
# Lean Thinking implementation in the automotive after-sales sector

Master degree in Automotive Engineering

João Jorge Comba da Silva

Leiria, march of 2025


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Dissertation under the supervision of Professor Marcelo Rudolfo Calvete Gaspar and Professor Luís Manuel Ventura Serrano

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# Originality and Copyright

This dissertation report is original, made only for this purpose, and all authors whose studies and publications were used to complete it are duly acknowledged.

# Resumo

A presente dissertação explora a aplicação dos princípios do Lean Thinking no setor de pós-venda automóvel, com especial enfoque no mapeamento do fluxo de valor (Value Stream Mapping - VSM) como ferramenta para identificar ineficiências e propor melhorias nos processos. O estudo foi conduzido através de um estudo de caso qualitativo realizado numa organização automóvel autorizada, recorrendo a uma metodologia de observador-participante, a entrevistas informais e ainda a análise documental para recolher dados empíricos sobre os processos de serviço existentes. Este estudo analisa o fluxo de valor no estado atual, mapeando cada etapa do processo de serviço de pós-venda, desde a marcação do serviço pelo cliente até ao acompanhamento pós-venda. O mapa do fluxo de valor no estado atual revelou várias ineficiências, incluindo redundância no tratamento de dados, atrasos na confirmação da disponibilidade de peças, aplicação inconsistente do processo de receção ativa e um fluxo de informação fragmentado entre departamentos. Com base nestas constatações, foi proposto um mapa de fluxo de valor do estado futuro, concebido para otimizar as operações, reduzir desperdícios e aumentar o valor percebido pelo cliente. As principais recomendações incluíram a integração dos sistemas de informação, a padronização dos procedimentos de receção e controlo de qualidade, a melhoria na gestão de peças e a redistribuição de tarefas não essenciais para pessoal de apoio. O estudo permitiu concluir que a aplicação dos princípios Lean neste contexto pode melhorar significativamente a qualidade do serviço e o desempenho operacional, oferecendo perspetivas práticas e aplicadas para organizações que pretendam otimizar as suas operações de pós-venda automóvel.

**Palavras-chave:** Lean Thinking, muda, valor, fluxo de valor.

# Abstract

This dissertation explores the application of Lean Thinking principles in the automotive after-sales sector, with a particular focus on Value Stream Mapping as a tool for identifying inefficiencies and proposing process improvements. The study was conducted through a qualitative case study in an authorized automotive workshop, employing participant observation, informal interviews, and document analysis to gather empirical data on existing service processes. The research analyzes the current state value stream, mapping each stage of the after-sales service process, from customer booking to post-service follow-up. The current state Value Stream Map revealed several inefficiencies, including redundant data handling, delays in parts availability confirmation, inconsistent application of active reception, and fragmented information flow between departments. Based on these findings, the study proposed a future state Value Stream Map designed to streamline operations, reduce waste, and enhance customer value. Key recommendations included the integration of information systems, standardization of reception and quality control procedures, improved parts management, and the reassignment of non-core tasks to support staff. The proposed improvements aimed to enhance operational efficiency, increase technician productivity, and improve overall customer satisfaction and loyalty. The study concluded that applying Lean principles in this environment can significantly enhance service quality and operational performance, offering practical insights for organizations seeking to optimize their after-sales service operations.

**Keywords:** Lean Thinking, *muda*, value, value stream, flow.

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# List of Abbreviations and Acronyms

| | |
|---|---|
| DMS | Dealer Management System |
| FRFT | Fixed Right First Time |
| KPI | Key Performance Index |
| LT | Lean Thinking |
| SO | Service Order |
| VSM | Value Stream Mapping |

# 1. Introduction

This work aims at creating a Lean Thinking implementation guide for the automotive after-sales industry, as so, all the work has been done under a universal analysis, regardless of any specific manufacturer or brand as they have different operational standards and mandatory procedures to be performed during a costumer visit.

## 1.1. Background and context

Lean Thinking is a management method introduced by Toyota after World War II and it's based on 5 main principles that will be approached later, the main goal is to increase product or service quality, costumers' satisfaction and perceived value while eliminating all kinds of waste, in other words, it aims to create a system or process as efficient as possible, doing more with less.

As mentioned by James P. Womack and Daniel T. Jones in their book "Lean Thinking: Banish Waste and Create Wealth in Your Corporation", that has been a huge inspiration for this work, on a LT approach the main word that should always be on managers mind is muda, the Japanese word for waste that refers to any human activity which absorbs resources but creates no value.

Although Lean Thinking is originated from the automobile manufacturing industry, this approach has been extended to numerous industries such as banking, mining, public service, hotel, and health care (Thangarajoo, 2015), which means that there was a transformation process from Lean Manufacturing to Lean Services and ultimately to Lean Enterprises (Womack & Jones, 2003).

Lean thinking is still present on the automotive manufacturing industry and has grown on the after-sales service, as manufacturers' service quality systems have gained more relevance, they are a great example of LT presence on today's market and its permanence in the future.

The systems' focus is to increase service quality and value by determine operational standards and workflows, defining all the mandatory tasks to be performed and promoting a

standard customer experience regardless of the visited repairer. This quality policies usually include a bonus program based on KPI's calculated from the customers' satisfaction surveys, which means based on customers' perceived value, those bonus programs are extremely relevant for the organization profitability.

Although these activities are mandatory, manufacturers still give some freedom to the organizations on the way they're performed, as so, after-sales managers have an extremely important role on finding the most effective and efficient way to achieve customer satisfaction and perceived value for maximum customer retain and ensure the organization future, while complying with those standards and keeping a good relationship with the manufacturers and importers. LT is a great solution to achieve all this goals with the least effort and resources' waste, in a market where the service industry is struggling for better quality and costs reduction (Bonaccorsi et al., 2011).

## 1.2. Motivation and goals

Over the last two years, I have taken on the role of quality manager and engineer at a multi-brand dealership, focusing on service quality, both in the sales and after-sales sectors, seeking to improve the customer experience throughout the company processes, which I believe is a key point to guarantee the future of a company and that customers whose expectations are exceeded, with a differentiated customer experience, will be our best marketing agents.

This position allowed me to continuously analyze the various customer satisfaction KPIs both internal and the ones from all the different manufacturers represented, allowing me to understand patterns, the strengths and weaknesses of the provided service and consequently seek solutions to improve service quality. Combined with this role and my future intentions to work as an after-sales manager led me to seek knowledge in management that would help me achieve those goals. That is when the Lean ideology emerged, focused on the concept of value and its definition from the customer's perspective as well as the continuous improvement of processes, which perfectly fit with my way of thinking.

This work proposes to create a Lean Thinking guide specific for the automotive after-sales service, that can guide myself and future after-sales managers to understand and implement LT approaches. To do so, there will be firstly reviewed the 5 LT principles and

the way they can be related to the automotive after-sales service, including value definition on a customer perspective based on survey comments, identification and analysis of all activities related to a customer visit on an LT and universal perspective independent of manufacturer or importer, inventory management methods aiming for customer satisfaction and organization rentability. Finally, it will be introduced an LT solution for the current processes regarding a type of waste identified on my last almost two years working in the industry.

The chose of this work subject had the purpose of challenging and preparing myself for managing an after-sales service organization, it was intended to mainly integrate and bring the last almost two years of my personal working experience on the automotive after-sales industry into this project.

The ultimate goal would be, not only to do an overview or review over the Lean Thinking philosophy, but to be able to achieve these personal goals and add something, different ideas and perspectives by looking from the inside of the industry and try to see the bigger picture, learning the principles and then identify some waste or muda and search for better solutions to improve the current processes, forcing myself to start looking at processes differently, to be a keen observer and Creative.

## 1.3.Structure

In the scope of this dissertation, in addition to this introductory chapter, the second chapter presents the literature review. This chapter explores topics directly and indirectly related to Lean Thinking and its application in the automotive after-sales sector.

Chapter three describes the methodology adopted in the development of the project. This includes the characterization of the operational environment in which the study was conducted, as well as the description of the processes and activities observed within the selected automotive after-sales service organization.

In chapter four, the focus is placed on the analysis of results obtained during the application of Lean Thinking methodologies in the case study. The chapter provides a detailed presentation of the current state VSM, the identification of value-added and non-value-added activities, and the formulation of operational improvement proposals. The

proposed future state VSM is also introduced, offering a redesigned process flow aimed at enhancing service efficiency, reducing waste, and increasing customer satisfaction.

Lastly, chapter five presents a critical reflection on the main outcomes of the project, drawing conclusions regarding the effectiveness and efficiency of the Lean approach applied in the automotive after-sales context, that is followed by the main conclusions section.

# 2. Literature Review

This chapter presents a review of the literature on Lean Thinking and its evolution, with a particular focus on its application in the automotive after-sales sector. It begins by introducing the origins and principles of Lean Thinking, highlighting its foundations in quality management and its core focus on waste reduction and value creation.

The chapter then explores the shift from Lean Manufacturing to Lean Services, examining how Lean principles have been adapted to meet the challenges of service environments. Special attention is given to the implementation of Lean practices in the automotive after-sales context, including the use of tools such as Value Stream Mapping (VSM), Kaizen, standardization, and visual management.

Finally, the literature review discusses how customer value is defined and addressed within Lean frameworks, particularly in service-based operations, to support continuous improvement and customer satisfaction.

## 2.1. Introduction to Lean Thinking

Lean Thinking originated from the Toyota Production System (TPS) and has since evolved into a globally recognized methodology for improving operational efficiency and enhancing customer satisfaction across a wide range of sectors (Ohno & Bodek, 2019). Grounded in the early quality management philosophies of W. Edwards Deming, Lean Thinking emphasizes the elimination of waste (muda) and the maximization of customer value. Its core objective is to reorient organizational focus towards processes that directly contribute to the end user's needs, fostering a mindset of continuous improvement and value delivery (Lyons et al., 2013; Smith A, 2015).

The methodology is built upon several key tools and techniques, including Value Stream Mapping (VSM), 5S, Kaizen, and Just-In-Time (JIT) production. These tools enable organizations to visualize their processes, identify bottlenecks, reduce cycle times, and remove non-value-adding activities. Central to Lean Thinking is the concept of flow—ensuring that every step in a process contributes meaningfully to the final product or servisse (Haque & James-moore, 2004; Hines et al., 2004). By optimizing flow, organizations can

enhance responsiveness and streamline their operations without compromising quality or customer experience.

Beyond operational benefits, Lean Thinking promotes a culture of employee empowerment and engagement. It encourages participation from all levels of the organization, valuing frontline insights and collaborative problem-solving. This inclusive approach not only improves process outcomes but also strengthens organizational cohesion, accountability, and innovation capacity. As employees become actively involved in shaping improvements, they contribute more meaningfully to long-term performance gains (Amaro et al., 2020, 2021).

While Lean Thinking has its roots in manufacturing, its principles have been successfully adapted to various service-oriented sectors, including healthcare, education, and automotive after-sales operations. The ability to tailor Lean to different contexts highlights its versatility and enduring relevance. In an increasingly dynamic and competitive global market, Lean provides organizations with the tools to remain agile, efficient, and customer-focused. Its adoption continues to shape the evolution of operational excellence, making it a critical framework for sustainable organizational development (Bonaccorsi et al., 2011; Julião & Gaspar, 2021).

## 2.2. Evolution from Lean Manufacturing to Lean Services

Lean Thinking, originally developed for industrial manufacturing was designed to reduce waste (muda), improve productivity, and enhance process efficiency (Ohno & Bodek, 2019). As non-manufacturing sectors began to face similar operational challenges, the potential for applying Lean principles to services became evident. The shift toward Lean Services required a rethinking of how value and flow are perceived, given the intangible, customer-facing, and highly variable nature of service delivery (Gupta et al., 2016). Despite these differences, the core Lean principles—defining value, mapping the value stream, creating flow, establishing pull, and striving for perfection—proved adaptable and effective in service contexts (Dahlgaard et al., 2013).

The adaptation of Lean Thinking to automotive after-sales services is particularly relevant due to the process complexities and customer-centric nature of this sector. After-sales operations include diagnostics, routine maintenance, repairs, and follow-up, all of which are prone to inefficiencies such as long wait times, variability in service quality, and

underutilization of resources. These inefficiencies negatively affect customer satisfaction and brand loyalty. Lean implementation in this context aims to address these pain points by improving workflow design, standardizing procedures, enhancing interdepartmental communication, and aligning service delivery with customer expectations (Abu Bakar et al., 2015; Bhasin, 2012).

Beyond automotive, Lean Thinking has been widely adopted in sectors such as healthcare, finance, and public services, where it is used to reduce service delivery delays and increase operational responsiveness (Abu Bakar et al., 2015; Hines et al., 2004). The successful application of Lean in these areas highlights its versatility and robustness. In the after-sales service environment, Lean also fosters a culture of continuous improvement by empowering frontline employees to participate in decision-making and problem-solving processes. This not only strengthens engagement and accountability but also supports long-term performance and service excellence, contributing to a more agile and customer-responsive organizational culture.

## 2.3.Lean in the Automotive After-Sales Sector

Recently, academic research and industrial practice have focused on Lean principles in automotive after-sales (Arlinghaus & Knizkov, 2020; Dombrowski & Malorny, 2016, 2018; Rudnick et al., 2020). Efficiency and customer satisfaction are more important than ever as the automotive industry evolves and faces new challenges. Several studies and case studies have shown that Lean tools and approaches work in car dealerships, workshops, and technical services. These initiatives optimize procedures, minimize waste, and improve customer satisfaction.

A dedicated case study by Rother and Shook (2003) showed how a specific automobile dealership used Lean principles to minimize service lead times and improve customer satisfaction. Standardized work practices and Value Stream Mapping (VSM) were used. The dealership visually mapped the service process to identify bottlenecks and waste, allowing them to implement targeted modifications that improved service delivery and customer satisfaction.

Key success elements in Lean after-sales deployment are essential for success (Kim et al., 2007). Strong leadership is a key driver. Leaders that are committed to Lean can inspire their teams to change. Additionally, employee involvement matters. Involving all employees

in the Lean journey encourages ownership and accountability, not simply top-down commands. Finally, promoting ongoing progress is crucial. Everyone in this culture strives to improve procedures and reduce waste.

Organisations sometimes struggle to implement Lean in after-sales. Change might be difficult for employees who are used to the old way. Insufficient training can worsen this issue because staff may not comprehend or apply Lean principles (Ruffa, 2008). Staff misunderstanding of Lean ideas can also cause dissatisfaction and poor implementation. These obstacles highlight the necessity of creating a supportive corporate culture that promotes Lean and provides the training and resources needed to implement it in automotive after-sales. Such issues and impediments can be addressed to expedite and optimize the after-sales process, improving customer happiness and loyalty. Lean principles in automobile after-sales will certainly remain important for organizations looking to stand out in a competitive market.

## 2.4. Value Stream Mapping

VSM in Lean Context Lean methodology relies on Value Stream Mapping (VSM) to visualise and analyse material and information flow throughout an organisation's activities (Basu & K. Dan, 2014; Seth et al., 2017). VSM identifies process activities and categorizes them into three groups: value-added activities, which directly meet customer needs; non-value-added but necessary activities, which are necessary for the process but do not add customer value; and avoidable and wasteful activities (Cavdur et al., 2019).

This classification is essential for organisations attempting to improve efficiency, minimize waste, and streamline operations Rother and Shook (2003). VSM begins by mapping the current state of a process, which shows how work is done. This initial mapping shows material flow, operation order, and information transfer. After assessing the situation, the following step is to identify waste—non-value-added operations that can be removed or reduced. This study reveals areas for improvement that can boost process efficiency and effectiveness.

Careful study of flow optimization and customer value delivery informs future state design. This future state mapping shows how organizations envisage a more efficient and productive process. Standard symbols and notations are used in VSM to clearly express process elements. Inventory levels, cycle times, bottlenecks, and information flow are

shown. This visual depiction helps with analysis and communication with stakeholders at all levels of the organisation.

VSM can help teams identify inefficiencies and create targeted improvement plans by deepening their understanding of processes (Pereira Librelato et al., 2014). By visualizing VSM, firms may improve stakeholder understanding of their processes and make mapping easier. Engagement is essential for collaboration and improvement conversations. VSM is both an analysis tool and a catalyst for organizational improvement and innovation. As teams assess their value streams, they foster a culture of continuous improvement and excellence, improving customer satisfaction and market position.

## 2.5.Defining Value from the Customer's Perspective

Understanding client value is essential in any service-oriented setting, especially in businesses where customer service is fundamental. Recognizing this perspective requires assessing customer happiness and loyalty using several techniques and methods. These include customer satisfaction surveys, which collect quantitative data directly from customers, and the Net Promoter Score (NPS), which measures customer referrals (Fisher & Kordupleski, 2019; Maubisson et al., 2024).

Qualitative feedback tools like open-ended survey questions and focus groups can also help organisations understand consumer value and service views (Kumar & Reinartz, 2016). After analyzing this data, companies may better understand how customers view their services and what they expect, allowing them to better meet customer needs. Enhancing service efficacy requires tying these consumer insights to First Response Fix Time (FRFT).

Customer service requires rapid and effective problem-solving, which FRFT promotes. Effective after-sales care boosts client loyalty. Quick and satisfactory problem resolution keeps customers loyal to a company, leading to repeat business and positive word-of-mouth referrals. This emphasizes the importance of customer-centric Lean initiatives for automobile service providers and other service-oriented businesses (Homburg et al., 2015).

Organizations can improve service quality and gain a competitive edge by focusing on customer value, especially in the after-sales automobile sector, where customer loyalty is fiercely disputed. Understanding and acting on customer insights can improve service

strategies for both the company and its customers, encouraging long-term partnerships and corporate success.

## 2.6. Continuous improvement

A variety of Lean methods and concepts optimize after-sales operations in the ever-changing automotive industry, improving productivity and customer satisfaction (Gaiardelli et al., 2007; Rudnick et al., 2020). In this context, the "5 Whys" method for root cause analysis can be used, as it allows teams to examine and find the root causes of challenges, enabling a complete grasp of the situation. Asking "why" five times helps teams dig deeper into a problem and produce effective and sustainable solutions that address the root causes rather than just the symptoms.

Standardized work is another essential Lean tool (Bragança & Costa, 2015). It provides an organized and consistent framework for after-sales tasks. Standardizing processes reduces service quality variability, ensuring every client experience meets a standard. This uniformity improves service quality and streamlines operations, making it easier for staff to work.

Also, as key Lean tools, visual management strategies use dashboards and performance boards to monitor KPIs in real time, complementing Lean Technologies (Eaidgah et al., 2016). Team members may readily assess progress and identify problem areas using such visual tools, fostering transparency and accountability. Hence, visual management can increase team engagement and productivity by clarifying objectives and encouraging proactive problem-solving.

Kaizen, which means continuous improvement, is also a key part of Lean tool. It is based on the idea that small, regular improvements made by everyone in the organization can lead to better processes, less waste, and more value for the customer (Colenso, 2000). This idea promotes continuous improvement, process optimization, and waste elimination. Kaizen can improve service quality and customer happiness in after-sales operations, where customer expectations are rising. Therefore, simple, continuing changes can improve operational efficiency and service performance. Thus, deliberate use of Lean methods and concepts in automobile after-sales operations is helpful and necessary for competitive firms.

Finally, it must be highlighted that automotive companies can improve after-sales performance and customer satisfaction by focusing on root cause analysis, standardizing processes, using visual management, and embracing a culture of continuous improvement.

# 3. Methodology

This chapter describes the methodological approach undertaken to collect data from customers and to identify and analyze the value stream within an automotive after-sales service environment.

## 3.1. Survey on defining value from the customer's perspective

Data collection was carried out over approximately one year through an analysis of customer satisfaction surveys from after-sales services. These surveys included both closed-ended questions, which allowed for the quantification of specific aspects of the customer experience, and open-ended questions, which provided deeper qualitative insights. The latter were particularly useful in identifying key expressions that customers associated with positive and negative aspects of the service, such as: "vehicle cleaning", "staff friendliness", "the receptionist was very helpful", "the vehicle had to return to the workshop", "fantastic facilities", "there were no parking spots available", or "the vehicle was in the workshop for an entire week".

The data analysis distinguished between positive and negative comments, helping to identify both the strengths of the organization and areas requiring improvement for an effective Lean Thinking implementation. To achieve this, customer feedback and complaints were categorized into different service dimensions, allowing for both quantitative and qualitative assessment. The identified categories included:

i) Ease of service booking
ii) Reception experience
iii) First Right Fix (FRFT – resolving the issue on the first attempt)
iv) Information provided during service
v) Service time
vi) Price
vii) Vehicle cleaning
viii) Vehicle delivery
ix) Parts availability
x) Follow-up after service

xi) Product quality

Although some of these categories can be linked between each other or can be classified into more comprehensive categories, per example, ease of service booking, reception, information during service, delivery and follow up can all be added up into a Costumer Service Category, or Parts Availability and Service Time could also be joined once most of the time their correlated, but this kind of categories would not lead to a full understanding over the organization weaknesses and strengths on customers perspective.

This classification systems allows, not only to understand the most valued aspects of the automotive after-sales service, within a specific market, but also to understand what are the main processes that need to be reviewed first.

## 3.2.Collecting data to identify the value stream of the company

To collect data to identify the company's value stream was a qualitative, exploratory case study approach. The data collection was conducted over three months in an authorized automotive workshop, where the researcher adopted the role of an observatory participant. This immersive approach allowed for direct observation and engagement in the daily operations of the after-sales process, ensuring a detailed understanding of workflows, information flows, customer interactions, and employee practices.

As an observatory participant, the researcher maintained a balanced position between observation and limited participation. This role facilitated trust-building with staff and provided access to informal conversations and insights that might otherwise have been inaccessible. Observations covered the entire customer service journey, including booking, vehicle reception, technical intervention, quality control, delivery, and follow-up. Field notes were recorded systematically, capturing the sequence of tasks, waiting times, communication flows, and moments of inefficiency.

To complement the observational data, informal interviews were conducted with service advisors, workshop managers, technicians, and parts department staff. These conversations aimed to clarify specific processes, understand decision-making rationales, and capture the staff's perceptions of operational constraints and opportunities for improvement. Additionally, key documents such as manufacturer service manuals, standard operating

procedures, customer feedback reports, and Net Promoter Score results were analyzed to compare the prescribed processes with actual practices.

The data collected were transcribed and organized thematically, focusing on value-added activities, necessary but non-value-added activities, and unnecessary waste. This classification guided the creation of a detailed current state VSM, which highlighted inefficiencies, bottlenecks, and areas of rework. Root cause analysis techniques, including the 5 Whys method, were applied to investigate the underlying reasons for observed inefficiencies. Based on these findings, a future state Value Stream Map was developed, proposing process improvements aimed at reducing waste and enhancing customer value.

Throughout the research, data triangulation was used to validate findings by cross-referencing observations, interviews, and documentation. Feedback sessions with management and frontline staff ensured that the findings were accurate, feasible, and aligned with operational realities. Ethical considerations were strictly observed, with informed consent obtained from all participants, and confidentiality was maintained at all times. The researcher ensured minimal disruption to operational activities while maintaining an objective and respectful presence within the workshop environment.

This methodology provides a comprehensive understanding of the after-sales service processes and served as a foundation for identifying Lean improvements, with the ultimate goal of enhancing efficiency and delivering greater value to the customer.

The analysis will focus on understanding each step of the customer journey and service process. The service flow will be broken down into the following main stages: booking and appointment planning, reception, technical intervention, quality control, vehicle cleaning, delivery, and follow-up. Each stage will be analyzed in terms of its contribution to customer value and operational efficiency.

## 3.3.Value stream mapping

The process of mapping the current value stream is a fundamental step in Lean Thinking implementation, as it allows organizations to visualize and understand how their processes function in practice. In the context of the automotive after-sales sector, Value Stream Mapping (VSM) serves as a tool to identify inefficiencies, bottlenecks, and opportunities for

improvement by documenting all the actions (both value-adding and non-value-adding) involved in delivering a service to the customer.

This mapping process is not only essential for understanding the current operational reality but also for designing and implementing an improved future state that aligns with Lean principles.

In this study, VSM was applied as an analytical and diagnostic tool to map the complete after-sales service process of an authorized automotive workshop. The mapping was developed based on data collected through participant observation over a three-month period, complemented by informal interviews with service advisors, technicians, workshop managers, and parts department staff. This immersive approach allowed for the identification of discrepancies between standard procedures and actual practices, providing valuable insights into the organization's operational dynamics.

# 4. Results and Discussion

As mentioned by James P. Womack and Daniel T. Jones there are five main principles to be considered on a lean thinking approach (Womack & Jones, 2003), those principles can be applied both in manufacturing and services industry, and they are the following:

- Specify Value
- Identify the Value Stream
- Flow
- Pull
- Perfection

These principles will be approach individually over this chapter taking into consideration the automotive after sales current reality on a personal working experience, all the knowledge acquired throughout the master's degree as well as an overview over Womack and Jones' book.

LT is ultimately related to value, it is the customer that decides the actual value of a product or a service, and therefore it is the way in which a company delivers value to its customers that will dictate their loyalty and retention, as well as the survival and future profitability of the company.

What do our customers expect from us? This is one critical question and its answer equally critical to the Lean Thinking implementation success or failure when value is not well defined.

It's clear that customer's expectations can change, from times to times, from a manufacture to another, from their personal experiences, and so many other factors, so it is extremely difficult to quantify value.

It is also important to understand that price and value, despite being related, have completely different meanings. It can be said that price is the amount you pay for a product or service, and value is what you receive in exchange for the price you've paid.

Value and value perception is all about expectations, on today's society and market every customer is a singularity, with different needs that need to be satisfied but above that

different expectations that need to be exceed in order retain customers and thrive in a constantly changing market.

As so the organization needs to evaluate their customers opinion in a way to perceive what those customers regard as value.

## 4.1. Defining value from the customer's perspective

Understanding customer value is a fundamental principle of Lean Thinking, particularly in the automotive after-sales sector, where service quality, efficiency, and cost are critical to customer satisfaction. To assess customer perception of value and identify areas for improvement, a survey-based analysis was conducted.

### 4.1.1. Customer satisfaction surveys

The objective of this analysis is to identify the main pain points affecting customer satisfaction and to apply Lean Thinking principles to propose solutions that enhance efficiency, reduce waste, and ultimately improve the service experience. The following section presents the survey results, highlighting the most frequently mentioned issues and discussing their implications for Lean-based process optimization.

To understand how value is defined from the customer's perspective in the automotive after-sales sector, a detailed analysis was conducted based on customer satisfaction surveys. The methodology followed the Lean Thinking principles, particularly the specification of value based on customer perceptions and expectations.

To assess customer perception of value and identify areas for improvement, a survey-based analysis was conducted using data from the company's Customer Satisfaction Surveys. Due to professional secrecy and non-competition agreements, the raw data is not disclosed in absolute figures; instead, it is analyzed as a percentage of total comments and complaints, as presented on Table 4.1. This approach ensures confidentiality while maintaining the integrity of the findings.

The collected data reflects customer opinions on various aspects of after-sales services, highlighting key pain points that influence satisfaction levels. By analyzing these factors, it is possible to identify inefficiencies and propose Lean-based improvements that enhance both operational performance and customer experience.

**Table 4.1 - Customers' comments analysis**

| Costumer Comment Category | Percentage within all comments |
|---|---|
| **Ease of service booking** | **1.58%** |
| **Reception** | **6.31%** |
| **FRFT** | **17.35%** |
| **Information during service** | **10.09%** |
| **Service Time** | **15.77%** |
| **Price** | **22.40%** |
| **Vehicle Cleaning** | **8.20%** |
| **Delivery** | **2.52%** |
| **Parts Availability** | **6.62%** |
| **Follow-Up** | **5.36%** |
| **Product** | **5.36%** |

The most frequently cited issue in customer feedback relates to price perception, accounting for 22.40% of total comments. Many customers express concerns regarding the high costs associated with after-sales services, often perceiving them as excessive when compared to alternatives in the market. While price reduction might seem like a straightforward solution, Lean Thinking suggests that improving perceived value is a more sustainable approach. This can be achieved through greater transparency in pricing structures, minimizing non-value-added activities to reduce costs, and better communicating the benefits of using certified service centers and original spare parts. Enhancing customer awareness of quality and reliability can help shift the perception of price towards a more value-driven perspective.

Another significant issue highlighted by 17.35% of respondents is the First Right First Time (FRFT) rate, which measures the ability to resolve a service issue correctly on the first attempt. A low FRFT rate results in repeat visits, increased costs, and customer frustration. From an operational standpoint, reducing rework is critical to achieving Lean efficiency. Standardizing diagnostic procedures, providing continuous technician training, and implementing root cause analysis techniques can significantly improve FRFT rates. Ensuring that the correct procedures and tools are used from the beginning of the service process minimizes errors and enhances overall service reliability.

Service time is another key concern, mentioned in 15.77% of customer comments. Delays in vehicle servicing can negatively impact satisfaction, particularly in cases where customers rely on their vehicles for daily use. A Lean approach to optimizing service times involves the application of Value Stream Mapping (VSM) to identify and eliminate bottlenecks in the workflow. Additionally, Just-in-Time (JIT) inventory management ensures that parts and tools are available when needed, reducing unnecessary waiting times. Improving scheduling systems and workflow efficiency can lead to faster turnaround times, increasing both customer satisfaction and operational productivity.

Transparency and communication also play a vital role in customer perception, with 10.09% of comments indicating dissatisfaction in this area. Customers expect timely and accurate updates on the status of their vehicle's service. A lack of clear communication leads to uncertainty and frustration, which can be mitigated through the implementation of automated messaging systems, online tracking tools, and proactive customer service engagement. Enhancing transparency not only improves customer trust but also reduces the likelihood of misunderstandings and service disputes.

Post-service follow-up, although mentioned by a smaller percentage of respondents (5.36%), remains a crucial element in building long-term customer relationships. Follow-up calls or surveys can provide valuable insights into customer experiences and areas for improvement. Additionally, personalized aftercare recommendations and loyalty programs can increase customer retention and satisfaction. While this area may not be a primary source of complaints, it presents an opportunity for businesses to differentiate themselves by demonstrating ongoing commitment to customer care.

Other aspects, such as ease of booking (1.58%) and vehicle delivery delays (2.52%), also contribute to customer dissatisfaction, albeit to a lesser extent. Simplifying appointment scheduling through digital platforms, optimizing vehicle handover procedures, and ensuring better coordination of service logistics can help mitigate these concerns. Although these issues may not appear as urgent as others, continuous monitoring and incremental improvements in these areas can further enhance the overall customer experience.

The survey results highlight two primary approaches to improving customer satisfaction. The first is cost reduction, which, while appealing to customers, may not be financially viable in the long run. The second and more sustainable approach involves optimizing

service efficiency, reducing errors, and improving communication, all of which contribute to a higher perceived value. Lean Thinking provides the necessary framework for achieving these improvements by eliminating waste, standardizing processes, and focusing on value-added activities.

### 4.1.2. Summary and discussion

Implementing Lean strategies in the after-sales sector requires a commitment to continuous improvement. Enhancing FRFT rates reduces rework and increases efficiency, optimizing service times improves workflow management, and improving transparency strengthens customer trust. Standardization of processes, investment in technician training, and proactive customer engagement all contribute to a more effective service model. By addressing key pain points through Lean methodologies, service providers can increase customer satisfaction, reduce costs, and improve overall operational performance.

The findings of this survey suggest that customer dissatisfaction in after-sales services is primarily linked to price perception, service accuracy, and waiting times. While pricing concerns cannot always be fully eliminated, Lean Thinking offers practical solutions to enhance service quality, transparency, and efficiency. By applying these principles, automotive after-sales providers can create a more customer-centric and sustainable business model, ensuring long-term competitive advantage in an increasingly demanding market.

By implementing Lean principles, automotive after-sales service providers can create a more customer-centric and operationally efficient business model, ensuring long-term sustainability and competitive advantage.

## 4.2. Value stream characterization

In this section the value stream of the company’s automotive after-sales service will be approached. The findings are based on qualitative data collected through participant observation over a three-month period in an authorized automotive workshop. The aim was to map the current value stream, distinguish between value-added and non-value-added activities, and identify areas of waste that could be addressed through Lean Thinking principles.

### 4.2.1. Mapping the current value stream at the company

Value stream defines the set of all specific actions required to bring a specific product or service through 3 critical management tasks, in services we have:

1. Problem-solving task: Find solutions for issues occurred between the conceptual process and the actual one.
2. Information management task: Organize and coordinate information flow since the consumer service request until the termination of it.
3. Physical transformation task: Tasks related to the physical process within the service provision itself (the technicians work in this specific case)

This principal leads the organization to 3 main tasks:

1. Identify all the activities involved in the service provision.
2. Determine the activities that add value.
3. Eliminate or improve processes on the activities identified as waste in the value stream within the following definitions:
    a. Value added activities - Efforts invested in transforming an input into an output that the customer sees as valued.
    b. Nonvalue added activities - Efforts invested in the same transformation but do not add value in a customer point of view that can be classified as:
        i. Unavoidable - wasteful activities that exist due to the current system structure.
        ii. Avoidable - unnecessary wasteful activities in the current system structure.

All the previous information can be found on Thangarajoo's work and approach, (Thangarajoo, 2015). A good example in the automotive service to understand this classification is the process of tightening a bolt, only the last turn actually adds value, but all the other ones are necessary to the process.

Manufacturers in the automotive sector are increasingly aware of the Lean Thinking ideas of adding value and perceived value implicit to their actions and operational standards to be followed.

As representatives of one or more manufacturers, the organization will have to comply with these operational standards and set of tasks to be performed. Although it may vary from one manufacturer to another, the basic workshop processes are increasingly standardized so that a customer has a similar experience regardless of the brand's authorized workshop they choose. The basic workshop processes will be discussed and analyzed below, are generally applicable to a wide range of brands, and ca be resumed by the following Figure 4-1:

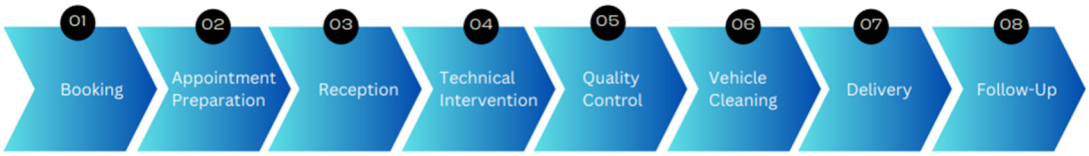


**Figure 4-1 - After-sales process chain.**

After knowing the processes related to a customer's visit it's essential to define them as well as all the tasks that should be performed by the organization collaborators inside all processes, that will be analyzed next.

**Booking**

During the Booking phase, it was observed that service advisors collected customer and vehicle information, verified service histories, and checked for recalls. While most activities in this phase aimed to prepare the service visit efficiently, duplications in data entry and manual follow-ups on previous services were identified as non-value-added but necessary activities, primarily due to limitations in the IT system.

This initial phase of the value stream encompasses the following steps:

- Customer Info collection: Collecting Name, Address, taxpayer number, contact information (email, cellphone number) – add to the data base or verify.
- Vehicle Info collection: License plate/VIN, age, kilometers.
- Vehicle info analysis: Service history to determine the next additional works like accessories or timing belt/chain replace. Check for recall campaigns – if there are recalls or service actions inform the customer about them and how long it will take.
- Follow-up on previous services: In case of a recent complaint verify if everything is fixed and there are no more issues related – shows interest and care for the customer's vehicle.
- Verify wear parts consumption profile, like break disks and pads or tires to predict if this kind of works will be necessary.
- Customer complaints registration: ask for more details that can help to understand the issues, recheck in the end, and ask for anymore works that might be needed. If any of the customer complaints is related to noises, inform the customer that a road test with him will be needed to avoid any repeated repairs – FRFT.

- Appointment booking: give customer 3 or 4 available dates by taking in consideration the time consumed by the works nature – by giving different option to costumers the organization is offering a more personal experience focused on customers' needs.
- Active reception proposal: Ask the customer for the possibility of an active reception, which means that it will be made quick overall inspection of the vehicle (tires, break disks and pads wear, scratches, or dents, for example) that can detect any anomalies and therefore avoid latter contact to ask permission for additional works that the customer will not be expecting – non-interruption of service flow while adding transparency, once costumers will be able to see the anomalies.
- Cost estimation: Give the customer a cost estimate for all the required services.
- Customer mobility offer: Verify customer's mobility needs by offering options like – renting service, taxi/tvde or courtesy vehicle, for example.
- Documentation needs: Remember the customer about all the documents needed in the moment of the vehicle reception, such as ID, vehicle registration and service record book.

**Appointment Preparation**

The Appointment Preparation process involved verifying parts and tool availability, reserving components, and confirming mobility solutions for customers. Although essential, delays frequently arose from communication gaps between departments, particularly between the service team and the parts department. These delays occasionally led to rescheduling, reducing customer satisfaction and increasing administrative workload—activities that were classified as avoidable waste.

This second stage of the value stream integrates the following steps:

- Required parts availability verification: Assure, with the parts department, that all parts needed for the specific service will be available, the service adviser should reschedule with the customer in case of any delay in supply. To make it possible is extremely important that the parts office have access to the appointment schedule.
- Required tools availability verification: Assure that all the specific tools needed are available and in good condition.

- Pre-picking - The parts office should reserve all the parts needed and get them in a specific container identified with the service order number, pre-service order number, license plate or VIN.
- Technical info collection: Verify the technical information available by the manufacturer that could help on the diagnostic.
- Paperwork preparation: Collect all paperwork for the reception day, like all the checklists for active reception, service, rental/loan forms, for example.
- Customer's mobility availability verification: Assure, in case of a renting service or a courtesy vehicle for customer mobility, that the car is available and in good cleaning and maintenance conditions.
- Appointment reminder sending: The customer should be remembered about the appointment one day before it.
- Marketing and Sales Force interaction preparation: Verify with the marketing team and sales force if there are any campaigns or vehicles that fit the customer.

**Reception**

In the Reception stage, the practice of active reception was observed to add significant customer value. By involving the customer in a joint inspection of the vehicle, potential additional services were identified early, avoiding later disruptions. However, inconsistent application of this practice across different service advisors led to variations in customer experience and potential missed opportunities for value creation.

The third stage of the company's value stream integrates the following steps:

- Greeting: When the customer arrives, the service advisor should express his/her satisfaction for the customer visit. Greet and treat him by his name and offering any hot or cold drink (water, coffee, tea), it is extremely important for to customer to feel comfortable and create a trusting relationship between our customers and the company, the service advisor is the face and personality of the company in the customer perspective, and that make this trusting relationship between the two a key point to accomplish customer loyalty.
- If it is the customer first visit the service advisor should first present himself and, if there is opportunity to do so, present other relevant organization members like

the service manager and sales force members. This action demonstrates transparency and availability.

- Services Resume: The service advisor should resume the services that will be done and ask for the needed paperwork, such as vehicle registration and service book, if the customer is not the vehicle owner, he should sign a service authorization declaration.
- Active Reception: In case of an active reception the service advisor should take the car to the lift and perform a visual inspection, taking notes in the checklist of all the non-conformities, such as scratches and dents it the paint or wheels, the headlights and rear lights, windows, mirrors, and whippers state, as well as the mandatory periodic inspection expiry date. The vehicle should be lifted by near a meter to verify all the wearable parts, such as break discs and pads as well as the tires. It should then be lifted again to verify the car underneath, for verification of exhaust system, dumpers and suspension components, visible transmission parts and to detect any oil or coolant leaks. Inside the vehicle should be verified any interior damages as well as the odometer information. If there are any damage, wear or failures detected in this visual inspection, it's a great opportunity for the service advisor to try to sell any additional services, to do that it's essential to explain for the customer the risks of not doing it and what kind of safety or running issues are associated with these non-conformities, as well as the time consumption costs for a new appointment.
- Noise complaints verification: In case any of the customer complains is about any kind of noise a road test should be taken in order to understand the real issue in the customer perspective, avoiding all kinds of waste, that can be: time solving another noises that the customer don't complain (different earing sensitivities can lead to it), customer non satisfaction after the works done that can lead to a repeated repair which will involve time cost as well as human and material resources that will not be charged in order to not improve the customer dissatisfaction and not losing him (after all, competition is getting higher and every customer is extremely important)
- Service resume after active reception: Review all the works to be done, give a new estimated cost in case of any additional works.

- Delivery expectation: Remember the customer about the delivery schedule, that information should also be in the service order, in that way all team members are informed.
- Customer's mobility provision: Take the customer to the vehicle in case his mobility is assured via rental or loaning vehicle, and record any damage, kilometers, and fuel level on the checklist.

**Technical Intervention**

The Technical Intervention process was one of the most structured areas. Service orders were assigned according to technician skills and availability, and daily briefings helped clarify priorities. Clock-in and clock-out procedures using the Dealer Management System (DMS) allowed performance monitoring. Despite this, inefficiencies were observed when unexpected additional work required customer approval, often resulting in downtime while waiting for decisions. This highlighted a need for more proactive communication during earlier stages of the process.

The fourth stage of the value stream integrates the following steps:

- Service order designation: The workshop manager should designate the service order to a technician depending on his knowledge, skills, and customer needs. Keeping in mind that it's important to let other technicians evolve and feel useful inside the organization, as so it's essential that all of them can and perform all kind of works. This can be achieved by invest on their training and let them actually do all kind of works, per example if a customer vehicle can stay a little longer at the workshop (it's customer's second vehicle or is mobility is assured) and the workshop manager is available to assist on the repair this kind of work can be designated to a not so experienced technician or to one that has more skills in other area. This is a relevant part to avoid human knowledge, skills, and abilities muda as well as improve these characteristics.
- Briefing: The repair process should start with a small briefing between the workshop manager and the technician, to clarify all the services to be caried on the vehicle and a general overview over the expected time for execution and work priorities. This briefing can be done first thing in the morning in a small (10 to 15 minutes) reunion with an overview of all the works to be done by every technician.

- Technical info overview: In diagnosis, recall or service campaign perform an overview of the existent technical information, this would help to improve repair quality and reduce repair time since all that type of information usually include all kind of diagnosis and repair problems that have been found all over the world at other service centers, and how to respond to them.
- Clock-in: All services should initiate with the clock-in on the DMS, that allows the workshop manager to control any deviations over the manufacturer established time for that specific work being performed as well as to evaluate technician performance, efficiency, and productivity. High efficiency levels should always be case studies, they can mean that it has been found a more efficient way to perform the task and then this information should be shared with the other team members, banishing any type of muda, or the technician is not complying with all procedures which can lead to poor service quality and customer complaints that may result in losing a customer.
- Parts collection: Collect all parts and special tools needed that should already be separated since the appointment planning.
- Technical help: If necessary, seek technical help within the manufacturer platforms. This assistance can also lead to reduce repair time since manufacturers usually have a technical help department that is in constant touch with all authorized repairers and as so have a lot of information collected and can guide into the diagnosis or repair procedure.
- Deviation and service order extension management: Any deviation of the estimated work time should be supervised by the workshop manager to help recover that exceeded time, if these deviations result in a delay the service advisor should be informed to contact the customer and justify the delay. Delays can also occur over other anomalies found by the technician during service that haven't been detected by the customer or during the active reception of the vehicle, in that cases that anomalies should be communicated to the manager and a cost estimation with the necessary additional works delivery to the service advisor. After contacting the customer, explaining the importance of carrying out this additional works and customer acceptance of the cost estimate this new line should be added to the service order on the DMS so the technician can record his work time. In case there is no acceptance of the additional work the line should be opened anyway and registered the non-acceptance by the customer avoiding

any risk of legal proceedings in case there is any problem with the vehicle after that intervention.

- 1st order quality control – After all the works have been performed the technician should do a quick control of every work done, like oil and fluids level check or if any of the customer concerns or vehicle anomalies are still present. In case any of the controls show any anomalies, the technician should keep working on the vehicle avoiding a high number of vehicles returning to the workshop after road testing, building up technician's confidence and reduce any time or resources muda.
- Reporting: Elaborate a small report with everything that has been done, this will be extremely important to help the service advisor to explain all the works that have been done and can make a huge difference in customer's value perception.
- On those works that need diagnosis the report can be made by a 4 C's method, that consists in "Concern confirmation", "Cause", "Correction" and "Control".
- Concern confirmation is, as named, the confirmation of what the customer states or complaints about and should include all the tests performed to confirm the existence of an issue.
- Cause – Refers to the cause founded for the issue and should contain all works performed that lead to this conclusion.
- Correction – All the works to be performed to solve the issue.
- Control – Is the 1st order quality control performed by the technician.

An applied example can be something like:

- Action number one of the service order – "1 – Customer states that vehicle is overheating"
- C1 - Concern confirmation – "Confirmed. Drove the vehicle and verified that the coolant temperature reached 97 ºC which is over the manufacturer limits.
- C2 – Cause – "Checked for coolant leaks, there were none. Running check vehicle and fans didn't turn on. Verified fan motors by induce tension to the terminals, fan motors were ok. Checked for fan motor connections with a continuity test and verified a power supply issue. Checked fan relay by induce tension and found him faulty.
- C3 – Correction – Fan relay replace.

- C4 – Control – Running checked vehicle and fans start running at manufacturer indicated temperature. Performed compression test for prevention over head gasket failure, all cylinders ok.

By the time the service advisor is explaining the invoice to the customer, the amount to be paid for a relay change with no report may seem extremely inappropriate, but with a proper report like this and a good explanation of the labor by the service advisor, customer can perceive extra value on all the actions and extra care that have been taken to his vehicle and completely change his perception of the repair, as so it is possible to mitigate the cost issue by adding value.

Clock-out marks the end of the technical intervention and it's, like clock-in, extremely helpful for performance evaluation and knowledge acquiree of training needs and most dominant areas of a technician, allowing for future service order designation decisions and creation of training plan specific to different technicians.

**Quality Control**

Quality Control includes post-repair checks, road tests, and verification of customer requests. These controls were generally effective in ensuring service quality, though variations in test routes and procedures were noted. This inconsistency created risks of overlooking faults and resulted in repeated repairs, classified as avoidable waste due to process non-standardization.

The fifth step of the value stream includes the following stages:

- Work review: Review and confirmation with the technician in charge of the vehicle that all customer requests were executed, avoiding possible customer complaints, invoice errors and time waste, since the vehicle would need to return to the workshop to finish the works and carry out a new road test, repeating processes, pure muda.
- Road test: After all works have been completed there should be performed a road test of the vehicle, it not only it increases confidence on the work done it will also be valued by customers, it shows extra care. Different type of works and the conditions under which the anomalies reported by the customer manifest themselves are essential criteria for route chose, duration and number of

kilometers to be done, regardless of that this route should always include a section of uneven pavement, by passing over this kind of roads it's possible to detect all kind of noises and anomalies that haven't been found during the technical interventions, in that case they should be communicated to the customer alongside a cost estimate for repair.

- This road test should, to ensure quality of customers use experience, have as key verification points engine behavior, clutch, wheel alignment, braking system, wipers, lights, indicators, and horn.
- Road test report: Usually made via checklist and should include the number of kilometers traveled, all verifications done, whether anomalies were found and the signature of the person who performed it, usually the workshop manager.
- Contact with the customer: After carrying out the road tests, checking all documents and preparing the invoice, the customer must be informed that all works are finalized and the possible times for the vehicle handover (with consideration for the vehicle washing time to be managed with the washing team)

**Vehicle Cleaning**

The Vehicle Cleaning phase, while often perceived by staff as a routine step, was highly valued by customers. External cleaning was provided as a standard service, and interior cleaning was offered as an additional paid option. However, the cleaning process was sometimes delayed due to scheduling conflicts with other services, affecting delivery times. Including cleaning services on the invoice, even when offered as complimentary, was identified as a practice that increased perceived value.

The following step on the value stream is composed by:

- Vehicle cleaning: In the service station the cleaning services agreed with the customer will be carried out, it is usually offered to the customer but depending on the organization it can also be a paid service. Car washing is extremely important because it's the first contact and image that the customers experience after service and is one of the most valuable. In almost every organization, at least an external vehicle cleaning is offered, cleaning the inside of the vehicle as well is a great way to add value.

- An important point over this section is to manage customer expectations, as so it is essential to have different types of cleaning with different prices, for example, have a free general simpler cleaning that includes exterior wash, floor mats vacuum cleaning and dashboard wipe, an intermediate priced one that includes a more detailed clean of all the above and also a leather/fabric seat clean, being available a more expensive full car detail as well.
- In this way, at the reception moment the service advisor can explain the different kind of cleanings that are available and prices, by informing the customer about the appropriated cleaning service due to the vehicle condition and even if there is no acceptance of a more expensive one, customer expectations will be lowered, as so it is a great opportunity to overcome this expectations and add value.
- Therefore, other important point to be considered is to, despite being offered, include the cleaning service in the invoice with 100% discount, in that way customers will understand that this offer has got costs imputed to the organization, and will see this service as a courtesy, helping to build a relationship and, again, adding value to the service.

**Delivery**

During the Delivery service advisors explained the work performed, provided invoices, and outlined future maintenance recommendations. The availability of technician reports and clear documentation enhanced customer understanding and trust. Nonetheless, the explanation quality varied depending on the service advisor's communication skills, which impacted customer satisfaction levels. Informing customers about satisfaction surveys was a standard practice, but the emphasis on survey scores sometimes detracted from authentic relationship-building.

Reaching the end of the value-stream, the delivery encompasses:

- Customer interaction prepare: Verification of different aspects like vehicle cleaning condition, invoice verification over parts and labor debit, and acknowledge over all the works that have been done for invoice explanation preparation. These verifications will add value down the process chain making the finalization of the visit process easier for the customer, more transparent as well

as ensure that the customer is amazed by the visit, aspects that are so important in current marketing strategies.

- Invoice explanation: this task consists of the explanation of all the works that have been carried out, it must have in consideration the type of customer ahead of the service advisor, depending on it this explanation can be more detailed and technical or a simpler one. This phase of the customer visit is a key point over the perceived value of the service as so it's crucial to be as clear and transparent as possible, building up a trusting relationship with the customer. A great help for this process to run smoothly is the report carried out by technicians after repairs, the more detailed the better as it allows the service accessor to have all the information and choose the most valuable one for the type of customer in question.
- Future services explanation: explaining what future services will be and when they should be carried out, usually in terms of date or kilometers, creates an unconscious commitment with the customer and shows extra care and that they are extremely important to the organization, and that the organization hopes to see them again. It's all about creating a more personal relationship.
- Inform of customer satisfaction survey: As manufacturers quality management has evolve and gain more relevance on the industry, the customer satisfaction surveys are associated with a bonus program extremely important for organization profitability, as so services advisers should inform that response is important for the organization to evolve and offer a better service. Nevertheless, the relationship between customer and organization are more of a customer and service advisor relationship, on this way it is also relevant that the service advisor explains to the customer that it is also an evaluation of his work and the scale inherent to the survey.

Most manufacturer use an NPS (Net Promoter Score) or OSAT (Overall Satisfaction) method. NPS method divides customers evaluation, on a scale from 0 to 10 for probability of recommendation, over three different categories:

- Promoters (9 or 10)
- Passive (7 or 8)
- Detractor (0 to 6)

The NPS results is obtained by subtracting the percentage of detractor over the percentage of promoters. OSAT use a 1 to 5 scale and is based on the customer satisfaction and the results are the percentage of satisfied customers.

1 – Very unsatisfied
2 – Unsatisfied
3 – Neutral
4 – Satisfied
5 – Very satisfied

Explanation of the scale is a key point in obtaining good results since for most people an 8 may be a good classification but ends up harming the organization on these bonus programs.

Vehicle delivery: When delivering the vehicle to the customer is important to remove seat, steering wheel, and gear knob protections in his presence, this will show how much the organization cares for the customer's vehicle and that by choosing this repairer his car will always be in good hands. These extra touches can make a huge difference on the customers perception.

**Follow-up**

The Follow-up process was identified as a critical stage in maintaining customer loyalty. Personalized contact by the same service advisor who managed the initial service was seen as adding value, yet this practice was inconsistently applied. Outsourced follow-up calls, though efficient, lacked the personal connection valued by customers.

The final stage of the value stream includes the following steps:

- Contact preparation: Despite many organizations have a person dedicated for this task or an external company, as mentioned the relationship between customer and service advisor is extremely important, by opting for one of the mentioned options the personal component of this process is removed, as so if the follow-up is made by the service advisor, the person who is seen by the customer as the one who always takes care of his vehicle, a lot of value will be added making a more personal service instead of being perceived as another customer satisfaction survey. Making a quick overview of the customer concerns presented in the

service order will help this contact being meaningful for the customer, once again, showing concern for the customer needs and creating a better relationship.

- Follow-Up contact: After collecting relevant information it's time to contact the customer and ask about his satisfaction with the service, how the vehicle is running and if every one of his concerns/complaints were resolved correctly. Abording customer's specific concerns will be seen as a "tailor made" experience, showing him that he's not just another customer but a valuable one to the organization.
- Complaints management: In case there are any problems with the vehicle, or the works performed it's extremely important to book an appointment as soon as possible and prioritize this case to mitigate the dissatisfaction shown and recover the customer. All customer complaints must be registered, monitored, and studied by the quality department and/or the after-sales manager to verify trends or sectors that affect customer satisfaction and to implement corrective actions.
- Corrective actions implementations: After identifying flaws within the process, corrective actions must be taken seeking continuous improvement of processes and service quality.

### 4.2.2. Summary and discussion

In a nutshell, it can be mentioned that the value stream in an automotive after-sales service context encompasses all activities required to deliver a service to the customer, from the initial service request through to vehicle handover and follow-up.

Through observation and engagement with the after-sales team, several key findings emerged. Hence, value-added activities included accurate diagnostics, transparent communication, efficient technical interventions, and proactive customer engagement. Non-value-added but necessary activities included regulatory documentation and data verification steps constrained by existing system architecture. Avoidable wastes were identified in areas such as redundant data entry, delays in customer approval for additional work, inconsistent application of active reception and quality control procedures, and ineffective coordination between departments.

The mapping of the current state value stream revealed several bottlenecks and inefficiencies. These included delays in parts availability confirmation, variation in customer experience during reception and delivery, and waiting times during technical intervention

due to communication gaps. Root cause analysis suggested the need for better integration of information systems, standardized practices across service advisors and technicians, and enhanced cross-functional coordination.

In summary, the identification of the value stream provided a comprehensive view of the current processes and highlighted areas where Lean Thinking principles could be applied to enhance efficiency and customer value. The insights gained through participant observation informed the development of a future state value stream map, proposing streamlined workflows, reduction of waste, and improved service quality in the automotive after-sales sector.

## 4.3. Value stream assessment

After-sales service in the automotive industry, with the evolution of competition and increasingly sophisticated vehicles, consequent training needs and price increases adjacent to those needs, has an increasing focus on the concept of quality that prioritizes the customer experience, the addition of value in different activities and the perception of value by customers.

### 4.3.1. Added Value and Nonvalue Added activities analysis

In this context, Lean Thinking has become the market trend when it comes to manufacturers' operational standards. Addressing those that are universal tasks within the industry, is possible to see the non-existence of activities that do not add value and are avoidable, as the non-valuable activities are important and needed for those that customers perceive as valuable ones and therefore unavoidable, as shown on Table 4.2.

**Table 4.2 - Value Added and Nonvalue added activities analysis**

| Process tasks | VA | NVA | | Comments |
|---|---|---|---|---|
| | | UNAV. | Av. | |
| Booking: | | | | |
| Info collection and analysis | | X | | Essential for a good Data Base on customers and vehicle information, helping to create a more personal experience lather on but it will not increase value perception once it doesn’t make booking easier for customers that can already have given a lot of this information on a previous appointment |

| | | | | |
|---|---|---|---|---|
| Follow-up on previous services | X | | | Shows extra care, adds value, and creates a better relationship with customer |
| Identify customer concerns and needs | X | | | It’s the main reason for customer contact |
| Offer a personal service solution | X | | | Customers value a personal experience – appointment schedule options, mobility offers, etc. |
| Send appointment confirmation | X | | | Adds a personal touch and shows that the organization is already counting on this appointment, and will prepare everything for an easier experience |
| Appointment planning: | | | | |
| Verify and coordinate parts supply and resources | | X | | Essential to reduce service time |
| Documentation prepares | X | | | Customers value an easier experience, and it will be perceived lather on the reception |
| Customer mobility prepare | | X | | Essential for customer mobility delivery |
| Remember customer | X | | | Customers value a personal experience, and it shows extra care and time dedication on him |
| Prepare customer interaction with marketing and sales force | | X | | Essential for customer retention and loyalty |
| Reception: | | | | |
| Verify customer concerns | X | | | Reason for customer visit |
| Perform active reception | X | | | Shows extra care for customer’s vehicle and attention to detail |
| Offer relevant services and products | X | | | Depending on the vehicle's needs detected in active reception being able to offer these services will make the customer’s experience easier |
| Complete service order and get customer’s signature | | X | | Essential to the process but doesn't add value in terms of ease of experience |
| Provide customer mobility service | X | | | Customer mobility service is extremely valued |
| Deliver service order at the workshop | | X | | Essential to the process but is not perceived by customer |
| Technical intervention: | | | | |
| Designate service order to a technician | | X | | Essential to the process but is not perceived by customer |
| Briefing | | X | | Essential to the process but is not perceived by customer |
| Service preparation | | X | | Essential to the process but is not perceived by customer |

| | | | | |
|---|---|---|---|---|
| Clock-in | | X | | Essential to the process but is not perceived by customer |
| Pick up parts and special tools | | X | | Essential to the process but is not perceived by customer |
| Diagnosis and manufacturer technical help if needed | | X | | Essential to the process but is not perceived by customer |
| Service Order execution | X | | | Reason for customer visit |
| Service order extension management | X | | | Shows attention to detail and that the organization is focused on the customer's vehicle perfect condition |
| 1st order quality control | X | | | Adds confidence and transparency to the repair service |
| Service order report with explanation of the work performed | X | | | Adds transparency and increases perceived value |
| Clock-out | | X | | Essential to the process but is not perceived by customer |
| Quality Control: | | | | |
| Work review | | X | | Essential to the process but is not perceived by customer |
| Road Test | X | | | Increases confidence on the repair, essential for FRFT and increase customers perceived value |
| Report | X | | | Only will increase perceived value on the invoice explanation. |
| Contact | X | | | Makes customer experience more personal - keeping them informed and allowing for a delivery schedule considering his preferences |
| Vehicle cleaning | | | | |
| Vehicle cleaning | X | | | First customer experience after repair, extremely important for perceived value increase |
| Delivery: | | | | |
| Customer interaction prepare | | X | | Essential to the process but is not perceived by customer |
| Invoice explanation | X | | | When done properly increases a lot of the customers perceived value, shows transparency |
| Future services explanation | X | | | Crates a commitment with customers for next services as well as in case of a future service that includes a lot of additional work will help managing customer expectations on price |

| | | | | |
|---|---|---|---|---|
| Inform of customer satisfaction survey | | X | | Doesn't add value over customers' perspective but is an essential point on the organization profitability |
| Vehicle delivery | X | | | Attention on details like vehicle interior protection elements, and care for customer goods adds a lot of value |
| Follow-Up: | | | | |
| Contact preparation | | X | | Essential to the process but is not perceived by customer |
| Follow-Up contact | X | | | Creates a more personal experience for customers which is extremely valued |
| Complaints management | X | | | Essential for customer retention, any complaint should be prioritized, making customer feel important for the organization |
| Corrective actions implementations | | X | | Essential to the process Continuous Improve but is not perceived by customer in short term |

This analysis is based on an "universal" value stream that is present on most organizations and required by a lot of manufacturers, that will mean that inside different organizations there will be some tasks added to this stream, those are ones that require a lot of attention as they could be classified as non-valuable and avoidable and therefore should be eliminated.

The focus for implementing lean thinking shouldn't only be on eliminating tasks but also on eliminating waste in the way these activities are performed or on ways to make the information exchange within the different areas of action (workshop, reception, parts section and warranty department, for example) easier and as so lead to a effort focus on customer interactions, technical interventions, and all the activities that increase customer's value perception, as it will be mentioned later.

One key finding from Table 4.2 is the significant proportion of activities categorized as "Non-Value-Added but Unavoidable" (UNAV). These activities, such as customer data verification during booking or internal documentation preparation, are essential for ensuring legal compliance, internal coordination, and process control but do not directly increase customer satisfaction. While they are necessary under the current system structure, Lean principles encourage minimizing the time and effort dedicated to these tasks, often through process automation or system integration.

Value-Added (VA) activities were identified predominantly in customer-facing processes. For example, actions like following up on previous services, offering personalized appointment solutions, performing active receptions, and explaining invoices were considered crucial for delivering a positive customer experience. These touchpoints are directly linked to how customers perceive the service's quality, transparency, and personalization—key drivers of satisfaction and loyalty in the after-sales sector. The observatory participant role made it evident that the human interactions in these phases were pivotal in shaping customer perception.

In contrast, the analysis revealed several activities that, although currently performed, offer limited customer value and could be considered Non-Value-Added and potentially Avoidable (AV). However, Table 4.2 indicates that in this case, the standardization imposed by manufacturers has largely eliminated avoidable non-value-added tasks. The focus, therefore, shifts from eliminating steps to optimizing the efficiency of the unavoidable ones.

For instance, the appointment booking phase often involved repetitive customer data collection, identified as a UNAV activity. This could be streamlined by improving the IT system to avoid redundant data entry and enhance database integration. Likewise, internal workshop processes, such as the designation of service orders, technical briefings, and clocking procedures, while classified as UNAV, are essential for operational control but remain invisible to the customer. Lean improvement initiatives in these areas should focus on reducing administrative burdens, potentially through digital solutions, to free up staff for more customer-focused tasks.

The delivery and follow-up stages presented notable opportunities for adding value. Personalized communication, attention to detail during vehicle handover, and proactive follow-up after service completion were practices observed to significantly enhance the perceived value. When properly executed, these interactions not only improve customer satisfaction but also support customer retention and contribute to positive survey outcomes, directly impacting manufacturer performance metrics such as Net Promoter Score (NPS) and Overall Satisfaction (OSAT).

Furthermore, vehicle cleaning, though often underestimated internally, was consistently observed to have a strong positive impact on customer perception. As indicated in Table 4.2,

including cleaning services on the invoice—even when complimentary—reinforced the perception of added value, making this a low-cost, high-impact intervention.

### 4.3.2. Summary and discussion

The identification and analysis of the value stream within the automotive after-sales service were informed by the data collected through direct participant observation, complemented by customer feedback and internal process reviews. Table 4.2 provides a structured analysis of the activities observed throughout the service process, classifying them according to their contribution to customer-perceived value. Activities were assessed as either Value-Added, Non-Value-Added but Unavoidable, or Non-Value-Added and Avoidable.

From a Lean Thinking perspective, the objective was to distinguish the processes that directly contribute to customer satisfaction and those that represent potential waste. The analysis highlighted both the operational necessity of certain activities and the opportunities to enhance customer experience by eliminating unnecessary tasks or improving process efficiency.

The results of this analysis underscore the importance of aligning operational activities with customer expectations. While certain tasks remain invisible to customers, their execution impacts the overall service efficiency and consistency. Lean Thinking advocates for the continuous review of these processes, seeking to reduce waste and streamline workflows without compromising the core value delivered to the customer.

In conclusion, Table 4.2 provided a comprehensive mapping of the observed activities along the value stream, offering clear guidance on where Lean interventions could be most effective. The focus should not only be on eliminating non-essential tasks but also on refining existing processes to enhance efficiency, reduce cycle times, and increase the consistency of customer-focused actions. The findings support the proposal of a future-state Value Stream Map that emphasizes streamlined workflows, improved information flows between departments, and the reinforcement of value-adding customer interactions across the automotive after-sales service journey.

## 4.4.Value stream mapping

When trying to reduce waste it´s extremely important to create a methodical way of doing all the activities involved in the value stream as it creates a habit that can easily reduce wasted time. As time is one of the most valuable assets in an organization and repair/service it needs to be considered as one of the main drivers when designing the flow of a process.

Effective time management can be approached considering two fundamental decisions: determining what tasks should or should not be undertaken, and establishing the sequence in which tasks should be prioritized and executed. Although this appears straightforward in theory, it is often challenging to implement in practice. For this reason, the identification and mapping of the value stream become essential.

### 4.4.1. Current state VSM

The current value stream encompasses the entire service delivery process, beginning with the customer's booking request and ending with post-service follow-up, in that way the organization is able to visualize and understand how their processes function in practice. During the observation period, each stage of the customer journey was analyzed to understand its contribution to the overall value provided, the efficiency of operations, and the areas where waste (muda) occurred.

The current state VMS (Value Stream Map), based on the same conditions as previously discussed, is the illustrated at the following Figure 4-2. It provides a visual representation of both the material and information flow required to deliver the service, from customer contact to vehicle return. This map highlights key activities of the process, their sequencing, and identifies areas where delays or inefficiencies exist.

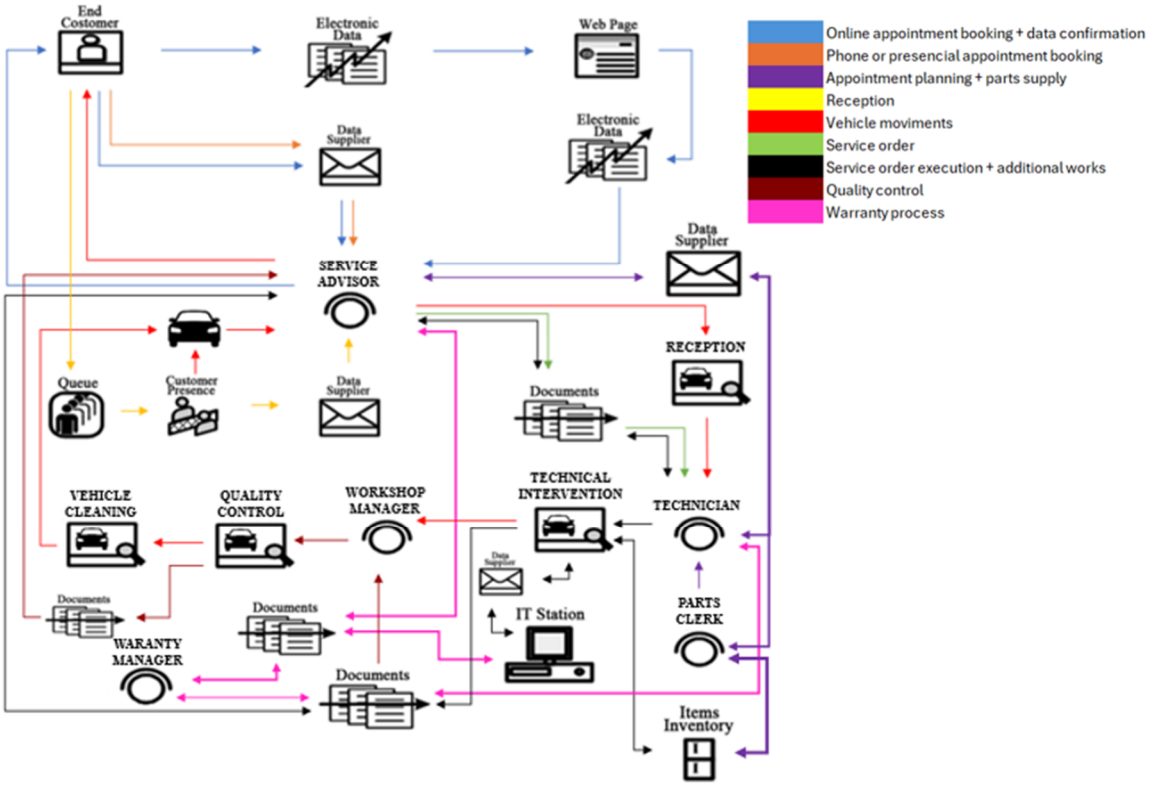


**Figure 4-2 - Current state VSM.**

As shown in the VSM, the process starts with the customer, whose demand triggers the booking process. Information flows are indicated by arrows leading to and from various functional areas, including service reception, workshop operations, and quality control. The physical flow of the vehicle is shown in parallel, moving through reception, technical intervention, quality check, vehicle cleaning, and finally delivery. These will be analyzed in further detail to understand and discuss the flow of the process.

### Process Flow

The process begins when a customer contacts the workshop to schedule a service. The booking and appointment planning phase involves collecting customer and vehicle data, verifying service history, and confirming parts and resource availability. Although this stage is crucial for ensuring a smooth service experience, redundant data entry and delays in part confirmation frequently extend the lead time unnecessarily.

Once the appointment is confirmed, the customer arrives for the reception and active diagnosis stage. Here, the vehicle is received by a service advisor, and an active reception is performed, involving a joint inspection with the customer. This process builds trust and

allows the identification of additional services; however, inconsistencies in its application lead to missed opportunities and uneven customer experience.

The vehicle then moves to the workshop, where the technical intervention takes place. Technicians perform the scheduled maintenance or repairs according to the service order. However, if additional work is identified, technicians pause their tasks while service advisors seek customer approval. This introduces waiting time and interrupts workflow continuity. Furthermore, technicians occasionally need to retrieve parts themselves due to coordination issues, reducing their productive time.

After technical intervention, the vehicle is passed to quality control. At this stage, post-repair checks and, in some cases, road tests are conducted to verify the completeness and quality of the repair. Variability in the rigor of quality checks often leads to inconsistent outcomes, with occasional oversights resulting in customer callbacks.

Following quality control, the vehicle proceeds to vehicle cleaning, which includes exterior washing and, depending on the service level, interior cleaning. This process is highly valued by customers but is not always well synchronized with preceding activities, leading to unnecessary vehicle waiting times.

Finally, the delivery process is carried out by the service advisor, who explains the services performed, delivers the invoice, and provides future maintenance recommendations. While some advisors excel in building rapport and reinforcing customer loyalty, others are less consistent, which can negatively impact the customer's perception of the service.

The process concludes with follow-up, typically conducted by the same service advisor. However, when outsourced call centers are used, customers often report a lack of personal connection, diminishing the impact of the follow-up.

**Information Flow**

The information flow illustrated in the current state VSM of Figure 4.2 reflects the sequence and communication pathways that support the execution of the after-sales service process within the workshop. It shows how information is generated, transmitted, and utilized to coordinate activities between the customer, service advisors, parts management, workshop technicians, quality control, and the delivery process.

The flow begins with the customer, who initiates the service request, typically via phone, email, or an online booking system. This initial contact triggers the booking and appointment planning process. At this stage, the service advisor collects relevant customer data, vehicle information, and service requirements. The advisor inputs this information into the dealer Management System (DMS), which acts as the central database. However, during observation, it was noted that limitations in system integration often necessitate manual data verification and repeated entries, increasing administrative workload and lead time.

Once the appointment is scheduled, the service advisor communicates with the parts department to confirm the availability of necessary components for the service. This step is critical to ensuring the smooth flow of operations on the day of the appointment. However, delays in information exchange and incomplete confirmations were frequently observed, which occasionally resulted in last-minute cancellations or rescheduling.

Upon the customer's arrival, the reception and active diagnosis process is conducted. Here, the Service Advisor engages in a direct discussion with the customer, documenting specific concerns and conducting an initial inspection of the vehicle in their presence. This interaction generates a detailed Service Order (SO), which is entered into the DMS and serves as the primary document guiding the subsequent technical intervention.

The SO is then transferred to the workshop, where the workshop controller assigns it to an available and appropriately skilled technician. Throughout the technical intervention, technicians may update the SO through the DMS, recording completed tasks and flagging any additional work required. If unforeseen issues arise that necessitate further repairs or parts, technicians communicate this information back to the service advisor, who must contact the customer for approval before proceeding. This approval process often introduces delays due to inefficient communication channels and customer availability.

Following the completion of technical work, the service advisor is informed, and the vehicle is moved to quality control, where the inspector performs final checks and road tests as necessary. The results are recorded, and any issues identified are communicated back to the technician for resolution before proceeding.

Once the vehicle passes quality control, the service advisor arranges for vehicle cleaning, coordinating with the cleaning staff. However, this step often lacks integration with the

DMS, relying instead on verbal instructions or manual scheduling, contributing to occasional delays.

Finally, when the vehicle is ready for delivery, the service advisor retrieves the complete service history from the DMS to present to the customer. The advisor explains the services rendered, delivers the invoice, and updates future maintenance schedules in the system. The post-service follow-up is initiated either by the same advisor or through an external call center, using information from the DMS to assess customer satisfaction and gather feedback.

Throughout the entire process, the Dealer Management System acts as the primary repository and conduit for information. Nevertheless, the lack of full integration with external systems and inconsistent adherence to communication protocols results in fragmented information flow, redundant data handling, and delays in decision-making.

### 4.4.2. Summary and discussion

The current process flow, as illustrated in Figure 4.2, reflects a traditional linear sequence of activities with frequent interruptions due to communication gaps, approval delays, and information silos. Despite following standardized manufacturer guidelines, the lack of integration between systems and inconsistent application of best practices introduces significant non-value-adding time into the process.

The timeline of the process clearly shows that value-adding time is substantially lower than total lead time. Large portions of time are consumed by waiting for approvals, parts availability, and administrative tasks that do not directly contribute to customer value.

The information flow in the current state value stream, as represented in Figure 4.2, is characterized by a mixture of automated and manual processes. While the DMS provides a structured framework for capturing and managing data, inefficiencies remain due to insufficient system integration, reliance on manual verification, and inconsistent communication between departments. These factors contribute to increased lead times, reduced operational efficiency, and a suboptimal customer experience.

The current state VSM highlights areas where Lean interventions could have a significant impact. These include improving the integration of booking systems to reduce redundant data entry, streamlining parts management to minimize appointment rescheduling,

standardizing the active reception and quality control processes, and enhancing technician workflow by eliminating non-core tasks.

By addressing these inefficiencies, the workshop can move towards a future state that reduces lead times, enhances process flow, and maximizes customer value. The insights gained from the current value stream mapping form the foundation for the development of the future state Value Stream Map, which proposes targeted improvements to the after-sales service process.

Following the analysis of the current state value stream, it became evident that several inefficiencies and sources of waste are present within the existing after-sales service process. These issues, including redundant data entry, delays in parts confirmation, inconsistent application of active reception procedures, and fragmented communication, negatively impact lead times, operational efficiency, and customer satisfaction.

In response to these findings, an improved value stream was designed in accordance with Lean Thinking principles. The proposed future state VSM aims to eliminate unnecessary activities, standardize processes, and streamline both information and material flows. The primary objective of the improved value stream is to enhance process efficiency, reduce waste, and deliver greater value to the customer, thereby contributing to increased service quality, customer loyalty, and overall organizational performance.

## 4.5. Operational improvement proposals

The following remarks outline the key operational improvements proposed to address the inefficiencies identified in the current value stream. These recommendations focus on streamlining processes, enhancing communication and information flow, reducing non-value-adding activities, and ultimately improving the overall efficiency and effectiveness of the after-sales service operations.

### 4.5.1. Operational flow remarks

To introduce flow improvement on the organization and work around him, first managers need to assure that all process are clearly defined and known by everyone inside the organization.

One of the best ways to improve flow on automotive after-sales service is to have vehicle movers, people dedicated to move customer's vehicles from one area to another, like from the reception to the workshop or from the workshop to the parking lot. In that way is avoided one of the most common types of muda, unnecessary or non-required movements, not product or vehicle movements but people's ones. For example, in organizations with bigger facilities if after reception is the service advisor that brings the customer's vehicle to the workshop, it's time that he/she is not at the workplace, which may carry to not being available to receive customers who arrive at the organization and that can lead to customer's dissatisfaction, even more relevant on the first hours after opening that is when most of people deliver their vehicles at the workshop and so it will generate queues that obviously don´t please customers. On the other hand, technicians moving vehicles will reduce their productivity and increase repair time, once again one of the most valuable aspects.

Other important topic on process flow is to not change the technician responsible for a vehicle during repairs, it is a huge promoter of repeated actions, principally diagnostic ones, pure muda. To do so, as referred previously, is important to promote that all technicians can perform all kinds of works that a modern vehicle require, mechanical, electrical, electronic, and mechatronic ones. This will able the workshop manager to designate a service order to a technician who can follow all the different works on it, therefore there will not be any repeated actions and no doubts that all the works have been performed. It's also relevant that the workshop managers have in consideration the technician's vacations and, designate simpler works, that can be finished until the day that the technician is going to be out for a few days.

Parts availability can also be a flow interruption point, to avoid that, stock management and pre-picking are essential. Over the appointment preparation process, a good communication between reception and parts department is extremely important to assure that all parts needed will be available, in that way the technician will be able to perform all needed tasks in a continuous way, decreasing repair time and increasing repair quality, once that interrupt a work to wait for parts creates a great possibility of forgetting any electrical connections or hoses that have been disconnected, for example.

Wear parts consumption profiles analysis for inventory management will also lead to decrease flow interruption, parts wear will depend on different aspects of the vehicle use. Parts like clutch plates, engine flywheel or similar don't make sense to keep in inventory as

they have less turnover rate and will probably stay on the shelfs for a long time, other ones like tires, brake pads and discs that have an high turnover rate are essential to keep in stock, especially because customers see, for example, brakes replacement as an easy and regular job, if a vehicle has to stay at the workshop for two or three days for brake pads replacement, it will generate customer's dissatisfaction.

### 4.5.2. Operational pull remarks

On the services industry, pull principle is all about inventory management, is a way to reduce inventory by only do certain task when customers ask to, only purchasing the specific tools and parts for the specific services to be performed when needed. Inventories are one of the biggest assets inside the organization, as so his volume a great indicator of the organization wealth and his management and profitability are essential for the organization's success and growth.

On the other hand, as seen before, repair time and parts availability is one of the most valuable aspects for customers and is a huge risk on customer's dissatisfaction, therefor stock management is an essential key to for the adding value activities.

### 4.5.3. Stock management

Parts department manager and after sales manager need to be extremely careful on stock management that tend to focus in three main questions:

1. How much to order?
2. When to order?
3. What is the safety stock so that there are no stockouts?

Inventories are identified as one of the most common types of muda, so it´s important to keep in mind that low turnover rate stock is immobilized capital that could be invested in other business areas or applied in stock with higher turnover rate reducing the risk of disruption.

Creating stocks have the purpose to serve customers' immediate consumption needs while allowing the organization assure parts availability on delivery delays or occasional high demands, for example when there is an unusual wear on some models' parts after release and that has no recall campaign from the manufacturer or before summer vacations

when customers usually attend to the workshop for maintenance and a check-up for security reasons.

There are three main costs to consider in stock management:

- Ordering cost – costs related to ordering, transport, and shipment arrival confirmation. Usually related to a progressive discount, that means an inverse proportionality with the number of ordered items.
- Holding cost – costs related to the maintenance and storage of items, facilities, insurance, taxes, obsolescence, and deterioration of items, usually there is a proportional correlation with the number of items in the inventory.
- Disruption costs – costs arising from parts unavailability for external customers or internal maintenance that can lead to production downtime, extended delivery times and naturally dissatisfaction or loss of customers.

The EOQ is a variable that gives managers the correlation between order and holding costs as shown on Figure 4-3 and is a great tool to answer the first stock management question.

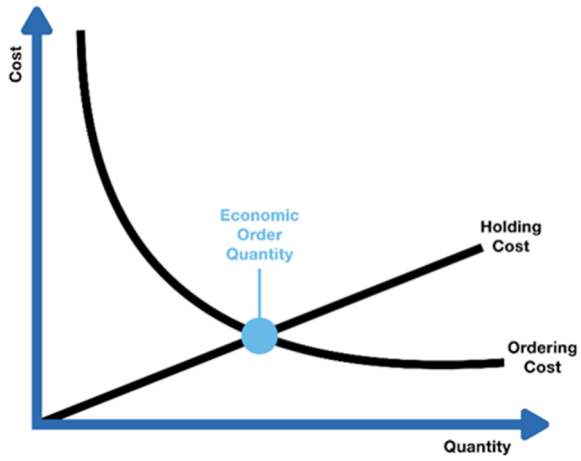


**Figure 4-3 - Economic order quantity (Weastherwax, 2024)**

This variable can be translated do the following expression:

$$Q^* = \sqrt{2 \times \frac{C_e \times D}{i \times c}}$$

Where:

$$C_e = Unitary\ order\ cost$$

$$D = Anual\ demand$$
$$i = Possesion\ cost\ rate\ in\ percentage\ of\ cost\ (\%/year)$$
$$c = Unitary\ cost$$

When to order is also an extremely important question on stock management to avoid stockout of parts needed to fulfill customers' demand. To answer that, the first thing that manager needs is to have a complete knowledge over the items that are part of the stock and classify them.

### 4.5.4. ABC method

The ABC method classifies all the items between three categories:

- Cat. A – Represent 20% off all the items in stock but 70% off the stock value, as said so these items are more relevant and have a higher value, for that reason, they need a strict management control.
- Cat. B – For their value and quantity they have an intermediate relevance, represents 20% of all items in stock as well as of the stock value.
- Cat. C – Less relevant items that represent 60% of all items and only 10% of the stock value.

These categories are represented on the following Figure 4-4.

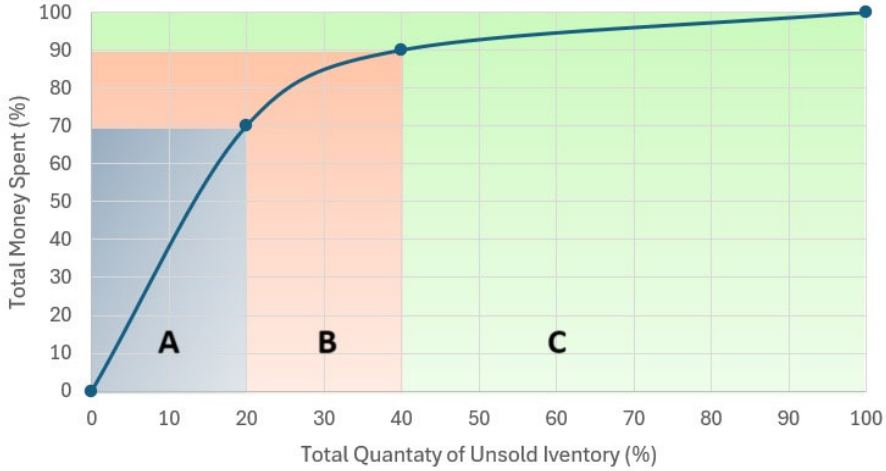


**Figure 4-4 - ABC stock management method.**

After application of the ABC method, managers should have an accurate view over the items that are part of stock and the ones to be focused on for their sales volume and profitability for the organization.

Then it's time to review the ordering process, the main variables for ordering are quantity and frequency, usually one of them is fixed depending on item categories.

### 4.5.5. Continuous review

For A and B class items the continuous review method fixes the order quantity with a variable frequency. In this method there are two relevant points to be considered, ordering point, which means that the order is taken every time the number of existing items in stock reach a certain level, and safety stock that is the number of items needed to fulfill customer´s need for the new order provision time, i.e. the time between order placing and the parts becoming part of the stock that depends on supplier stock, production time, transportation time and payment conditions.

Ordering point ($O_p$) can be defined by the following equation:

$$O_p = C_{Av} \times L + S_S$$

Where:

$$C_{Av} = Average\ Consumption$$
$$L = Provision\ time$$
$$S_s = Safety\ stock$$

And:

$$S_s = Z_x \times \sigma \times \sqrt{L}$$
$$Z_x = Probability\ of\ rupture\ assumed\ by\ the\ organization$$
$$\sigma = standard\ deviation$$

Figure 4-2 illustrates the ordering process.

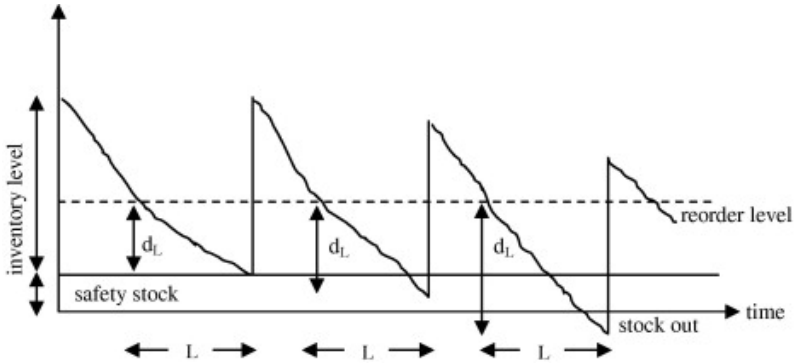


**Figure 4-5 - Continuous review method (Setyaningsih & Basri 2012)**

Since A and B class items have a lower turnover rate, a periodic order placing would most likely continuously increase the stock level considering that it will take more time to resell those items and, as so, they are less likely to stockout even with supply delays, besides that A and B class items represent 90% of the stock value and have higher holding costs, then if the number of items increase the immobilized capital will also increase.

### 4.5.6. Periodic review

On the other hand, C class items have a higher turnover rate and can be reviewed periodically, the periodic review method stablishes the ordering periodicity with a variable quantity that tends to get the number of items in stock to maximum.

Because of the vulnerability of supply time this method needs higher stock levels to avoid stockout and that's why this method fits better for C class items since they have less value and again, a higher turnover rate.

Since order placing is periodic it´s important to have this point in consideration to determine stock level goal and safety stocks, as so, stock level goal, for this method, is defined by the following equation number X:

$$SL_g = C_{Av} \times (L + P) + S_S$$

Where:

$$SL_g = Stock\ level\ goal$$
$$P = Review\ periodicity$$
$$S_s = Safety\ stock$$

And safety stock is defined by equation number X:

$$S_s = Z_x \times \sigma \times \sqrt{L + P}$$

The number of items to order is the difference between the stock level goal and the actual number of items in stock, figure 4-6 shows the ordering process.

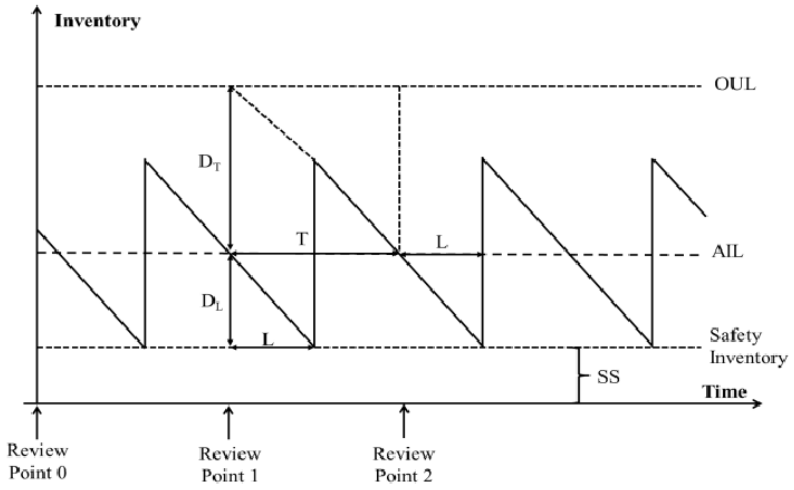


**Figure 4-6 - Periodic review method (Dutta & Chakraborty, 2007)**

C class items are usually perceived by customers as more common ones and therefore it's essential to keep stock levels monitored and avoid any risks of stock out as well as it´s important to review order periodicity once any change on items' demand can lead to over stock and that's pure muda.

Applying the pull principle is about have in consideration parts demand to only have on the organization stock items that customers need and ask to. On all these methods is taken in consideration average consumption, reducing risks of overstock and stockout, banishing waste and focusing on what customers value since parts unavailability lead to interrupt flow inside the organizations processes and increased service time.

### 4.5.7. Perfection

Implement the lean thinking on an organization is an endless job, there is always room for improvement. Figure 4-7 illustrates how Lean Thinking implementation flows throw management decisions.

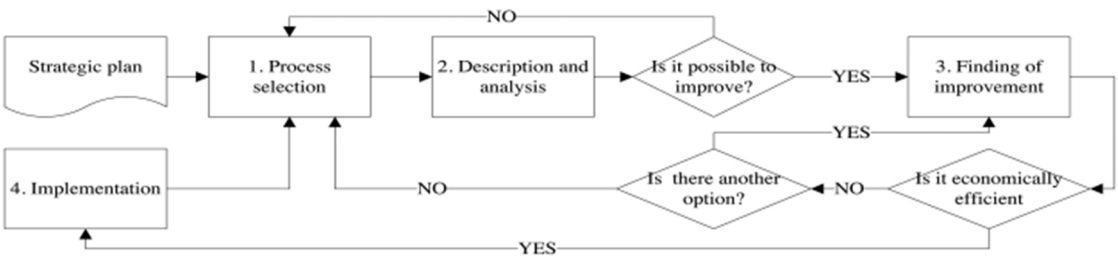


**Figure 4-7 - Process improvement procedure (Rohac, 2014)**

As shown, it´s a cyclic process with no end to it, Lean Thinking not only requires managers to have great analyze skills but also to be as creative as possible to see the bigger

picture and all the changes required to improve processes, customer, and team members satisfaction.

Teams' motivation and satisfaction inside the organizations are essential for the success of Lean Thinking implementation, a motivated team will not only increase productivity but also be more open to changes, and on a Lean Thinking company there will be a lot of them, from time to time, seeking continuous improvement and perfection over the processes.

As said so, it's important for manager to have in consideration the needs of all the team members, promoting that they are listened and the process changes lead to simplify them, giving all team members more time and motivation to focus on the VAA (Value adding activities), for example, by simplifying processes service advisor can have more time to invest on their relationship with customers increasing value and customer satisfaction.

There have been identified seven common types of waste (Ohno & Bodek 1988):

1. Overproduction
2. Inventories
3. Unnecessary processing
4. Non required motions
5. Defects
6. Waiting
7. Transportation

Later, it was added underutilized Human knowledge, skills, and abilities.

The technological revolution and its exponential improve over the last decades have created another type of muda, the technological resources one, that I've been experiencing and observing over nearly two years.

## 4.6. Improved value stream proposal

Analyzing the current state VSM (Figure 4-2), It can be observed that significant data transactions are required for a single costumer visit. Hence, all such information is considered vital, not only by the organization, but also for manufacturers and technicians to carry out the work and related processes.

For the technical intervention to be performed correctly, which leads to increase customer satisfaction and retention, it is unavoidable that all this data needs to exist and needs to reach the different business areas as that customers can be won or lost due to administrative processes that go along with services transactions (Tapping, 2005).

The problem lies over the way information and data flow throughout a customer's visit, information circulates over and over to different business areas like reception, workshop, parts department, warranty department when it could be concentrated in a single point and be consulted by everyone.

Let's take for example, a customer appointment for a regular maintenance where some additional works are found within the process:

i) Service advisor creates a pre-service order and verifies that a recall campaign is available for the vehicle, requests pre-picking for all interventions and a requisition is made to the parts department, that then will inform the service advisor for parts availability, and depending on that, there can be need to reschedule with the costumer, if all parts are available the service advisor will confirm the appointment.

ii) After reception there could be found some vehicle needs like tires or wiper blades for example, that will need once again to be checked for availability, and perhaps a new requisition.

iii) While technical interventions are being performed, the related technician identifies the need to replace a coolant hose, then the technician will leave the workshop and go to the reception, waiting for the service advisor to be available and inform him/her.

iv) Following the previous steps, the service advisor will then make a cost estimate, contact parts department for parts availability and price, add labor, ask for customer's permission, after acceptance a new requisition is made to the parts department, and the technician will be informed and perform the additional work.

v) Once this vehicle had a recall campaign, different kinds of information will be needed, depending on the vehicle manufacturer, like photographs or videos of the license plate, VIN number, changed parts, also DTCs report before and after works, that need to be handed over to the warranty department.

The significant issue that has been found within these processes is that usually all this vital information is carried in papers or transmitted verbally, as so, it can lead to miss understandings, loss of information, and loss of a lot of time on waiting for all this information being caried out from one place to another. As a result, significant overproduction takes place, as multiple requisitions are created and unnecessary processing is carried out as a large amount of paperwork is printed multiple times, unnecessary motions take place for different collaborators to get the information needed and sometimes they even will need to wait for others availability. This is pure muda!

### 4.6.1. Goal VSM

Considering the above discussion, an improved value stream (Figure 4-8) was designed and proposed as the goal VSM for a new process and information flow for the organization. The main goal of this proposal is to simplify processes and reduce the amount of energy and time spent on these activities and apply it on processes that add value from the customer's perspective.

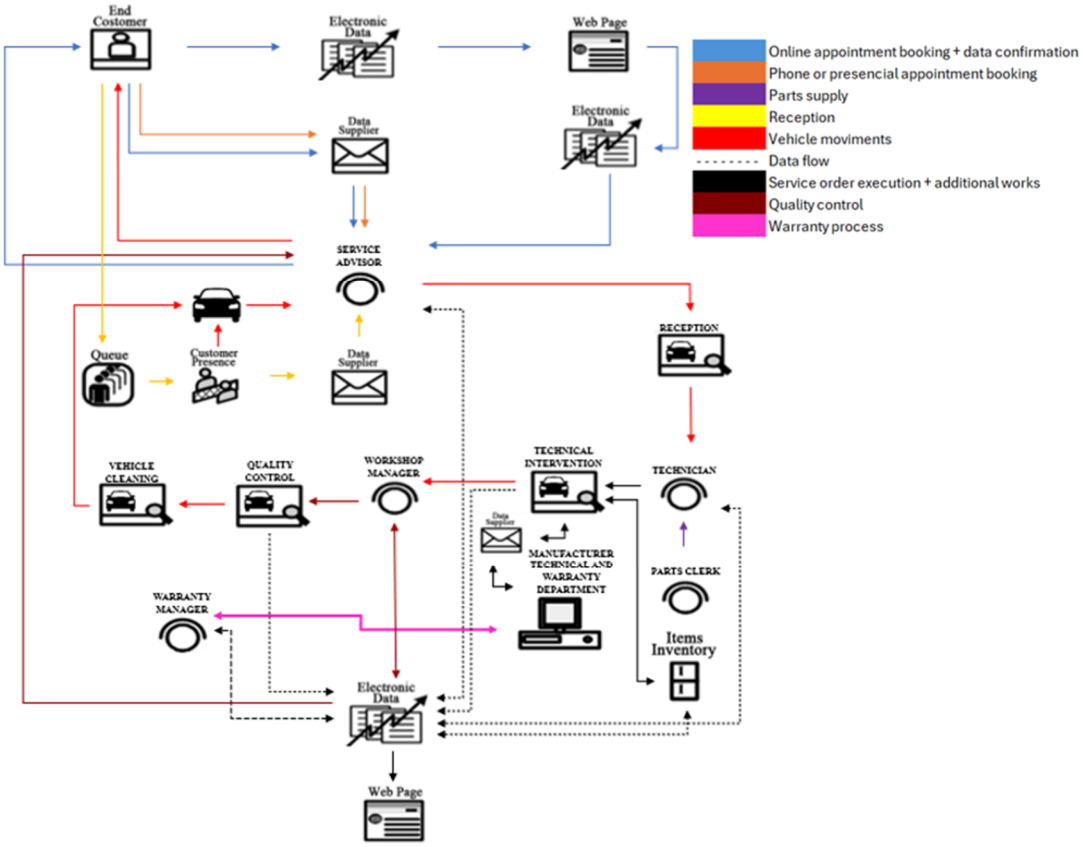


**Figure 4-8 – Goal VSM.**

To do that it was developed, using the Google Forms platform, a new solution where all information can be uploaded:

1. Starting on reception the first section of the Forms is vehicle information, that asks the service advisor for vehicle brand, license plate number and millage, then using the code implemented on the Forms App Script, creates a folder named with the vehicle license plate number, millage, and entry date, where all files will be uploaded, this folder will be inside a specific Google Drive folder for the vehicle brand.
2. Second section is about the vehicle condition, depending on the brand selected different option will be available for Service Advisor and Technician names. The service advisor must select the technician to whom the service has been assigned, that will be necessary for the notification systems, implemented via Forms App Script.
3. On the same section the service advisor will have a dedicated space to upload vehicle pictures, including all vehicle damage, this will ensure that the

organization have proof of any damages presented on the vehicle at the time, and therefor in case customers states any damage after visit those pictures will verify if those damages were made previously or not, to help with that process is also available a scheme with numbered vehicle panels to identify damages, it would be recommend the upload of a license plate and a VIN number picture for warranty purposes.

4. At the same Forms section, is also a wiper blade and tire verification with measurement for each individual tire, by promoting those verifications it will increase service advisor's probability of selling additional services once the customer can see with is own eyes all the anomalies, by carrying out these verifications in front of the customer it shows concern for his vehicle condition and his safety, aspects that are highly valued, increasing the trusting relationship with customers.
5. At the end of this section is a space for comments where the service advisor can write all kinds of useful information for the service, like tire size and brand that will help the parts department to identify and give a quote for them.
6. Still on section number two it's asked for the service advisor to verify the next date for the next mandatory annual inspection and since the next preventive maintenance service can be by time or traveled kilometers, which one comes first, it's also asked to verify both, those will be extremely important for the delivery process, by giving this information to the customer it will create an unconscious commitment for that service and therefor promote customer retention.
7. Last question before the service advisor comments is to check the connectivity options of the vehicle. Connected services are not only a great tool for customers to always be connected with their vehicle, it's also extremely important for the organization, some brands let customers chose a preferred repairer, by selecting the workshop the vehicle himself will generate Leads that will inform the organization whenever a fault light appears as well as the approach of maintenance services, allowing to contact the customer and make those diagnostic or maintenance appointments, once again making the customer's experience and interaction with the authorized repairer simpler and promoting customer's retainability. As so the first two sections are dedicated for the service advisor responses, once all the mandatory responses are on these sections, it's possible to submit the form without answering the remaining. That will send notifications,

with an edit link and via email, to the designated technician, who will know that the vehicle assigned to him is already on the facilities and will be able to start works soon, as well as the parts department, which will be able to verify the need to identify and quote parts and submit those quotes, by doing that the service advisor will then be notified.

8. The following section number three is dedicated to the technician, in this section it's asked to identify as ok and not ok all the verifications included in all services, such as front and rear suspension, front and rear brake pads and discs, the battery test, steering alignment, etc. Then there is a yes or no question for warranty interventions, as so, in case of affirmative answer the warranty department collaborators will also start to be notified for Form changes. At the end there is a comments section where the technician can list other needs or indicate that he has uploaded files for the warranty process or a cost estimate for a necessary intervention that is not on the service order, pending acceptance.

### 4.6.2. Summary and discussion

The proposed notification system implemented allows early on the process that as soon as the service advisor submits the Form, the parts department is notified and consequently be able to inform availability and prices of the necessary parts, as so, the service advisor can inform the customer before he leaves the facilities, the selling probability increases since the customer will not be so inclined to check the prices charged by competitors and his experience is simplified, going to the same service provider for all necessary work.

This means that the technician does not need to leave the workshop and go to reception, wait for the service advisor to be available and wait for the cost estimate to be approved, as the advisor has been notified, it will respond as soon as possible, while the technician performs the remaining works.

By using App Script on this Form, based on responses like name of the service advisor, name of the technician and brand to notify the right parts clerk, it's possible to automatically notify only the interested collaborators and, once the form is editable, in case of any changes on the people involved in situations of vacations or sick leave this method will assure those changes. Whenever changes are made, all those involved will be notified, ensuring that there

is no interruption in the flow of information, reducing the risk of losing information or misunderstandings. The entire process can be carried out on any device with internet access and an organization email account, in other words, the service advisor will be able to use his computer, service cell phone or tablet, the first being more suitable for uploading files and quotes, for example, and the last two will be very practical for uploading photographs and all other responses next to the vehicle, this is also valid for the remaining people involved.

Beside increase the ease of communication, as Google Forms saves all responses on a Google Sheets spreadsheet all kinds of data analysis can be done, per example, service advisors' performance on identifying anomalies and sells on tire services, wiper blades, and everything that can be verified at the reception, technician performance on identify vehicle needs at the included verification service. By comparing the performances of different people within the same brand, their strengths and weaknesses and promoting the sharing of information between them will bring continuous improvement for all employees at the organization.

It can also be useful to analyze the wear profiles of a specific customer, filtering by license plate for example, on long term this will allow the service advisor to predict the needs at the booking phase and therefor parts will be available, reducing service time and increasing customer satisfaction.

Since manufacturers usually use the same parts provider for different models, and as so the same kind of materials on wear parts, the whole brand can be analyzed, comparing the identified needs with the actual sales will be useful in inventory management, which as previously mentioned is one of the main types of waste identified, this analysis will get to the organization the same kind of benefits as the individual vehicle analysis.

# 5. Summary and Discussion

### 5.1.1. Key-findings and takeaways

The research initiated with the mapping of the current state value stream, documented through participant observation, informal interviews, and process walkthroughs. This approach allowed for an accurate depiction of the service delivery process, encompassing booking and appointment planning, reception and active diagnosis, technical intervention, quality control, vehicle cleaning, and customer delivery and follow-up.

The current state VSM (Figure 4.2) revealed several inefficiencies within the existing processes:

- Redundant administrative tasks, particularly during booking and data collection, resulting in wasted time and increased workload for service advisors.
- Delays in parts availability confirmation, often due to fragmented communication between service advisors and the parts department, leading to last-minute rescheduling and customer dissatisfaction.
- Inconsistent application of active reception practices, causing variability in customer experiences and missed opportunities for identifying additional service needs early in the process.
- Waiting times during technical interventions, as technicians frequently paused work while awaiting customer approvals for unforeseen repairs. These interruptions directly impacted workshop productivity and contributed to extended lead times.
- Non-standardized quality control and vehicle cleaning procedures, resulting in variation in service quality and further delays in the final vehicle delivery to customers.
- Limited integration of information systems, with reliance on manual data handling and insufficient use of the Dealer Management System (DMS), leading to redundant data entry and lack of real-time visibility over the status of service orders.

Quantitative data gathered during the study confirmed that value-adding time was significantly outweighed by non-value-adding time, particularly in the form of waiting,

unnecessary motion, and excessive processing. The cumulative effect of these inefficiencies was reflected in extended lead times, reduced First Right First Time performance, and lower customer satisfaction scores.

Based on the current state analysis, the study proposed a set of operational improvements grounded in Lean Thinking principles, aimed at reducing waste, streamlining processes, and enhancing customer-perceived value.

- Improved information flow and system integration: One of the primary recommendations was the enhancement of the Dealer Management System to reduce manual data entry and improve real-time information sharing between departments. This includes integrating the booking system with the parts inventory database to confirm parts availability at the time of scheduling.
- Standardization of customer reception processes: By formalizing the active reception process and ensuring consistent application across all service advisors, the workshop can improve early problem identification, increase upselling opportunities, and enhance customer trust.
- Optimization of parts management: Implementing ABC classification and EOQ analysis for parts inventory was recommended to ensure critical components are always available, thus minimizing service delays.
- Reduction of technician downtime: Introducing dedicated support staff for non-core tasks, such as moving vehicles or fetching parts, allows technicians to focus solely on value-adding repair activities, thereby improving overall productivity.
- Enhanced quality control and cleaning coordination: Standardizing quality control procedures and better aligning the scheduling of vehicle cleaning with service completion times can reduce lead times and ensure consistent service quality.
- Proactive customer communication and follow-up: Personalizing the follow-up process by maintaining consistent points of contact throughout the service journey fosters stronger customer relationships and increases satisfaction.

The empirical data collected through direct observation and informal interviews enriched the understanding of real-world operational challenges in the automotive after-sales sector. Unlike previous studies that focused primarily on Lean applications in manufacturing, this research demonstrated how Lean principles can be adapted to a service-based environment characterized by high customer interaction and service complexity.

### 5.1.2. In-house validation of the operational contributions

Working on a multi-brand organization the implementation of this new solution was made on the least representative workshop, that means the one with the lower amount of vehicle entrances per day. As the main users of this solution were the service advisor, technicians, parts clerk and the warranty manager, the conclusions of this implementation had to be taken in consideration of their opinion.

The organization's service advisor states that, besides the time taken to adapt to this different work method, the solution is user friendly and have given her more freedom to concentrate her energy and time on customer's relation, once communicating with all the others was easier, information didn't got lost and there was no need to print and scan documents over and over again to send them to all the people involved.

Technicians have said that their work was simplified on aspects like not waiting on the reception for the service advisor to finish talking to a customer to ask for permission on additional services and therefor start performing the remaining works, they felt more productive. On the other hand, they were pleased for the availability of documents upload allowed them to just download the manufacturer parts list for a specific service and upload without the need to write all parts references.

Parts clerk states that the notification system was extremely helping in a way that the amount of nonapproved electronic requisitions decreased, which means requisitions that were made just for quotation, reducing the number of requisitions on the DMS and making it easier to focus on parts supply.

Once all documents were concentrated at the same place the warranty manager have found himself not searching for them with the service advisor or the technicians, once there was less risk for documents to get lost or being forgotten to send to him the amount of time wasted was reduced.

As said so, this implementation was successful on its main goal, to simplify processes for the involved collaborators while letting them focus on the adding value activities.

The main flaw presented is the lack of DMS integration, which is desired by everyone, as so future works adjacent to this implementation would be to create this integration with the IT team, and as so implement it on the other brands workshops.

As Lean Thinking is endless on seeking perfection and continuous improvement it will be important to monetarize customers' satisfaction evolution, the improvements on FRFT, stock management evolution and collaborators satisfaction, looking for all kinds of waste presented on the current process and searching to eliminate it.

On the personal level all goals were achieved over the development of this project and dissertation, I feel that my personal and working experience over the last year have improved my management knowledge and skills, being one step closer to be capable to manage workshop teams and an after sales service on the future.

### 5.1.3. Strategic implications for the organization

One of the most critical contributions of the future VSM is the establishment of a streamlined, pull-based process that reduces lead times, minimizes waiting periods, and ensures that value-adding activities are prioritized. The future VSM eliminates unnecessary steps, particularly those associated with redundant data entry, inefficient communication, and uncoordinated scheduling of resources. By simplifying these processes and enhancing system integration—particularly between booking systems, parts inventory management, and workshop scheduling—the organization can achieve a more continuous and predictable workflow.

Additionally, the future VSM emphasizes standardization in key areas such as active reception, quality control, and follow-up. These standardized procedures not only improve service consistency and quality but also provide the basis for more accurate performance measurement and continuous improvement initiatives. As a result, the organization is better equipped to monitor KPIs, such as FRFT rates, lead times, and customer satisfaction scores, and to respond proactively to any deviations from the desired performance levels.

From a customer perspective, the implementation of the future state VSM ensures a more seamless and transparent service experience. Reduced lead times, reliable communication, and personalized customer engagement contribute directly to higher satisfaction and loyalty, which are critical factors in the highly competitive after-sales market.

Operationally, the future VSM also facilitates more effective resource utilization. By reallocating tasks—such as the movement of vehicles and procurement of parts—to dedicated support roles, skilled technicians are able to focus exclusively on core value-adding activities. This targeted use of human resources enhances overall productivity,

reduces process variation, and supports the development of a more engaged and specialized workforce.

Strategically, the future state VSM positions the organization to adopt a culture of Lean continuous improvement. It serves as a visual management tool that aligns all stakeholders—from front-line staff to management—around a common vision of operational efficiency and customer value creation. As a result, the future state VSM is not merely a tool for process redesign but a foundational element of the organization’s broader Lean transformation strategy.

In summary, the proposed future VSM delivers a comprehensive framework for improving service quality, increasing operational efficiency, and enhancing customer satisfaction. It provides clear guidance on where and how to eliminate waste, streamline workflows, and embed Lean Thinking principles into everyday practice, ultimately supporting the organization's long-term competitiveness and profitability in the automotive after-sales sector.

# 6. Conclusions and future works

This study investigated the implementation of Lean Thinking within the automotive after-sales sector, focusing on the identification and optimization of the value stream to enhance operational efficiency and customer satisfaction. Through an in-depth case study carried out in an authorized automotive workshop, and adopting a qualitative, observatory participant research approach, the study has provided empirical insights into how Lean principles can be effectively adapted and applied in a service environment characterized by high variability, customer interaction, and complex operational demands.

Key empirical contributions of this study include evidence that standardization and system integration are critical enablers for Lean success in after-sales operations, where variability and customer expectations are high. This study also showed that active reception and personalized follow-up are significant value-adding activities that directly enhance customer satisfaction and loyalty.

The implementation of the proposed future state value stream is expected to bring substantial and measurable benefits to the organization's after-sales service operations. One of the most significant improvements anticipated is the reduction in overall service lead time. By streamlining processes, eliminating unnecessary steps, and improving coordination between departments, the time required to complete service orders will decrease. This reduction not only enhances the efficiency of internal workflows but also translates into shorter waiting times for customers, ultimately contributing to higher levels of customer satisfaction.

Another key benefit of the future state value stream is the improvement in FRFT performance. By standardizing procedures and ensuring that diagnostic and repair processes are executed correctly from the outset, the likelihood of errors and omissions is reduced. This leads to a decline in the number of customer complaints and a decrease in the need for rework. As a result, customers perceive a higher level of quality in the service provided, which reinforces trust in the organization.

In addition to quality improvements, the future value stream enables increased productivity and operational efficiency. Through the better allocation of technician time and the reassignment of non-core tasks—such as vehicle movement and parts retrieval—to

support staff, technicians are able to focus exclusively on value-adding repair activities. This targeted approach minimizes idle time, enhances resource utilization, and boosts the overall throughput of the workshop.

The implementation of the improved value stream also plays a critical role in strengthening customer loyalty and retention. By delivering a consistent and personalized customer service experience—characterized by transparent communication, reliable appointment scheduling, and proactive follow-up—the organization fosters stronger relationships with its customer base. Satisfied customers are more likely to return for future services and to recommend the workshop to others, which is essential for sustaining long-term competitiveness in the automotive after-sales sector.

Moreover, the study highlights the importance of fostering a culture of continuous improvement as an integral part of the organization's Lean transformation. The successful application of the future state value stream map is not a one-time initiative but a foundation for ongoing process refinement. By embedding Lean Thinking principles into daily routines, the after-sales service team can continuously monitor operations, identify new inefficiencies, and implement corrective actions in a systematic and timely manner.

In conclusion, the adoption of the proposed future state value stream map represents a strategic opportunity for the organization to achieve sustainable operational excellence. Through a combination of reduced lead times, improved service quality, enhanced productivity, and increased customer satisfaction, the organization is well-positioned to realize significant competitive advantages. By promoting a continuous improvement mindset, the after-sales service team can ensure that these gains are maintained and further developed over time.

This research confirms that Lean Thinking offers a structured and effective methodology for improving processes in the automotive after-sales sector. By focusing on value from the customer's perspective, identifying waste, and fostering cross-functional collaboration, organizations can enhance their service quality, operational efficiency, and competitive advantage.

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