon, A., & Bogers, M. (2013). Lean startup and the business model: Experimenting for novel customer value. Journal of Engineering and Technology Management, 30(1), 1-22.