Trabajo de integración Curricular previa a la obtención de título de Master en Ingeniería Automotriz con mención en procesos y calidad de servicio automotriz.

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Implementación de Estrategias de Mejora Continua Para Fortalecer la Gestión de Calidad en el Mantenimiento Preventivo y Correctivo: Caso de Estudio en un Taller Concesionario

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APROBACIÓN DEL TUTOR DEL TRABAJO DE INTEGRACIÓN CURRICULAR

Yo, Soraya Nathalie Ruiz Salazar, en calidad de tutor del Trabajo de Integración Curricular denominado: Implementación de Estrategias de Mejora Continua Para Fortalecer la Gestión de Calidad en el Mantenimiento Preventivo Y Correctivo: Caso de Estudio en un Taller Concesionario realizado por Eduardo Xavier Guevara Barros, Juan Pablo Silva Cortez, Roxanna de los Ángeles Caisa Fajardo ha sido orientado y revisado en todas sus partes y considero que cumple los requisitos establecidos por la institución. En virtud de ello doy mi aprobación a fin de continuar con el proceso académico correspondiente.



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Juan Fernando Iñiguez Izquierdo

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Gabriela Fernández

Gestora Cultural

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A mi familia, por su apoyo inquebrantable, por enseñarme que la constancia y el amor son la base de todo logro.

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IMPLEMENTACIÓN DE ESTRATEGIAS DE MEJORA CONTINUA PARA FORTALECER LA GESTIÓN DE CALIDAD EN EL MANTENIMIENTO PREVENTIVO Y CORRECTIVO: CASO DE ESTUDIO EN UN TALLER CONCESIONARIO

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RESUMEN

Introducción: El estudio evaluó el proceso operativo del técnico-asesor en un concesionario automotriz de Quito, con el fin de identificar ineficiencias en los servicios de postventa para mantenimiento preventivo y correctivo, estandarizar procedimientos y fortalecer la calidad del servicio. Para ello, se aplicó metodologías de mejora continua basadas en Kaizen, 5S e ISO 9001:2015, integrando control visual, estandarización documental y acciones de optimización del flujo operativo. **Metodología:** Se combinó un enfoque cuantitativo, mediante el análisis censal de 2.072 órdenes de trabajo (enero–agosto 2025) y encuestas NPS, con un enfoque cualitativo, basado en observaciones del proceso, análisis causa efecto (Ishikawa) y diagnóstico organizacional. El diseño fue cuasiexperimental, comparando indicadores antes y después de la intervención, con mediciones sistemáticas de tiempos de servicio, reprocesos y satisfacción del cliente. **Resultados:** evidenció mejoras relevantes tras la aplicación del plan de mejora continua. El tiempo promedio de servicio se redujo de 119,81 min a 95,40 min, acompañado de una disminución de la variabilidad (CV de 29,1 % a 3,61 %). El porcentaje de reprocesos pasó de 6,37 % a menos del 0,35 %, mientras que el Net Promoter Score (NPS) aumentó desde 88,8 % hasta valores superiores al 95 %, reflejando una percepción altamente favorable del servicio. **Conclusión:** la implementación integrada de Kaizen, 5S e ISO 9001:2015 fortaleció la disciplina operativa, mejoró la estabilidad del proceso y elevó la calidad percibida por el cliente. Los hallazgos evidencian que la mejora continua constituye un mecanismo eficaz para optimizar la gestión posventa y fortalecer la competitividad del concesionario.

Palabras clave: Mejora continua, eficiencia operativa, satisfacción del cliente, técnico-asesor, Kaizen, 5S, ISO 9001:2015.

ABSTRACT

Introduction: The study evaluated the operational process of the service technician–advisor at an automotive dealership in Quito, with the aim of identifying inefficiencies in preventive and corrective maintenance services, standardizing procedures, and strengthening service quality. To achieve this, continuous improvement methodologies based on Kaizen, 5S, and ISO 9001:2015 were applied, integrating visual control, documented standardization, and operational flow optimization actions. **Methodology:** A quantitative approach was combined—using a census analysis of 2,072 work orders (January–August 2025) and NPS surveys—with a qualitative approach based on process observations, cause–effect analysis (Ishikawa), and organizational diagnosis. The design was quasi-experimental, comparing indicators before and after the intervention through systematic measurements of service times, rework, and customer satisfaction. **Results:** Significant improvements were observed after the implementation of the continuous improvement plan. The average service time decreased from 119.81 min to 95.40 min, accompanied by a reduction in variability (CV from 29.1% to 3.61%). The rework rate decreased from 6.37% to below 0.35%, while the Net Promoter Score (NPS) increased from 88.8% to values above 95%, reflecting a highly favorable perception of the service. **Conclusion:** The integrated implementation of Kaizen, 5S, and ISO 9001:2015 strengthened operational discipline, improved process stability, and enhanced the quality perceived by customers. The findings demonstrate that continuous improvement is an effective mechanism for optimizing after-sales management and reinforcing the dealership's competitiveness.

Keywords: Continuous improvement, operational efficiency, customer satisfaction, service technician–advisor, Kaizen, 5S, ISO 9001:2015.

INTRODUCCIÓN

La calidad del servicio postventa en el sector automotriz es crucial para la fidelización y sostenibilidad de las marcas (Balinado et al., 2021a). Los concesionarios deben transformar sus procesos de mantenimiento mediante metodologías que mejoren la eficiencia operativa y también la satisfacción del cliente percibida, lo que fortalece la competitividad del servicio (Titu et al., 2025). El concesionario estudiado, ubicado en Quito, presenta reprocesos internos y externos, demoras en los servicios y reducción de la satisfacción del cliente, afectando costos, fidelización e imagen de marca. Aunque dispone de personal y recursos adecuados, carece de una estructura formal de mejora continua, lo que ocasiona ausencia de estandarización, errores recurrentes y una gestión de calidad limitada, evidenciando la necesidad de aplicar estrategias basadas en modelos comprobados.

La investigación destaca la utilidad de metodologías de mejora continua para optimizar procesos de mantenimiento automotriz, empleando Kaizen, 5S e ISO 9001 (Quiroz-Flores et al., 2023). Kaizen impulsa la participación del personal y una cultura de mejora; 5S promueve orden y disciplina para la productividad; e ISO 9001 establece procedimientos documentados que aseguran coherencia y trazabilidad (Titu & Pop, 2025). Su aplicación conjunta reduce tiempos no productivos, minimiza costos por reprocesos, incrementa la confianza del cliente y fortalece la competitividad al alinearse con estándares internacionales (da Fonseca et al., 2019a).

La investigación tiene relevancia académica y profesional al abordar una problemática frecuente en talleres concesionarios con un enfoque técnico y sistemático. Económicamente se puede reducir costos operativos al minimizar desperdicios y optimizar los recursos, socialmente se fortalece la confianza con el cliente y se genera relaciones más sostenibles entre los consumidores y concesionarios.

MARCO TEÓRICO

En los servicios automotrices actuales, para medir el desempeño resulta fundamental evaluar la efectividad de los procesos de servicio y asimismo, la satisfacción

brindada a los clientes (Balinado et al., 2021b). Los indicadores de desempeño (KPI) cuantifican los resultados frente a los objetivos estratégicos y apoyan a las decisiones basadas en evidencias (Nunes et al., 2024). Entre los más relevantes está el Net Promoter Score (NPS), permite medir la lealtad según la disposición del cliente para así recomendar el servicio (Nadanyiova et al., 2022). Junto con otros KPI como son, el tiempo de servicio, la tasa de reprocesos y el cumplimiento de estándares ofrecen una visión integral del desempeño y también de la satisfacción percibida por parte del cliente, permitiendo identificar mejoras y así fortalecer la gestión de la calidad (Balinado et al., 2021c).

La gestión de la calidad automotriz ha evolucionado hacia modelos que integran la mejora continua, estandarización de los procesos y enfoque al cliente (Titu & Pop, 2025). En este marco, herramientas como 5S, Kaizen e ISO 9001 han demostrado eficacia para optimizar el desempeño operativo y así fortalecer la satisfacción del cliente (Quiroz-Flores et al., 2023).

1. Normativa

1.1. ISO 9001:2015

La norma ISO 9001:2015 establece los principios para un Sistema de Gestión de la Calidad basado en el enfoque hacia el cliente y la gestión por procesos conjuntamente con la mejora continua (Díaz et al., 2025) orienta políticas internas alineadas con requerimientos de los clientes, gestión de riesgos y evaluación sistemática de la satisfacción. Su implementación permite documentar los procedimientos, controlar las desviaciones y generar las evidencias de desempeño, fortaleciendo la confiabilidad y la percepción de valor (da Fonseca et al., 2019b). De este modo, las concesiones que aplican ISO 9001 mejoran sus resultados operativos y su posicionamiento competitivo en los mercados altamente exigentes en calidad y servicio.

1.1.1.Ciclo PHVA (Planificar–Hacer–Verificar–Actuar)

El ciclo PHVA representa en el fundamento metodológico para la mejora continua en Kaizen y en la norma ISO 9001. Este modelo integra la planificación (Plan), la ejecución

(Do), la verificación (Check) y la acción correctiva o estandarización (Act)(Deeb et al., 2018). En el sector automotriz, permite estructurar proyectos de mejora para evaluar su impacto y mediante los indicadores operativos asegurar la sostenibilidad de los resultados. Su carácter iterativo garantiza la retroalimentación constante y el aprendizaje organizacional continuo (Deeb et al., 2018).Entre los principales enfoques aplicados al sector se destacan las metodologías 5S y Kaizen, la norma ISO 9001:2015 y la incidencia que tiene en la satisfacción del cliente y la competitividad del taller.

1.1.2.Satisfacción del cliente

La satisfacción del cliente se define como el resultado de comparar las expectativas previas del cliente y la experiencia percibida tras recibir un servicio (Balinado et al., 2021c).

1.1.3.Calidad percibida

La calidad percibida corresponde a la valoración subjetiva del cliente sobre el servicio recibido en relación con sus expectativas previas. Un servicio impecable genera confianza y refuerza la imagen profesional del taller. Asimismo, se vincula con la percepción de valor y la intención de recompra, por lo que constituye un indicador central de la satisfacción global del cliente (Balinado et al., 2021c).

1.1.4.Tiempo de servicio

El tiempo de servicio es un factor altamente sensible en la percepción del cliente ya que refleja la eficiencia del proceso y también la capacidad de respuesta del taller (da Fonseca et al., 2019b). La puntualidad en la entrega es el cumplimiento de plazos y la comunicación por demoras influyen directamente en la satisfacción. La gestión, la planificación de recursos, la coordinación interna y eliminación de reprocesos requieren ser eficaz y rápida. De esta manera, el tiempo de servicio representa un indicador clave de desempeño fundamental que refleja la eficacia del sistema de gestión de calidad.

1.1.5.Confiabilidad

La confiabilidad es la capacidad que tiene el taller para ofrecer un servicio consistente, preciso y libre de errores a lo largo del tiempo (Deeb et al., 2018). Requiere

ejecutar procedimientos conforme a estándares del fabricante empleando herramientas calibradas y manteniendo la capacitación continua. En gestión de calidad se asocia con la disminución de retornos, reclamos o devoluciones, reforzando seguridad y profesionalismo ante el cliente. Un servicio confiable no solo resuelve una necesidad puntual, sino que construye una relación de largo plazo basada en confianza y previsibilidad del desempeño (Balinado et al., 2021).

1.1.6.Atención y comunicación

La atención y la comunicación constituyen el elemento que se vincula con la calidad del servicio. Incluyen el trato cordial, la claridad en la información técnica, la transparencia en presupuestos y el seguimiento post-servicio (da Fonseca et al., 2019b). Una comunicación efectiva reduce la incertidumbre y genera percepción de acompañamiento, mientras que la empatía del asesor y su habilidad para traducir lenguaje técnico en explicaciones comprensibles fortalecen la confianza.

1.1.7.Valor percibido

El valor percibido es la evaluación subjetiva del cliente al comparar los beneficios recibidos con los costos asumidos (da Fonseca et al., 2019b). En talleres automotrices abarca precio, calidad técnica, tiempo invertido, atención y garantía. Un alto valor percibido se genera cuando el cliente considera que obtiene más de lo que paga.

2. Metodología 5S

La metodología 5S, de origen japonés, busca mejorar el entorno de trabajo mediante orden, limpieza y disciplina (Quiroz-Flores et al., 2023). Su aplicación en talleres genera condiciones favorables para la productividad y la seguridad ya que reduce los tiempos de servicio y reprocesos (da Fonseca et al., 2019b). En talleres automotrices, estos beneficios producen flujos de trabajo más ágiles y estandarizados, influyendo en la percepción de calidad y en la confiabilidad del proceso (Balinado et al., 2021d).

3. Kaizen

El enfoque Kaizen se fundamenta en la mejora continua mediante pequeños cambios sostenidos y la participación activa de toda la organización (Titu & Pop, 2025). Impulsa una mentalidad de responsabilidad y mejora que consolida el rendimiento operativo y la flexibilidad frente al mercado. En el contexto automotriz, permite minimizar correcciones, potenciar la utilización de recursos y calibrar las capacidades del taller según los requerimientos de demanda, incidiendo en la experiencia del cliente mediante una atención más expedita, adaptada y segura. Asimismo, al fomentar el diálogo interno y la solución cooperativa de dificultades, potencia indirectamente la percepción de calidad en la atención que recibe el usuario final.

4. Relación de metodologías y satisfacción al cliente

Los tiempos de atención como la eficiencia operativa, la demanda del servicio, los reprocesos, las condiciones del mercado y políticas internas determinan el desempeño operativo y por ende la experiencia del cliente. Así, la reducción de tiempos y reprocesos mediante 5S, la optimización continua de Kaizen y la estandarización bajo ISO 9001 generan servicios más confiables, oportunos y también consistentes, incrementando de forma medible la satisfacción del cliente en el taller.

En síntesis al integrar 5S, Kaizen e ISO 9001 conforma un sistema de gestión que controla variables operativas críticas, fortaleciendo la orientación al cliente y mejora la satisfacción vinculada a la calidad, tiempo, confiabilidad, atención y valor percibido (Titu & Pop, 2025). En consecuencia, el perfeccionamiento constante facilita la optimización de las operaciones internas y la transformación de la vivencia del cliente, creando un ciclo positivo de productividad, credibilidad y fidelización en el sector automotriz.

5. Diagrama de Ishikawa como herramienta de análisis operacional

El diagrama causa efecto se aplicó como recurso analítico operacional para establecer los factores originarios de los inconvenientes detectados en la evaluación inicial. A diferencia del FODA, que resume factores internos y externos con fines estratégicos, el Ishikawa profundiza en los factores técnicos que generan desviaciones como tiempos altos,

reprocesos y variabilidad del proceso. Su uso no constituye un diagnóstico paralelo, sino un complemento directo del FODA: mientras este define estrategias globales, el Ishikawa evidencia causas operativas que respaldan la selección de ISO 9001, Kaizen y 5S. De este modo, el análisis causa–efecto se integra como insumo técnico para el cruce estratégico y para definir acciones correctivas orientadas a la mejora continua.

6. Diagrama de flujo de procesos

El diagrama de flujo representa de manera gráfica el orden lógico de operaciones, bifurcaciones decisorias y asignaciones de responsabilidad dentro de un procedimiento. Su objetivo fundamental es mostrar visualmente la trayectoria del servicio desde la admisión del automóvil hasta su entrega final, reconociendo puntos críticos de supervisión, obstáculos operativos y actividades redundantes.

MATERIALES Y MÉTODOS

7. Diseño metodológico

El diagnóstico mixto es un enfoque metodológico que integra técnicas cuantitativas y cualitativas para analizar de manera integral un fenómeno o problema. El enfoque cuantitativo permite caracterizar objetivamente el desempeño operativo mediante indicadores medibles (tiempos de servicio, reprocesos, NPS), mientras que el enfoque cualitativo facilita la comprensión de las condiciones organizacionales, percepciones del personal y factores contextuales mediante observaciones directas, análisis causa–efecto y evaluación del entorno de trabajo. La complementariedad de ambos enfoques fortalece la validez de los hallazgos y fundamenta técnicamente las estrategias de mejora implementadas.

La investigación empleó un diseño metodológico aplicado con un enfoque mixto, basado en un diagnóstico integral de tipo cuantitativo y cualitativo. El diagnóstico mixto permitió, por una parte, caracterizar objetivamente el desempeño operativo del taller mediante indicadores medibles como tiempos de servicio, reprocesos y resultados de encuestas NPS; y, por otra, analizar las condiciones organizacionales y operativas a través de

observaciones directas, análisis causa–efecto y evaluación del entorno de trabajo. Este enfoque facilitó la identificación de ineficiencias, la explicación de las relaciones entre variables operativas y la fundamentación técnica de las estrategias de mejora continua implementadas.

El enfoque mixto integró datos cuantitativos indicadores de tiempo, reprocesos y encuestas NPS con información cualitativa obtenida de observaciones, percepciones del personal y resultados de 5S, Kaizen e ISO 9001. El estudio se desarrolló como un caso único cuasiexperimental y transversal, comparando resultados antes y después de la implementación de las estrategias en un periodo definido y bajo condiciones reales de operación.

Figura 1: Diagrama de etapas



Fuente: *Autores (2025).*

8. Población y muestra

La población de estudio correspondió a los servicios de mantenimiento preventivo y correctivo realizados entre enero y agosto de 2025 en un concesionario automotriz de Quito, sector El Labrador, e incluyó registros históricos de órdenes de trabajo, tiempos de servicio, reprocesos y encuestas de satisfacción.

La muestra se definió mediante muestreo censal por conveniencia, abarcando todos los registros y encuestas disponibles en el periodo, sustentados en la información oficial del concesionario, lo que garantiza representatividad, confiabilidad y validez. Participaron personal técnico, asesores de servicio, jefes de taller y lavadores, quienes intervinieron en la aplicación de instrumentos y en la ejecución de las mejoras.

8.1. Marco muestral y criterios

En esta investigación se utilizaron fuentes primarias generadas por el concesionario automotriz. Se analizó el historial de órdenes de trabajo (OT) del sistema DMS/ERP como registro formal de cada intervención Anexo 1. También se emplearon reportes internos de los tiempos de servicio desagregados por actividad, para evaluar la eficiencia operativa y reportes de reprocesos que evidencian fallas, los retrabajos o desviaciones del estándar. Asimismo, también se incorporaron encuestas de satisfacción bajo metodología NPS éstas asociadas a las OT para vincular desempeño operativo y percepción del usuario. En conjunto, estas fuentes aportaron información objetiva, trazable y pertinente para el análisis.

8.2. Criterios de inclusión:

Se establecieron los criterios de inclusión con el fin de asegurar la consistencia temporal, operacional y analítica en la base de datos. Se consideraron únicamente las órdenes de trabajo cerradas entre el periodo de enero y agosto de 2025 denominados la etapa previa y las finalizadas entre octubre a noviembre de 2025 denominada etapa posterior. Cada registro debía contar con trazabilidad completa, incluyendo fecha de cierre y clasificación del tipo de servicio. Además, solo se incorporaron las encuestas de satisfacción bajo el esquema NPS que estuvieran asociadas a la misma OT, para evitar

respuestas aisladas o inconsistentes. Estos criterios permitieron trabajar con información depurada, y pertinente para el análisis.

8.3. Criterios de exclusión:

Los criterios de exclusión aplicados a la base de datos previnieron sesgos por información incompleta o no controlada. Se descartaron los servicios tercerizados, al no contar con supervisión operativa directa ni mecanismos internos de control de calidad, lo que impediría atribuir resultados al taller. También se eliminaron todos los registros con datos críticos faltantes como número de OT, fecha de atención o identificación vehicular, ya que su ausencia impide asegurar trazabilidad, comparabilidad y validez analítica. De este modo, la muestra final incluyó únicamente información íntegra y verificable.

8.4. Depuración y tamaño final de muestra

Se ejecutaron procesos de depuración para eliminar duplicados, filtrar servicios fuera del periodo y verificar la integridad de los datos. El tamaño final se expresó en cuatro indicadores:

Tabla 1: *Tamaño de la muestra*

Indicador	**Descripción**	**Fuente**
Número OT	Órdenes de trabajo válidas	DMS
Tiempos	Registros de tiempo asociados	Reloj técnico
Reproceso	Registros de reproceso	Módulo de garantías interna
Encuestas	Encuestas válidas emparejadas a OT	NPS

Fuente: *Autores (2025).*

9. Ubicación y contexto del estudio

El estudio se lleva a cabo en el área operativa de mantenimiento automotriz de un concesionario ubicado en Quito. La zona en cuestión incluye labores de inspección, reparación y conservación preventiva y correctiva de vehículos de categoría liviana. Quedan fuera del alcance las dependencias administrativas y de contacto inmediato con clientes, enfocando el análisis en el rendimiento de los procedimientos internos y su correlación con

la experiencia del usuario final. El contexto operativo presenta condiciones reales de demanda, disponibilidad de recursos y dinámicas propias de un taller concesionario, lo que otorga validez ecológica a los resultados.

10. Instrumentos de recolección de datos

Actualmente, la satisfacción del cliente en el taller se evalúa mediante una encuesta estandarizada basada en una pregunta final del Net Promoter Score (NPS). Este instrumento es la principal herramienta de medición de la satisfacción y sustenta un análisis comparativo de los resultados previos y posterior a implementación de las metodologías de mejora continua.

El nivel de satisfacción del usuario fue evaluado mediante instrumentos de encuesta aplicados después de completarse el servicio, utilizando el método Net Promoter Score (NPS). Los datos recabados forman la base del análisis de contraste entre los períodos previo y subsecuente a la aplicación de las acciones de mejora, conforme a los lineamientos del numeral 9.1.2 de la ISO 9001:2015, exhibiéndose en el Anexo 2.

Como elemento adicional a la medición numérica de satisfacción, se ejecutó un monitoreo posventa dentro de las 24 a 72 horas siguientes a la restitución del vehículo, a través de contacto vía telefónica, orientado a capturar comentarios complementarios, verificar la experiencia proporcionada y reforzar el canal comunicacional con el cliente. Los archivos generados por este monitoreo constituyen comprobación del sistema de retroalimentación y lealtad del cliente, de acuerdo con el numeral 8.2.1 de la norma ISO 9001:2015, presentándose en el Anexo 3.

11. Procedimiento

El desarrollo metodológico se estructuró en cinco fases consecutivas. La primera, se efectuó un diagnóstico inicial para recopilar información histórica, identificar problemas recurrentes y evaluar la organización del taller según 5S. La segunda, se aplicó la metodología 5S, orientada al orden, la clasificación y la estandarización del entorno mediante apoyo visual. La tercera fase incluyó acciones Kaizen, pequeñas mejoras

continuas propuestas por el personal para reducir reprocesos y optimizar tiempos. La cuarta fase, realizó la alineación con ISO 9001 mediante procedimientos documentados y verificación del cumplimiento de estándares internos. Finalmente, la quinta fase, efectuó una evaluación comparativa de resultados operativos y satisfacción antes y después de la intervención.

Los indicadores fueron clasificados en tres categorías: rendimiento operacional, calidad procedimental y satisfacción del usuario. Comprendieron la duración media del servicio, la tasa de retrabajos, el grado de orden según el checklist 5S y los hallazgos de las encuestas NPS, facilitando la valoración objetiva del efecto de las metodologías implementadas sobre la gestión de calidad y el funcionamiento del taller.

12. Recursos

La investigación empleará recursos materiales, tecnológicos y humanos disponibles en el taller automotriz.

12.1. Recursos documentales y de control

Formatos de registro de órdenes de trabajo, hojas de verificación 5S, formularios de observación, diagramas de flujo e Ishikawa, y planillas de seguimiento.

12.2. Recursos tecnológicos

Computadoras personales, software de hoja de cálculo Microsoft Excel para el procesamiento estadístico y elaboración de gráficos, así como plataformas institucionales de respaldo de datos.

12.3. Recursos visuales y didácticos

Señalética 5S, carteles de orden y limpieza, etiquetas identificativas, manuales de procesos y material de capacitación en Kaizen e ISO 9001.

12.4. Recursos humanos

Técnicos-asesores de servicio y jefe de taller que participarán en la aplicación de las estrategias y en la toma de datos, con el apoyo del equipo directivo del concesionario.

El proceso contará con respaldo institucional, especialmente del jefe y gerente de agencia, quienes facilitarán los recursos y la coordinación durante la implementación de las mejoras.

12.5. Análisis de datos

El tratamiento de la información se efectuará mediante estadística descriptiva y análisis comparativo, utilizando Microsoft Excel para la tabulación, el cálculo de promedios y porcentajes, así como la generación de gráficos de tendencia.

13. Etapas de análisis de datos

La etapa anterior y posterior, con el propósito de identificar variaciones en los indicadores establecidos. El análisis de estos garantizará una interpretación integral de los resultados.

14. Consideraciones éticas y de validez

Durante todo el procedimiento se mantendrá el carácter anónimo y reservado de la información organizacional. La información procede de archivos oficiales del concesionario, lo cual asegura su validez y confiabilidad. Asimismo, la colaboración del personal es de carácter voluntario y está enfocada hacia el perfeccionamiento continuo del ambiente de trabajo, sin conllevar consecuencias valorativas ni punitivas.

15. Procesamiento y análisis de indicadores

En la fase cuantitativa se aplicó estadística descriptiva para caracterizar los indicadores operativos y de satisfacción del cliente previos a la intervención. El procesamiento se realizó en Microsoft Excel, calculando promedios, desviaciones, proporciones y coeficientes del desempeño del taller automotriz. El análisis se basó en una base de datos censal de órdenes de trabajo (OT) del sistema DMS, complementada con encuestas NPS, y cada indicador se trató según principios básicos de medición y control estadístico en ingeniería de calidad.

15.1. Número de órdenes de trabajo (OT)

El total de órdenes válidas se obtuvo mediante conteo directo de registros únicos, considerando como muestra todos los servicios realizados en el periodo de estudio. Este valor funcionó como base estadística (n) para el cálculo de las demás medidas descriptivas, garantizando representatividad y validez en los resultados.

15.2. Tiempo promedio de servicio ($\bar{x}$)

El tiempo promedio de servicio (TMS) se calculó como el promedio de los tiempos individuales de atención de las órdenes de trabajo, de acuerdo con la expresión mostrada en la Ecuación 1 (Montgomery, 2013).

Ecuación 1: *Tiempo promedio de servicio*

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Donde, (Ẋ) es el tiempo medio de servicio, (Xi) es el tiempo de servicio de cada orden de trabajo y (n) es número total de órdenes de trabajo (OT) atendidas. Este parámetro permite valorar el rendimiento operacional del taller e identificar potenciales restricciones en el flujo de trabajo del servicio.

15.3. Desviación estándar y coeficiente de variación (s, CV)

Con el fin de analizar la consistencia de los procesos, se calcula la desviación estándar (s), que representa el grado de dispersión de los tiempos individuales respecto al promedio general: La desviación se calcula con la Ecuación 2, que permite estimar la dispersión de los valores con respecto a la media (Montgomery, 2013).

Ecuación 2*: Desviación estándar*

$$s = \sqrt{\frac{\sum \left(x_i - \bar{x}\right)^2}{n-1}}$$

A partir de ella se obtuvo el coeficiente de variación (CV):

Ecuación 3: *Coeficiente de variación*

$$CV = \frac{s}{\bar{x}} \times 100$$

El CV se utiliza como indicador de variabilidad relativa, facilitando la comparación de estabilidad entre distintos periodos o tipos de servicio.

15.4. Porcentaje de reprocesos (p)

El indicador de reproceso mide la proporción de órdenes de trabajo que requirieron una intervención adicional por fallas técnicas o incumplimiento de procedimientos.
Su cálculo se efectuó mediante la relación:

Ecuación 4: *Porcentaje de reprocesos*

$$p = \frac{\text{Número de reprocesos}}{\text{Número total de OT}} \times 100$$

Este porcentaje refleja el nivel de eficiencia operativa interna y constituye un parámetro crítico para valorar la efectividad de los controles de calidad implementados.

15.5. Tasa de encuestas válidas (r)

Con el propósito de garantizar la representatividad del análisis de satisfacción, se determina la tasa de respuesta de los clientes que completaron las encuestas NPS, mediante la Ecuación 5:

Ecuación 5: *Tasa de encuestas válidas*

$$r = \frac{\text{Encuestas válidas}}{\text{Total de OT analizadas}} \times 100$$

Una tasa elevada garantiza la fiabilidad del diagnóstico sobre la percepción del servicio y respalda la validez de las conclusiones cualitativas.

15.6. Net Promoter Score (NPS)

En esta investigación, se utilizó el Net Promoter Score (NPS) como métrica principal para evaluar la fidelidad del usuario y su predisposición a sugerir el servicio automotriz. Este índice se obtiene a partir de la pregunta estandarizada “¿Qué tan probable es que recomiende el servicio?”, cuyos resultados permiten segmentar la satisfacción percibida.

Las puntuaciones de 9 a 10 se clasificaron como promotoras, al reflejar una experiencia altamente favorable; las valoraciones de 7 u 8 se consideraron neutras, por expresar conformidad sin fidelización; y las calificaciones de 0 a 6 se identificaron como detractoras, por asociarse con experiencias negativas o insatisfactorias. El valor del NPS se calculó mediante la ecuación 6, que relaciona los porcentajes de promotores y detractores para generar un indicador sintético de desempeño relacional.

Ecuación 6: *NPS*

$$NPS = (\%\text{Promotores}) - (\%\text{Detractores})$$

El resultado se interpretó en una escala de −100 a +100, donde valores negativos reflejan predominio de clientes insatisfechos y valores positivos indican fidelización y recomendación activa.

15.7. Instrumentos y validación de datos

El procesamiento se llevó a cabo conforme a las siguientes etapas metodológicas:

15.8. Depuración

Eliminación de registros duplicados y verificación de consistencia entre campos de tiempo, tipo de servicio y reproceso.

15.9. Codificación

Conversión de variables categóricas a valores numéricos para facilitar su análisis estadístico.

15.10. Cálculo automatizado

Aplicación de fórmulas en Excel para obtener promedios, desviaciones y porcentajes.

15.11. Validación cruzada

Revisión de coherencia entre las fuentes DMS y los registros de encuestas.

Esta metodología permitió garantizar la exactitud de los cálculos, la trazabilidad de

los resultados y la validez estadística de los indicadores, asegurando la confiabilidad del diagnóstico previo a la implementación de las estrategias de mejora continua.

RESULTADOS Y DISCUSIÓN

1. Etapa 1: Diagnóstico Previo

1.1. Modelo Laboral en la Marca y su Aplicación en el Concesionario Analizado

En la estructura organizacional definida por la marca, los concesionarios operan con dos figuras laborales diferenciadas: técnico mecánico y asesor de servicio, cada una con responsabilidades y procesos claramente delimitados. No obstante, en el concesionario analizado estas funciones se integran en un solo puesto denominado técnico–asesor, que combina actividades operativas, administrativas y de atención al cliente. Esta fusión de roles implica una carga operativa significativamente mayor a la prevista por el modelo estándar de la marca. Para dimensionar su impacto, se puede estimar la distribución de tiempo por función dentro de una OT promedio de 119,81 minutos en la etapa previa.

***Tabla 2**: Distribución estimada de tiempo por función en el rol técnico-asesor*

Función	Actividades	Tiempo estimado	% del total
Atención al cliente	Recepción, diagnóstico conjunto, entrega, comunicación	~35 min	29%
Gestión administrativa	Apertura OT, registro DMS, facturación, encuesta	~20 min	17%
Ejecución técnica	Mantenimiento o reparación del vehículo	~65 min	54%
Total		**~120 min**	**100%**

Fuente: Autores, elaboración propia basada en los perfiles de puesto y el tiempo promedio de la etapa previa.

Esta distribución evidencia que aproximadamente el 46% del tiempo del técnico-asesor se destina a funciones no técnicas, lo que reduce directamente su capacidad productiva en taller. En un esquema de roles separados, el técnico ejecutaría el servicio

mientras el asesor gestiona simultáneamente la atención al cliente, lo que teóricamente permitiría reducir el tiempo de ciclo total. Sin embargo, el concesionario mantiene este modelo por razones operativas y de estructura organizacional propias, lo que hace que la estandarización del proceso mediante el POE-AS-01 sea aún más relevante como mecanismo compensador de esa carga dual.

Desde la perspectiva de la viabilidad operativa, el esquema técnico-asesor es sostenible bajo condiciones de demanda controlada y proceso estandarizado, como lo demuestran los resultados de la etapa posterior. No obstante, representa un factor de riesgo latente en escenarios de alta demanda o rotación de personal, dado que la ausencia de un solo colaborador afecta simultáneamente la capacidad técnica y la atención al cliente. Esta limitación estructural debe considerarse en la planificación de la capacidad del taller y justifica la necesidad de mantener el POE-AS-01 como herramienta de continuidad operativa independientemente del operador.

1.2. Análisis del Perfil del Asesor de Servicio

El documento institucional correspondiente al perfil del asesor de servicio describe un rol orientado principalmente a la atención al cliente y la gestión administrativa del proceso posventa. Incluye actividades como la admisión del vehículo, la apertura y el seguimiento de la orden de trabajo, la comunicación de hallazgos, la validación de trabajos adicionales y la entrega final del vehículo. Corresponde a un cargo caracterizado por intensa interacción con el cliente y compromiso respecto a la comprensibilidad del proceso, los períodos de atención y el nivel de satisfacción final del usuario. **Anexo 4**.

1.3. Análisis del Perfil del Técnico Mecánico

El perfil del técnico mecánico establece un conjunto de funciones centradas en el diagnóstico, mantenimiento y reparación de los vehículos conforme a protocolos técnicos específicos. Las actividades incluyen inspección, uso de herramientas especializadas, ejecución de reparaciones mecánicas y eléctricas, aplicación de torque según manuales del fabricante y validación técnica antes del cierre de la orden de trabajo. Este rol se caracteriza

por su naturaleza operativa y la exigencia de precisión, orden y cumplimiento de estándares de trabajo seguro **Anexo 5.**

1.4. Análisis del Mapa de Procesos del Concesionario

El Mapa expone de forma estructurada la organización de los procesos estratégicos, operativos y de apoyo. El esquema evidencia la prestación del servicio en taller que forma parte de un flujo interrelacionado con logística de repuestos, facturación, administración, calidad y recursos humanos. La estructura refleja una división funcional clara, en la cual cada etapa del proceso posee un responsable asignado según su especialidad **Anexo 6**.

La evaluación de la etapa inicial posibilitó la construcción del diagnóstico base del taller automotor antes de ejecutar las iniciativas de mejora continua. Las métricas obtenidas muestran la condición operativa y de conformidad del cliente durante el intervalo que abarca de enero a agosto de 2025, definiendo el punto de partida para la comparativa con los datos posteriores a la intervención.

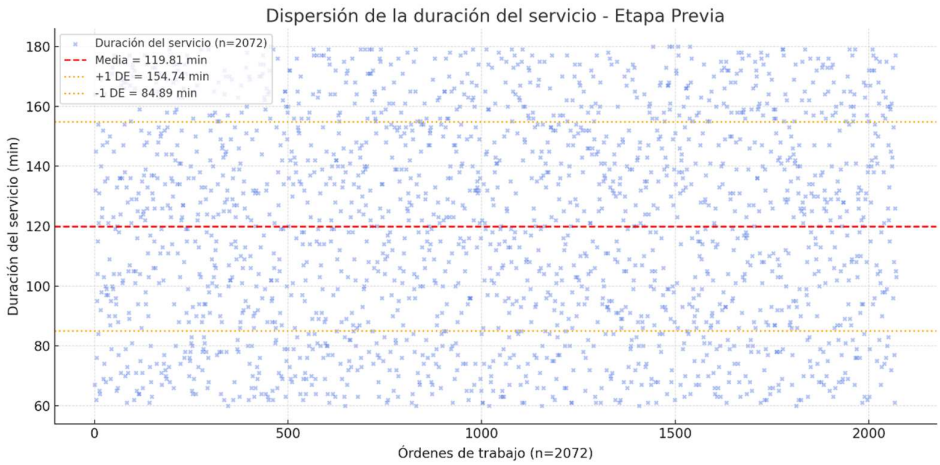
1.5. Número de órdenes de trabajo

Durante el periodo previo de estudio se registraron 2.072 OT en el taller concesionario. Este total corresponde a todas las atenciones de mantenimiento de la fase previa y constituye una base de datos suficientemente amplia para caracterizar el desempeño operativo y definir una línea base consistente para la comparación con los resultados posteriores a la intervención.

1.6. Tiempo promedio de servicio

El tiempo promedio registrado de atención fue de 119,81 minutos por OT. El cálculo se realizó en base a la diferencia entre horas de inicio y cierre registradas para las 2.072 OT, indicando que aunque se encuentra dentro de un rango operativo habitual, la evidencia muestra ineficiencias vinculadas a esperas internas, que podrían optimizarse mediante estandarización de procesos.

Figura 2: *Dispersión de tiempo de servicio*



Fuente: Autores (2025).

Este indicador evidencia que hay una eficiencia limitada en la gestión del flujo de trabajo, afectando a la capacidad del taller para atender más vehículos.

1.7. Variabilidad de los tiempos

El análisis de los tiempos de servicio previos evidencia una dispersión significativa, indicando una falta de estandarización de procesos. Con base en 2.072 órdenes procesadas válidas, se determinó una duración media de 119,81 minutos y una desviación típica de 34,92 minutos, correspondiente a un coeficiente de variación del 29,1%, indicando una dispersión notable en los tiempos de atención.

1.8. Porcentaje de reprocesos

El 6,37 % de las órdenes analizadas correspondió a reprocesos, es decir los trabajos que debieron repetirse por fallas técnicas o incumplimiento de estándares de calidad. Este valor supera los rangos aceptables en operaciones maduras que son 3% al 5%, evidenciando deficiencias en los trabajos.

Los reprocesos representan pérdidas directas en la productividad y generan insatisfacción en el cliente prolongando los tiempos de entrega esto afecta tanto la eficiencia del taller como también a la imagen institucional.

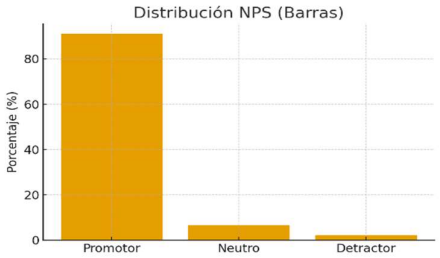
1.9. Tasa de encuestas válidas

Del total de 2.072 órdenes procesadas en la fase previa, 1.593 encuestas fueron completadas y registradas correctamente en el sistema esto equivale a una tasa de respuesta del 76,9 %.Esta tasa ofrece un fundamento robusto y adecuado para realizar un estudio estadísticamente coherente sobre la satisfacción y recomendación del usuario, reduce el riesgo de sesgo por falta de respuesta y habilita el uso de los hallazgos como información fiable para las decisiones vinculadas al mejoramiento continuo, monitoreo posventa y comunicación subsecuente a la entrega.

1.10. Nivel de recomendación del cliente

El Net Promoter Score (NPS) calculado para la fase previa fue de 88,8 %, a partir de la clasificación de los clientes en 91,1 % promotores, 6,6 % neutros y 2,3 % detractores.

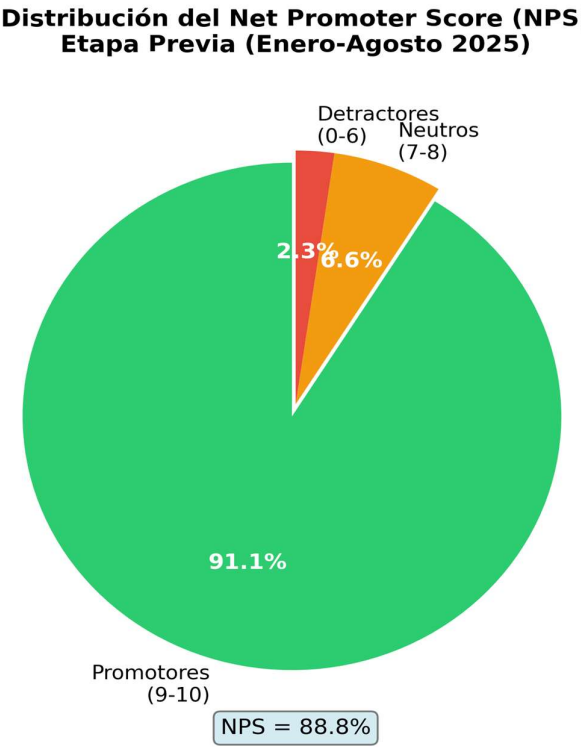
Figura 3: *Nivel de recomendación del cliente*



Fuente: Autores (2025).

La distribución detallada de la clasificación NPS en la etapa previa se presenta a continuación:

Figura 4: *Distribución del Net Promoter Score (NPS) - Etapa Previa*



Fuente: Autores (2025).

El resultado evidencia una percepción altamente favorable del servicio y una elevada disposición a recomendar el taller. Sin embargo, la combinación de un NPS muy positivo con alta variabilidad operativa exige alinear la experiencia del cliente con mayor estabilidad en los tiempos de servicio, sosteniendo la recomendación en la consistencia del proceso. En la práctica, por cada usuario dispuesto a recomendar, más de treinta expresan inconformidad, afectando reputación y fidelización. Este escenario coincide con estudios que relacionan altos tiempos de ciclo y baja transparencia informativa con deterioro del NPS. Por ello, la implementación de Kaizen, 5S e ISO 9001:2015 es imprescindible para revertir la tendencia, reducir insatisfacción y fortalecer la confianza en el servicio.

1.11. Síntesis del Diagnóstico Previo

En conjunto, los resultados previos describen un sistema operativo funcional pero heterogéneo, con tiempos de servicio de 119,81 minutos y una variabilidad relativa del 29,1 %. Aunque el proceso gestiona un volumen considerable de órdenes de trabajo, la

dispersión refleja una experiencia del cliente no totalmente predecible ni uniforme.
Estos hallazgos constituyen la línea base para evaluar el impacto de 5S, Kaizen e ISO 9001, orientadas a optimizar el flujo, reducir variabilidad y mejorar la percepción del cliente. Como complemento a las causas raíz identificadas con el Ishikawa, se consolidaron factores estratégicos mediante FODA: este sintetiza condiciones internas y externas, mientras el Ishikawa explica las desviaciones operativas. En este caso ambos instrumentos se integran sin duplicación y sustentando las estrategias del cruce FODA en causas técnicas reales.

A partir de los hallazgos del diagnóstico previo, que establecieron la línea base operativa del taller, se procedió a realizar un análisis situacional estratégico mediante herramientas de planificación (FODA) y análisis causa-efecto (Ishikawa) para identificar las líneas de acción prioritarias y fundamentar técnicamente la selección de las estrategias de intervención.

1.12. Análisis Estratégico Situacional

1.12.1. Flujograma del proceso operativo inicial

Antes de la implementación de las estrategias de mejora continua, el proceso operativo del técnico-asesor presentaba las siguientes características: falta de estandarización en la secuencia de pasos, ausencia de listas de verificación, tiempos variables entre órdenes de trabajo, descoordinación en el abastecimiento de repuestos y escasa disciplina operativa. El siguiente flujograma representa la situación inicial del proceso:

Figura 5:*Flujograma del proceso inicial*



Fuente: Autores (2025).

Este flujograma evidencia la ausencia de controles sistemáticos, puntos críticos de espera (especialmente en el abastecimiento de repuestos) y la falta de protocolos estandarizados en cada etapa, factores que contribuían a la alta variabilidad de tiempos (CV=29.1%) y elevada tasa de reprocesos (6.37%) observados en la etapa previa.

1.13. Análisis FODA

Como complemento del análisis previo, se realizó un análisis FODA con la información del taller bajo las condiciones de operación observadas. Este análisis permitió sintetizar los factores internos y externos que influyen en la eficiencia del servicio.

Figura 6: *Análisis FODA*

DEBILIDADES	FORTALEZAS
D1 Tiempos de servicio altos y variabilidad significativa. D2Porcentaje de reprocesos elevado . D3 Falta de orden, señalética y control visual. D4 Ausencia de procedimientos estandarizados del proceso (POE inexistente). D5 NPS bajo D6 Bahías productivas reducidas (2)	F1 Personal técnico con experiencia en mantenimiento automotriz. F2 Infraestructura, área de taller y herramientas adecuadas para la operación. F3 Disponibilidad de registros históricos (OT, tiempos, NPS) para análisis real. F4 Alto volumen de órdenes de trabajo que permite mediciones representativas. F5 Alta demanda del servicio con buena gestion de citas
AMENAZAS	**OPORTUNIDADES**
A1 Alta competencia A2 Clientes más exigentes e informados A3 Fluctuaciòn económica A4 Dificil accesibilidad al consecionario en horas pico.	01 Incrementar la satisfacción del cliente (NPS) mediante mejoras en servicio. 02 Incremento de clientes que buscan un taller con servicio autorizado. 03. Incremento de flotas empresariales 03 Clientes que buscan repuestos originales. 05 Diferenciarse de talleres informales mediante procesos claros y calidad superior.

Fuente: Autores (2025).

1.14. Análisis del cruce estratégico del FODA

El cruce del FODA permite identificar líneas de acción basadas entre Debilidades (D), Fortalezas (F), Amenazas (A) y Oportunidades (O). Estas combinaciones ayudan a visualizar con claridad cómo cada una de las estrategias responde a condiciones específicas de la operación del taller.

Figura 7: *Cruce estratégico FODA*

ESTRATEGIAS	DEBILIDADES	FORTALEZAS
	D1 Tiempos de servicio altos y variabilidad significativa. D2Porcentaje de reprocesos elevado . D3 Falta de orden, señalética y control visual. D4 Ausencia de procedimientos estandarizados del proceso (POE inexistente). D5 NPS bajo D6 Bahías productivas reducidas (2)	F1 Personal técnico con experiencia en mantenimiento automotriz. F2 Infraestructura, área de taller y herramientas adecuadas para la operación. F3 Disponibilidad de registros históricos (OT, tiempos, NPS) para análisis real. F4 Alto volumen de órdenes de trabajo que permite mediciones representativas. F5 Alta demanda del servicio con buena gestion de citas
AMENAZAS A1 Alta competencia A2 Clientes más exigentes e informados A3 Fluctuaciòn económica A4 Dificil accesibilidad al consecionario en horas pico.	**ESTRATEGIA DE SUPERVIVENCIA** (1)D1 + D2 + D4 + A1 + A2 Estandarizar el proceso de servicio para reducir variabilidad y reprocesos frente a competidores más eficientes. (2)D3 + A2 Implementar control visual, señalética y orden para responder a clientes más exigentes e informados. (3)D5 + A2Programa inmediato de recuperación del NPS para evitar fuga de clientes ante la competencia. (4)D6 + A4 Optimizar uso de bahías para evitar cuellos de botella en horas pico	**ESTRATEGIA DEFENSIVA** (1)F1 + F3 + A1 Utilizar la experiencia técnica y datos históricos para diferenciarse de talleres informales y competidores. (2)F2 + A4 Mejorar accesibilidad y tiempos de permanencia usando la infraestructura existente. (3)F5 + A2 Proteger la base actual de clientes mediante una gestión de citas más precisa y orientada al cliente exigente. (4)F4 + A3 Aprovechar el alto volumen de OTs para simular escenarios ante la fluctuación económica.
OPORTUNIDADES 01 Incrementar la satisfacción del cliente (NPS) mediante mejoras en servicio. 02 Incremento de clientes que buscan un taller con servicio autorizado. 03. Incremento de flotas empresariales 03 Clientes que buscan repuestos originales. 05 Diferenciarse de talleres informales mediante procesos claros y calidad superior.	**ESTRATEGIA ADAPTATIVA** (1)D1 + D4 + O1 Reducir tiempos de servicio mediante estandarización formal del proceso. (2)D2 + O2 + O5 Disminuir retrabajos para potenciar la imagen de servicio autorizado y diferenciado. (3)D3 + O5 Orden y señalética clara para mostrar procesos superiores y diferenciados frente a talleres informales. (4)D5 + O1 + O3 Programa de mejora del NPS para atender flotas y clientes corporativos. (5)D6 + O3 Ampliar capacidad real mediante optimización de bahías para captar flotas empresariales.	**ESTRATEGIA OFENSIVA** (1)F1 + F3 + O1 Programa de mejora continua basado en datos para elevar el NPS y escalar la calidad del servicio. (2)F2 + O3 Aprovechar la infraestructura del taller para ofrecer mantenimiento a flotas empresariales. (3)F5 + O2 Potenciar la gestión de citas como ventaja competitiva para captar clientes que buscan servicio autorizado. (4)F4 + O5 Usar el alto volumen de datos para demostrar calidad superior y diferenciarse del mercado informal.

Fuente: Autores (2025).

1.14.1. Estrategias de Supervivencia (Debilidades + Amenazas)

Estas estrategias surgen por la necesidad de sostener la operación corrigiendo vulneraciones internas en el entorno.

La primera combinación D1 (tiempos altos), D2 (reprocesos elevados), D4 (falta de POE), A1 (competencia) y A2 (clientes exigentes) evidencia la urgencia de estandarizar el proceso de servicio para disminuir la variabilidad y evitar que los competidores más eficientes tomen ventaja.

Por otra parte, la unión entre D3 (falta de orden y señalética) y A2 (clientes más informados y exigentes) resalta la necesidad de implementar control visual y organización para sostener la confianza del usuario.

En el caso de D5 (NPS bajo) junto con A2, se vuelve imprescindible desarrollar un programa inmediato de recuperación del NPS que evite la fuga de clientes hacia alternativas más atractivas.

Finalmente, la combinación de D6 (bahías productivas reducidas) con A5 (difícil accesibilidad en horas pico) muestra el riesgo de saturación operativa en el área, lo que exige optimizar el uso de las bahías para prevenir cuellos de botella en momentos críticos o de alta demanda.

1.14.2. Estrategias Defensivas (Fortalezas + Amenazas)

Estas estrategias buscan proteger la posición del taller mediante el uso de sus fortalezas frente a las amenazas externas.

La combinación de F1 (personal técnico con experiencia) y F3 (registros históricos disponibles) frente a A1 (alto nivel de competencia) demuestra la posibilidad de diferenciarse mediante evidencia técnica y datos reales.

Asimismo, F2 (infraestructura y herramientas adecuadas), en conjunto con A5 (dificultad de acceso en horas pico), orienta la necesidad de gestionar mejor los tiempos de permanencia usando la infraestructura actual.

Otra relación clave es F5 (gestión de citas eficiente) con A2 (clientes exigentes), que permite asegurar una atención más precisa para proteger la base actual de clientes.

Finalmente, la combinación entre F4 (alto volumen de OTs) y A3 (fluctuación económica) abre la posibilidad de usar estos datos para simular escenarios y anticiparse a cambios en la demanda.

1.14.3. Estrategias Adaptativas (Debilidades + Oportunidades)

En las estrategias adaptativas se busca superar debilidades aprovechando factores positivos del entorno.

La unión de D1 (tiempos altos) y D4 (ausencia de POE) con O1 (incrementar la satisfacción del cliente) evidencia la importancia de reducir tiempos mediante estandarización formal para elevar la experiencia del usuario.

De igual modo, D2 (reprocesos elevados) alineado con O2 (crecimiento de clientes que buscan talleres autorizados) y O5 (diferenciación frente a talleres informales) sugiere que disminuir fallos fortalece la imagen del taller como servicio confiable.

La combinación de D3 (falta de orden) con O5 señala que la organización visible del taller se convierte en un diferenciador inmediato frente a alternativas no oficiales a la marca.

En cuanto al NPS, el escenario conformado por D5 (NPS bajo) más O1 y O3 (incremento de flotas empresariales) subraya la necesidad de configurar un programa destinado a elevar la calidad de la experiencia del cliente.

Por último, D6 (bahías reducidas) combinado con O3 muestra la oportunidad de ampliar la capacidad real del taller para así captar flotas, optimizando el uso del espacio ya existente.

1.14.4. Estrategias Ofensivas (Fortalezas + Oportunidades)

Estas estrategias buscan incrementar el potencial competitivo del taller aprovechando fortalezas internas frente a oportunidades del entorno.

La combinación de F1 (experiencia técnica) y F3 (datos históricos) con O1 (incrementar satisfacción del cliente) permite impulsar un programa de mejora continua que permita elevar el NPS y la calidad del servicio.

Asimismo, F2 (infraestructura adecuada) junto con O3 (crecimiento de flotas empresariales) señalan la posibilidad de ampliar la oferta hacia servicios especializados.

La articulación de F5 (gestión de citas efectiva) con O2 (clientes que prefieren talleres autorizados) refuerzan la capacidad del taller para poder captar nuevos usuarios mediante la organización precisa y profesional.

Finalmente, la unión de F4 (alto volumen de datos y OTs) con O5 (diferenciación

frente a talleres informales) permite demostrar calidad y consistencia operativa mediante análisis objetivo consolidando una ventaja competitiva sostenible.

1.15. Identificación bajo ISO 9001, Kaizen y 5S como solución a las estrategias del FODA

A partir del análisis FODA cruzado, se identifican la norma ISO 9001, el enfoque Kaizen y la metodología 5S como marcos metodológicos idóneos para responder a las estrategias estratégicas definidas. En tanto el análisis FODA facilita el reconocimiento de los componentes internos y del entorno que inciden en el desempeño del taller, dichas metodologías emergen como mecanismos sistematizados aptos para transformar esas estrategias en prácticas operacionales coherentes, medibles y sostenibles.

De este modo, se asegura la correspondencia entre el diagnóstico estratégico y la planificación de mejoras, evitando rupturas metodológicas y garantizando que las acciones propuestas se fundamenten directamente en los hallazgos del análisis situacional.

1.15.1. Identificación de estrategias de supervivencia bajo ISO 9001, Kaizen y 5S

Las debilidades detectadas, asociadas a tiempos elevados de servicio, alta variabilidad operativa, reprocesos frecuentes, desorden en las áreas de trabajo y bajos niveles de satisfacción del cliente, evidencian la necesidad de un control estructurado del proceso. Dentro de este marco, la norma ISO 9001:2015 se establece como un modelo pertinente para reforzar la uniformización y la supervisión operativa, particularmente a través de los apartados 8.1, 8.2 y 8.5, adicionalmente, la identificación de riesgos operativos se abordó de forma implícita mediante el análisis causa-efecto (Ishikawa), que permitió anticipar las principales fuentes de variabilidad y reprocesos antes de la implementación. Si bien el taller no cuenta aún con un registro formal de gestión de riesgos conforme a la cláusula 6.1 de ISO 9001:2015, el diagnóstico previo actuó funcionalmente como herramienta de identificación y priorización de riesgos operativos junto con los criterios documentales detallados en el **Anexo 7**.

De igual forma, se establece que la organización y el control de la operación, por medio de la gestión de reservas y la coordinación de la carga laboral, concuerdan con los criterios del numeral 8.1, permitiendo confirmar la disponibilidad de recursos y una distribución eficaz del tiempo, conforme se registra en el **Anexo 8**. La identificación y revisión de los requisitos del cliente se vinculan con la cláusula 8.2, formalizándose a través del formato de recepción del vehículo, lo que garantiza claridad, trazabilidad y coherencia desde el inicio del servicio **Anexo 9**.

De igual forma, se identifica que la comunicación técnica transparente y la validación de las intervenciones propuestas, documentadas en el informe de diagnóstico conjunto, contribuyen a fortalecer la confianza del cliente y a reducir reprocesos, en concordancia con los principios de la norma ISO 9001 **Anexo 10**. Durante la ejecución del servicio, la documentación de hallazgos adicionales, modificaciones al alcance inicial y aprobaciones del cliente mediante la bitácora del sistema DMS se reconoce como un mecanismo alineado con el control de cambios operativos establecido en la cláusula 8.5.6 **Anexo 11**.

La verificación de la conformidad del servicio antes de la entrega del vehículo se asocia con la cláusula 8.6, a través del checklist de inspección final que valida aspectos técnicos, de limpieza y cumplimiento del trabajo realizado **Anexo 12**. Finalmente, la entrega del vehículo y la aceptación del servicio por parte del cliente se identifican como elementos clave de comunicación y validación final, formalizados mediante el acta de entrega y conformidad, en correspondencia con la cláusula 8.2.1 **Anexo 13**.

Paralelamente, se identifica el enfoque Kaizen como un facilitador de mejoras incrementales orientadas a reducir retrabajos y variabilidad diaria, mientras que la metodología 5S, especialmente en sus fases Seiri, Seiton y Seiso, se reconoce como un soporte fundamental para fortalecer el orden, la señalización y la inspección visual, disminuyendo errores operativos y optimizando las bahías productivas en escenarios de alta demanda.

1.15.2. Identificación de estrategias defensivas bajo ISO 9001, Kaizen y 5S

Frente a las amenazas externas del entorno, se identifican las capacidades internas del taller como un factor clave para sostener su posición competitiva. Desde esta perspectiva, el marco ISO 9001 posibilita identificar la supervisión de métricas operativas tiempos de servicio, reprocesamiento y NPS como un sistema de validación objetiva de calidad y transparencia, particularmente relevante para clientes que comparan concesionarios oficiales con talleres no certificados.

Asimismo, la metodología 5S posibilita identificar oportunidades de mejora en la señalización y el layout del taller, favoreciendo la fluidez del proceso y la reducción de tiempos de permanencia, particularmente en contextos donde existen limitaciones de accesibilidad.

El control de citas, alineado con los lineamientos de la sección 8.2 del estándar ISO 9001, se establece como un componente esencial para asegurar coherencia en la atención del cliente. Complementariamente, el enfoque Kaizen Costing se identifica como una herramienta pertinente para detectar y eliminar desperdicios, aspecto crítico en escenarios de fluctuación económica que exigen un control riguroso de costos y una mayor eficiencia operativa.

1.15.3. Identificación de estrategias adaptativas bajo ISO 9001, Kaizen y 5S

Ante la necesidad de corregir limitaciones internas aprovechando posibilidades del mercado, se determina la sinergia entre ISO 9001, Kaizen y 5S como un factor decisivo. La uniformización del procedimiento a través de la sección 8.5 de ISO 9001 se identifica como una vía para acortar los períodos de atención, condición indispensable para incrementar la conformidad del cliente evidenciada en el NPS.

De forma adicional, Kaizen y 5S se presentan como enfoques dirigidos hacia el hallazgo de orígenes problemáticos y el afianzamiento de la organización operativa,

contribuyendo a minimizar equivocaciones y repeticiones de trabajo, consolidando así la percepción de un servicio homologado y seguro. La rotulación y el ordenamiento visual del área de trabajo se valoran, igualmente, como aspectos diferenciadores ante establecimientos informales.

En última instancia, la evaluación sostenida del NPS conforme al requisito 9.1.2 de ISO 9001 y el empleo de tableros de indicadores se determinan como recursos para decisiones basadas en evidencia cuantitativa, mientras que Kaizen Layout y 5S Seiton se posicionan como fundamentos para la racionalización del espacio disponible, habilitando la gestión de flotas empresariales.

1.15.4. Identificación de estrategias ofensivas bajo ISO 9001, Kaizen y 5S

Cuando se busca potenciar fortalezas internas y aprovechar oportunidades externas, se identifica que la sinergia entre ISO 9001 y Kaizen favorece el crecimiento sostenible del taller. Partiendo de registros históricos, dichas metodologías se establecen como una plataforma consistente para diseñar un programa de optimización continua enfocado en elevar la calidad de atención y el NPS.

La infraestructura disponible se identifica como un activo estratégico que puede fortalecerse mediante procedimientos operativos estandarizados (POE) bajo ISO 9001, garantizando consistencia en la atención a clientes corporativos y flotas empresariales. Del mismo modo, la representación de procesos y el estudio de la demanda, característicos de la metodología Kaizen, se identifican como instrumentos para detectar restricciones operativas y adaptar las capacidades funcionales del taller.

Por último, la aplicación de sistemas de indicadores KPI dentro de un esquema unificado ISO 9001–Kaizen se determina como un soporte crucial para la gestión decisional fundamentada en evidencia, proyectando al entorno comercial una operación estructurada, profesional y de calidad excepcional, manifiestamente distinta del mercado informal.

2. Etapa 2: Implementación

Durante el mes de septiembre de 2025 se procedió a la aplicación sistemática de las estrategias derivadas del análisis FODA y del diagnóstico causa-efecto. Esta etapa concentró la implementación de las metodologías Kaizen, 5S e ISO 9001:2015, junto con el desarrollo del Procedimiento Operativo Estándar (POE-AS-01) y la reorganización del área de servicio.

2.1. Implementación de estrategias derivadas del cruce FODA

2.1.1. Identificación de causas raíz mediante el diagrama de Ishikawa

La evaluación recoge los factores identificados mediante la herramienta de Ishikawa con el fin de transformarlos en intervenciones correctivas alineadas a la matriz FODA, garantizando que las estrategias se fundamenten en causas raíz reales, evitando duplicidad metodológica y asegurando coherencia entre diagnóstico, planificación e implementación.

Previo a la aplicación de los instrumentos de perfeccionamiento, se elaboró un diagrama de Ishikawa con el objetivo de identificar los factores originarios de las variaciones en la dinámica operativa del técnico-asesor. Este proceso analítico habilitó la categorización de variables críticas que influían en el rendimiento, la calidad del servicio y la satisfacción del consumidor, estableciendo las bases para determinar acciones remediales.

Las acciones correctivas definidas a partir del análisis de causas raíz fueron documentadas mediante formularios estandarizados que permitieron registrar la no conformidad, identificar la causa raíz, definir la acción correctiva, asignar responsables y verificar su cierre. Estos registros constituyen evidencia del tratamiento sistemático de las desviaciones conforme a la cláusula 10.2 de la norma ISO 9001:2015, y se presentan en el **Anexo 14**. Estos registros constituyen evidencia del tratamiento sistemático de no conformidades conforme a la cláusula 10.2 de ISO 9001:2015. Cada formulario documentó la desviación detectada, su causa raíz, la acción correctiva definida, el responsable asignado y la verificación de cierre, garantizando trazabilidad completa del proceso de corrección **Anexo 14**

La identificación y registro sistemático de incidencias operativas se realizó mediante formularios de observación interna aplicados durante la ejecución del servicio, los cuales

permitieron documentar desviaciones, comportamientos recurrentes y oportunidades de mejora. Estos registros constituyeron la base para el análisis causa–efecto y la definición de acciones Kaizen, evidenciando la aplicación de la mejora continua conforme a la cláusula 10.3 de la norma 9001:2015, y se presentan en el **Anexo 15**.

Figura 8: *Causas de las desviaciones en el proceso operativo del técnico asesor*



Fuente: Autores (2025).

2.1.2.Acciones correctivas derivadas del análisis causa–efecto

Complementarias para lograr la estandarización, la eficiencia y la mejora continua del servicio.

Tabla 3: *Análisis causa efecto*

Categoría	**Causas raíz identificadas**	**Intervención a aplicarse (KAIZEN / 5S / ISO 9001)**
Método (procedimientos)	• Falta de estandarización y secuenciación de pasos del servicio. • Ausencia de check list operativo. • Falta de retroalimentación formal del proceso.	• Crear POE-AS-01 basado en pasos de servicio. • Aplicar ISO 9001 – 8.5 (control operacional). • Incorporar señalética y tableros visuales 5S.

Categoría	Causas raíz identificadas	Intervención a aplicarse (KAIZEN / 5S / ISO 9001)
Mano de obra (técnico-asesor)	• Desorganización personal (no prioriza tareas). • Falta de motivación y compromiso. • Débil disciplina operativa y escaso autocontrol. • Ausencia de liderazgo interno y cultura de mejora.	• Implementar KAIZEN individual y grupal (reuniones cortas de 10 min). • Aplicar 5S: Seiketsu y Shitsuke. • Reconocer logros con indicadores visuales. • ISO 9001 – 7.3 (toma de conciencia del personal).
Materiales / Repuestos	• No verificación previa del stock. • Retrasos en requisición de piezas. • Falta de control visual del inventario.	• Etiquetado 5S (clasificar y ordenar). • Plan de abastecimiento previo al paso 1 (Cita). • Control de proveedores bajo ISO 9001 – 8.4.
Máquinas / Herramientas	• Equipos sin mantenimiento o calibración. • Falta de control diario de herramientas. • Desorden en el área de trabajo técnico.	• Programa de mantenimiento autónomo KAIZEN. • Aplicar 5S: Seiri y Seiso. • Registros de calibración (ISO 9001 – 7.1.5).
Medio ambiente / entorno	• Espacio de trabajo desordenado o mal señalizado. • Falta de ergonomía. • Interrupciones por ruido o circulación inadecuada	• Completar implementación 5S. • Reorganizar layout con flujo unidireccional.
Medición / control	• No existen métricas visuales diarias. • Falta de seguimiento a	• Instalar tablero de control KAIZEN visible. • Monitorear indicadores

Categoría	Causas raíz identificadas	Intervención a aplicarse (KAIZEN / 5S / ISO 9001)
	indicadores (NPS). • Retroalimentación poco sistemática.	semanales. • Auditorías internas (ISO 9001 – 9.1).

Fuente: Autores (2025).

2.1.3.Intervención y aplicación de herramientas de mejora continua

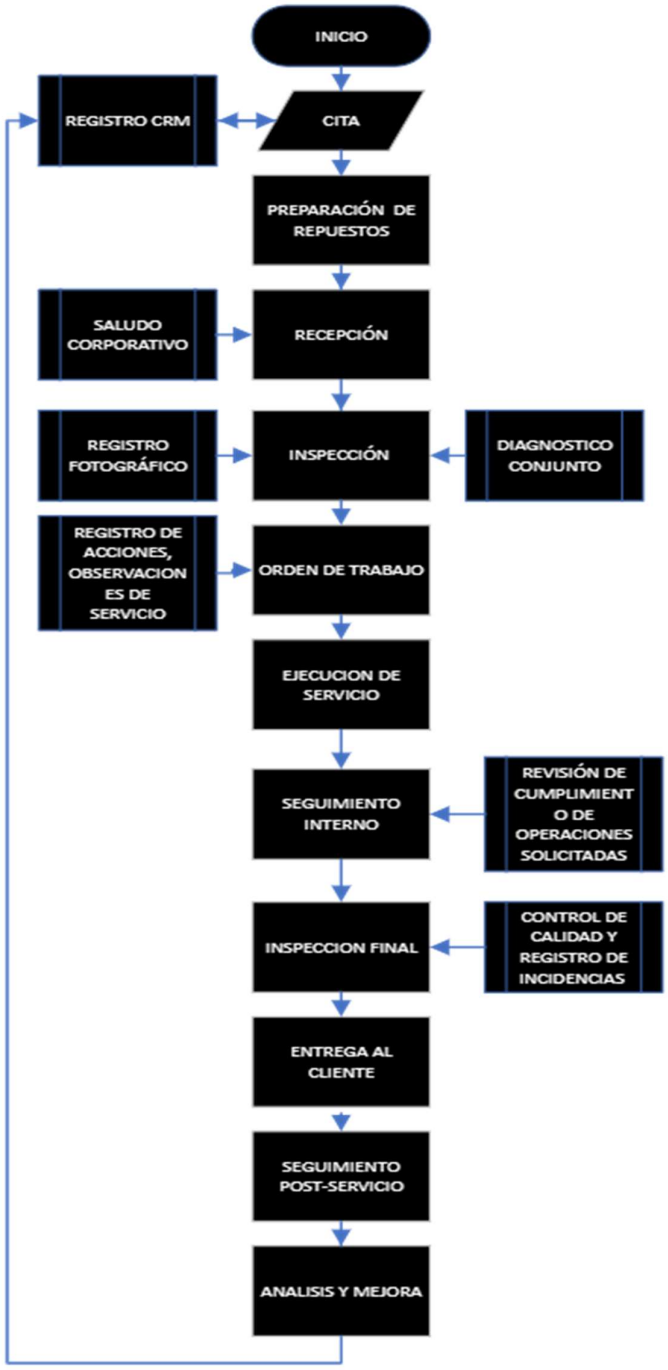
Partiendo de los orígenes identificados mediante el diagrama de Ishikawa, se diseñó un plan de acción integral orientado a corregir las desviaciones en la operación del técnico-asesor. El plan aplica de forma coordinada Kaizen, 5S e ISO 9001 para estandarizar procedimientos, fortalecer la disciplina operativa y asegurar trazabilidad en cada etapa del servicio. Las medidas planteadas, detalladas en la tabla precedente, representan el fundamento para establecer un sistema de gestión dirigido hacia la eficiencia, el ordenamiento y la conformidad del cliente.

2.1.3.1. Flujograma del proceso operativo del técnico asesor

Con el fin de estandarizar actividades y garantizar la trazabilidad del servicio, se diseñó un flujograma operativo basado en los Diez Pasos del Proceso de Servicio. Este esquema secuencia las acciones del técnico-asesor desde la programación de la cita hasta el seguimiento post-servicio, asegurando criterios de calidad y mejora continua.

El flujograma integra Kaizen, 5S e ISO 9001, estableciendo control visual de etapas críticas: recepción, diagnóstico, ejecución, inspección, entrega y seguimiento. Su implementación disminuye la variabilidad en las operaciones, fortalece la disciplina en el área de trabajo y consolida un esquema de atención enfocado hacia la conformidad del cliente y la excelencia en el servicio.

Figura 9: *Flujograma del proceso operativo del técnico asesor*



Fuente: Autores (2025).

2.1.3.2. Procedimiento Operativo Estándar (POE-AS-01)

Gestión del Proceso Operativo del Técnico-Asesor en el Concesionario Automotriz

2.1.3.3. Propósito

Establecer un procedimiento normalizado que asegure la programación, realización y supervisión de las tareas del técnico-asesor, asegurando la conformidad del servicio con la ISO 9001:2015, los Diez Pasos del Proceso de Servicio y las metodologías Kaizen y 5S, potenciando la satisfacción y lealtad del cliente.

2.1.3.4. Alcance

Aplica a todos los servicios de mantenimiento, diagnóstico y reparación realizados en el concesionario, desde la programación de la cita hasta el seguimiento post-servicio, comprendiendo la atención al cliente, la gestión documental, la ejecución técnica y el control de calidad del vehículo.

2.1.3.5. Referencias normativas

ISO 9001:2015 Sistemas de gestión de la calidad. Requisitos

Manual de calidad del concesionario, procedimiento de atención posventa, los diez pasos del proceso de servicio, política de satisfacción al cliente y estándares de marca.

2.1.3.6. Responsables

Técnico-asesor: ejecución técnica y administrativa del proceso; responsable del registro y comunicación con el cliente. El jefe de taller realiza la verificación del cumplimiento del POE, control de indicadores y revisión de registros. El gerente de servicio debe realizar la supervisión del sistema de calidad y validación de las acciones de mejora.

2.1.3.7. Entradas

Agenda de citas generadas (presencial, telefónica o digital).

Historial del cliente y del vehículo.

Disponibilidad de repuestos, herramientas y recursos técnicos.

Requisitos específicos del cliente o de la marca (campañas, recalls, mantenimientos).

***Tabla 4**: Etapas de proceso de servicio técnico asesor*

Nº	Etapa del proceso	Descripción de la actividad	Registro generado
1	Cita y preparación	Confirmar cita, revisar historial, verificar repuestos y preparar orden preliminar.	Agenda digital / Lista de verificación de preparación
2	Recepción y saludo	Recibir al cliente, validar datos del vehículo y motivo de visita.	
3	Diagnóstico conjunto	Inspección visual y funcional con el cliente; registro fotográfico.	Informe de diagnóstico / Evidencia digital
4	Orden de trabajo (OT)	Formato de recepción Explicar hallazgos, detallar costos y tiempos; obtener autorización del cliente.	OT firmada o digitalizada
5	Ejecución del servicio	Realizar las tareas aprobadas aplicando el principio “Reparar bien a la primera (FRFT)”.	Registro técnico de ejecución
6	Seguimiento interno	Documentar hallazgos adicionales y comunicarlos al cliente para su aprobación.	Bitácora o sistema DMS*
7	Inspección final	Revisar cumplimiento técnico y limpieza del vehículo.	Lista de control de calidad / Checklist 5S
8	Entrega al cliente	Revisión conjunta, explicación de trabajos, entrega de factura y garantía.	Acta de entrega y conformidad
9	Seguimiento post-servicio	Llamada de satisfacción (24 h) y encuesta NPS (72 h).	Registro de seguimiento / Encuesta digital
10	Análisis y mejora continua	Evaluar indicadores, identificar desviaciones y proponer acciones Kaizen.	Acta de reunión Kaizen

Fuente: Autores (2025).

2.1.3.8. Incorporación de señalética y tableros visuales

Como componente del mejoramiento continuo y la normalización, se estableció un sistema de gestión visual destinado a optimizar la comunicación organizacional y el

monitoreo operativo del técnico-asesor, fundamentado en 5S y en ISO 9001:2015 (apartados 7.1.3 y 8.5), garantizando que la información esencial resulte nítida y de fácil acceso. La señalética en áreas de trabajo, almacenamiento y atención al cliente, junto con tableros visuales Kaizen, permitió identificar recursos, controlar indicadores como tiempo de servicio, reprocesos y NPS, y realizar revisiones diarias. En conjunto, estas herramientas reforzaron la organización, la transparencia y la autodisciplina, consolidando una cultura de orden y responsabilidad compartida en el área de servicio.

2.1.3.9. Implementación de Kaizen individual y grupal

Se aplicó Kaizen en dos niveles para fortalecer la mejora continua. En el nivel individual, cada uno del técnico asesor realizó autoevaluaciones respecto al cumplimiento de los Diez Pasos del Servicio. En el nivel grupal, se desarrollaron reuniones breves diarias (daily Kaizen) para revisar indicadores como tiempo promedio, reprocesos y NPS. Este enfoque ayudó a la participación activa, comunicación efectiva y reducción de desviaciones operativas, impulsando una cultura de orden y una mejora constante en el área de servicio.

2.1.3.10. Aplicación de 5S: Seiketsu y Shitsuke

Para fomentar la organización del área de servicio se aplicaron las fases finales de 5S: Seiketsu (estandarizar), se estableció normas visuales y procedimientos para mantener el orden, y Shitsuke (disciplina), esto fortaleció la disciplina y el compromiso del personal.

El seguimiento y control de la metodología 5S se realizó mediante hojas de verificación periódicas que permitieron evaluar el estado de orden, limpieza, señalización y disciplina operativa en el área de servicio. Estos registros constituyen evidencia objetiva de los resultados alcanzados en el control del entorno de trabajo durante la etapa posterior a la intervención y se presentan en el **Anexo 16**.

Figura 10: *Rotulación 5S*



Fuente: Autores (2025).

2.1.3.11. Reconocer logros con indicadores visuales

Se implementó un reconocimiento visual de logros para fortalecer la motivación del personal, basado en Kaizen y gestión visual.

2.1.3.12. Aplicación de ISO 9001 – 7.3

Para fortalecer el compromiso del personal, se aplicó el requisito 7.3 de ISO 9001:2015, esto orientado a la toma de conciencia. Mediante sesiones breves, charlas técnicas, el personal comprendió cómo su desempeño impacta en la satisfacción del cliente. Esto aumentó la responsabilidad individual y en el sentido de pertenencia, fomentando a la calidad como pilar del control operacional y la mejora continua.

2.1.3.13. Etiquetado 5S clasificar y ordenar

Como parte de la metodología 5S, se implementó un sistema de etiquetado visual para clasificar y ordenar el área de servicio. Mediante Seiri (clasificar) y Seiton (ordenar). Este sistema fortaleció la organización, trazabilidad y disciplina operativa, en concordancia con los principios de control operacional de ISO 9001:2015.

2.1.3.14. Control de proveedores bajo ISO 9001 – 8.4

Para garantizar calidad y trazabilidad de los insumos, se implementó el control de proveedores conforme al apartado 8.4 de ISO 9001:2015, regulando evaluación, selección y

seguimiento de proveedores externos. El proceso se aplicó a repuestos, materiales y servicios subcontratados, verificando certificados, cumplimiento normativo y desempeño histórico, además de establecer retroalimentación entre repuestos, asesoría técnica y compras. Esta gestión fortaleció la confiabilidad del proceso operativo, redujo riesgos de suministro y mantuvo la calidad del servicio técnico y la satisfacción del cliente.

2.1.3.15. Programa de mantenimiento autónomo Kaizen

Con el fin de preservar la operatividad de herramientas y equipos, se implementó un programa de mantenimiento autónomo basado en Kaizen, promoviendo la responsabilidad individual del técnico asesor en el cuidado preventivo. Mediante rutinas semanales de inspección y limpieza, apoyadas en formatos y registros visuales y checklist, se aseguró trazabilidad y control. Esta práctica, alineada con ISO 9001:2015 (cláusula 8.5.1), fortaleció la disciplina, la eficiencia y la mejora continua, reduciendo fallas y tiempos improductivos en el área de servicio.

2.1.3.16. Aplicación de 5S: Seiri y Seiso

Durante Seiri (clasificar) y Seiso (limpiar) se optimizó el área de servicio mediante la eliminación de elementos innecesarios y rutinas de limpieza preventiva. Estas acciones liberaron espacio, mejoraron la accesibilidad a las áreas y permitieron detectar fallas tempranas. En conjunto, Seiri y Seiso reforzaron la seguridad, la eficiencia y la disciplina, evidenciando una cultura de orden y mejora continua en el concesionario.

2.1.3.17. Registros de calibración (ISO 9001 – 7.1.5)

Para asegurar precisión y confiabilidad en las mediciones de las herramientas, se implementó un sistema de registros de calibración conforme al apartado 7.1.5 de ISO 9001:2015. Cada equipo de diagnóstico y medición fue identificado, codificado y controlado mediante etiquetas y registros de verificación, esto garantiza la trazabilidad y cumplimiento de parámetros del fabricante. Las calibraciones serán realizadas por laboratorios autorizados o personal calificado, los certificados serán archivados en el sistema de gestión de la calidad.

2.1.3.18. Implementación 5S Seiton, Seiketsu, Shitsuke

Con el propósito de consolidar el área de servicio y asegurar la sostenibilidad del sistema de mejora continua, se implementó la metodología 5S integrando Seiton, Seiso y señalética estandarizada. Mediante ubicaciones fijas, rutinas de limpieza y señalización visual, se refuerza la disciplina operativa y la eficiencia del equipo técnico, consolidando una cultura de orden y calidad sostenida en el área de servicio.

La sostenibilidad del orden, la limpieza y la seguridad en el área de servicio se respaldó mediante planillas de mantenimiento y limpieza que establecieron rutinas periódicas para el cuidado del entorno y de los equipos del taller. Estos registros permitieron asegurar la disciplina operativa y la estandarización de prácticas asociadas a las fases Seiso y Seiketsu de la metodología 5S, y se presentan en el **Anexo 17**.

2.1.3.19. Reorganizar layout con flujo unidireccional

Con el fin de optimizar la circulación interna y reducir interferencias, se reorganizó el layout del área de trabajo bajo un flujo unidireccional, conforme a 5S (Seiketsu) y al control operacional de ISO 9001:2015. El rediseño eliminó cruces y zonas de espera, delimitó áreas para recepción, diagnóstico, reparación, control de calidad y entrega final, reduciendo desplazamientos, mejorando seguridad y facilitando la trazabilidad. Esto incrementó productividad, coordinación y la experiencia del cliente en el concesionario.

2.1.3.20. Instalar tablero de control Kaizen visible

En el marco de la gestión visual y la optimización permanente, se incorporó un cuadro de mando Kaizen en el área operativa para concentrar los KPI y apoyar la toma de decisiones respaldada por datos concretos. Diseñado con codificación por colores (verde, amarillo y rojo), permite visualizar metas de tiempo de servicio y reprocesos, registrar observaciones y definir acciones correctivas en reuniones diarias. Su ubicación estratégica facilita seguimiento en tiempo real, transparencia y motivación del personal, consolidando una cultura de participación y compromiso con la calidad acorde con ISO 9001:2015, Kaizen y 5S.

2.1.3.21. Monitorear indicadores mensuales

Para analizar el desempeño operativo y promover el mejoramiento continuo, se configuró un monitoreo periódico mensual de parámetros clave (NPS) en el área de posventa alineado con ISO 9001:2015. Se estudian la duración promedio del servicio, el reprocesamiento y el NPS, cuyos datos se presentan gráficamente en un cuadro de control Kaizen. Durante los encuentros de revisión mensuales, el grupo de posventa reconoce comportamientos y formula acciones remediales o preventivas. Este esquema consolida decisiones sustentadas en evidencia real y promueve una mentalidad de calidad con perfeccionamiento constante en el concesionario.

2.1.3.22. Auditorías internas (ISO 9001 – 9.1)

Conforme a lo establecido en la cláusula 9.1 de ISO 9001:2015, se estableció el proceso de auditorías internas de modo que permita corroborar la eficacia del sistema de gestión de calidad y la conformidad procedimental del sector de servicio. El programa, actualmente en proceso de revisión y validación, evaluará indicadores como tiempo promedio, reprocesos y NPS, además de la aplicación de Kaizen y 5S. Esta acción establece un ciclo sistemático para la verificación, retroalimentación y optimización, así fortaleciendo la transparencia y eficiencia operativa del concesionario.

3. Etapa 3: Evaluación

Este período se orientó hacia la medición estructurada de los impactos derivados de la implementación realizada en septiembre, mediante el rastreo de los parámetros operacionales y de satisfacción del usuario definidos metodológicamente. Los datos recopilados permiten evaluar la eficacia de las acciones aplicadas y respaldar la comparación analítica con la etapa anterior.

3.1. Resultados de la Evaluación Posterior

La evaluación correspondiente a los meses posteriores a la aplicación del plan de mejora continua (octubre y noviembre de 2025) evidencia cambios relevantes en los indicadores operativos y de satisfacción del cliente. Durante este periodo se registraron 297

y 269 órdenes de trabajo respectivamente, lo que permite contar con una base empírica suficiente para el análisis comparativo frente al periodo previo.

En cuanto a la tasa de respuesta de encuestas NPS, se registraron 131 encuestas válidas en octubre y 113 en noviembre, representando tasas del 44,11% y 42,01% respectivamente, frente al 76,9% de la etapa previa. Esta reducción se explica por tres factores: el menor volumen de OT en la etapa posterior (566 vs. 2.072), el período de adaptación al nuevo esquema de seguimiento post-servicio implementado en el Paso 9 del POE-AS-01, y la naturaleza voluntaria de la encuesta. Si bien la tasa es inferior, el volumen de 244 respuestas válidas es estadísticamente suficiente para caracterizar la percepción del cliente en el período analizado.

Tabla 5: *Comparación de indicadores pre y post intervención*

Periodo	**Órdenes de trabajo (n)**	**Tiempo promedio (min)**	**CV (%)**	**NPS**
Enero–Agosto 2025 (Previo)	2072	119.81	29.10	88.80
Octubre 2025 (Post)	297	95.51	3.63	100
Noviembre 2025 (Post)	269	95.29	3.60	99.12

Fuente: Autores (2025).

A través del análisis de las duraciones individuales de atención registradas en el sistema DMS durante octubre y noviembre de 2025, se logró una descripción estadística del comportamiento operacional subsecuente a la intervención. En octubre (n = 297), la duración media alcanzó 95,51 minutos, con una dispersión estándar de 3,46 minutos y un coeficiente de variación del 3,63%. Para noviembre (n = 269), el promedio se estableció en 95,29 minutos, con dispersión estándar de 3,43 minutos y coeficiente de variación de 3,60%. Tales cifras reflejan una operativa estable y regulada, consistente con el POE-AS-01, la normalización 5S y las prácticas Kaizen.

En cuanto a calidad técnica, el campo REPROCESO registró 1 caso en octubre (0,34 %) y 1 en noviembre (0,37 %), mostrando una reducción significativa frente al 6,37 % previo. En

percepción del cliente, las tasas de respuesta NPS fueron de 44,11 % en octubre y 42,01 % en noviembre, con distribuciones mayoritariamente promotoras (100 % y 99,12 %, respectivamente), lo que explica los puntajes NPS de 100 % y 99,12 %.

Estos indicadores refuerzan la validez de la comparación pre-post e indican mejoras simultáneas en estabilidad operativa, calidad técnica y percepción del cliente.

Tabla 6: *Indicadores complementarios de la etapa posterior*

Indicador	**oct-25**	**nov-25**	**Total Oct–Nov**
Órdenes de trabajo (n)	297	269	566
Tiempo promedio (min)	95,51	95,29	95,40
Desviación estándar (min)	3,46	3,43	3,45
CV (%)	3,63 %	3,60 %	3,61 %
Reprocesos (n)	1	1	2
Reprocesos (%)	0,34 %	0,37 %	0,35 %
Encuestas válidas	131	113	244
Tasa encuestas válidas	44,11 %	42,01 %	43,11 %
Promotores (%)	100%	99,12 %	99,59 %
Neutros (%)	0%	0,88 %	0,41 %
Detractores (%)	0%	0%	0%
NPS (%)	100%	99,12 %	99,59 %

Fuente: Autores (2025).

3.2. Comparación entre la etapa previa (enero–agosto) y la etapa posterior (octubre–noviembre)

3.2.1. Análisis comparativo entre etapas

La comparación integrada entre la etapa previa (enero–agosto) y la etapa posterior (octubre–noviembre) evidencia mejoras sustanciales en los principales indicadores operativos y de satisfacción del cliente. El tiempo promedio de servicio se redujo de 119,81 a 95,40 minutos, lo que representa una disminución del 20,4 %. Asimismo, la desviación estándar descendió de 34,92 a 3,45 minutos y el coeficiente de variación de 29,10 % a 3,61

%, demostrando que el proceso no solo se volvió más rápido sino también más estable y homogéneo.

En términos de calidad técnica, los reprocesos se redujeron de 6,37 % en la etapa previa a 0,35 % en la etapa posterior, disminuyendo 130 casos y confirmando un impacto directo de las mejoras aplicadas en la estandarización de tareas y el control de calidad. La valoración del cliente mostró aumentos notables, incrementando el NPS desde 88,80% hasta 99,59% en la fase posterior, lo que manifiesta una mejora considerable en la vivencia del usuario y en la fiabilidad del procedimiento de atención.

Tales hallazgos confirman la efectividad del POE-AS-01, la adopción de la metodología 5S y las prácticas Kaizen instauradas, evidenciando un efecto que posibilita valorar tanto el rendimiento operacional como la conformidad del cliente.

El monitoreo y evaluación de las métricas fundamentales de desempeño se sustentó en un panel visual que integró datos vinculados con la duración de atención, la fluctuación del proceso (CV) y el grado de satisfacción del usuario (NPS), agilizando la interpretación de hallazgos y las decisiones fundamentadas en información. Este instrumento de administración visual fortaleció el seguimiento y el perfeccionamiento continuo del procedimiento según el apartado 9.1 del estándar ISO 9001:2015 y los fundamentos de Kaizen, documentándose en el **Anexo 18**.

Los resultados consolidados de la intervención se sintetizan en la siguiente tabla comparativa, que presenta de manera integral los indicadores operativos y de satisfacción en ambas etapas del estudio.

***Tabla 7**: Comparación entre etapa previa y etapa posterior*

Indicador	**Etapa previa (Ene–Ago 2025)**	**Etapa posterior (Oct–Nov 2025)**	**Variación**
Órdenes de trabajo (n)	2.072	566	—
Tiempo promedio (min)	119,81	95,40	↓ 24,41 min (–20,4 %)
Desviación estándar (min)	34,92	3,45	↓ 31,47 min (–90,1 %)

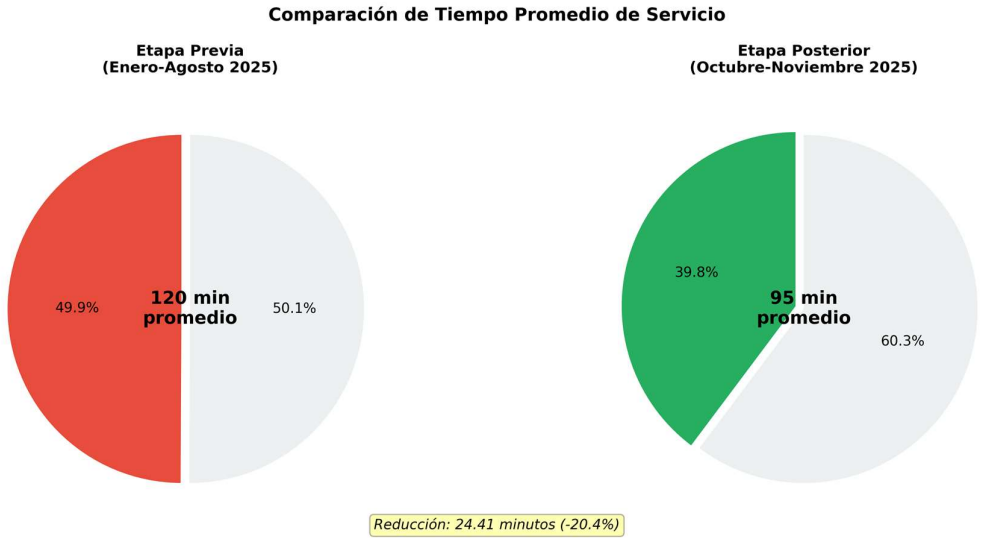
Indicador	Etapa previa (Ene–Ago 2025)	Etapa posterior (Oct–Nov 2025)	Variación
Coeficiente de variación (%)	29,10 %	3,61 %	↓ 25,49 puntos
Reprocesos (n)	132	2	↓ 130 casos
Reprocesos (%)	6,37 %	0,35 %	↓ 6,02 puntos (–94,5 %)
NPS (%)	88,80 %	99,59 %	↑ 10,79 puntos
Encuestas válidas (n)	1593	244	No aplica
Tasa de encuestas válidas (%)	76.90%	43,11 %	No aplica

Fuente: Autores (2025)

3.2.1.1. Visualización comparativa de resultados

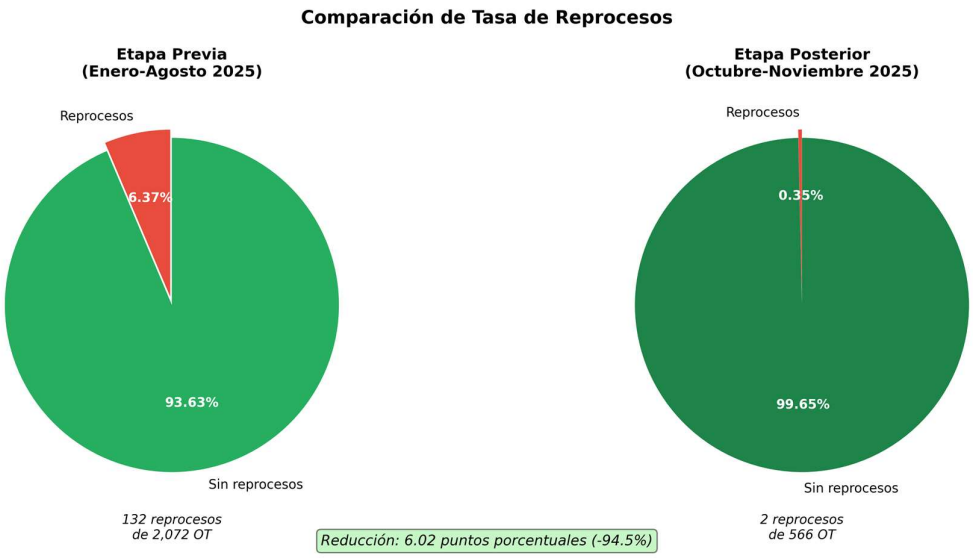
Para facilitar la interpretación de las mejoras logradas, se presentan a continuación gráficos comparativos tipo pastel que ilustran la evolución de los indicadores clave entre la etapa previa y la etapa posterior.

Figura 11: *Comparación de tiempos de servicio (etapa previa vs. posterior)*



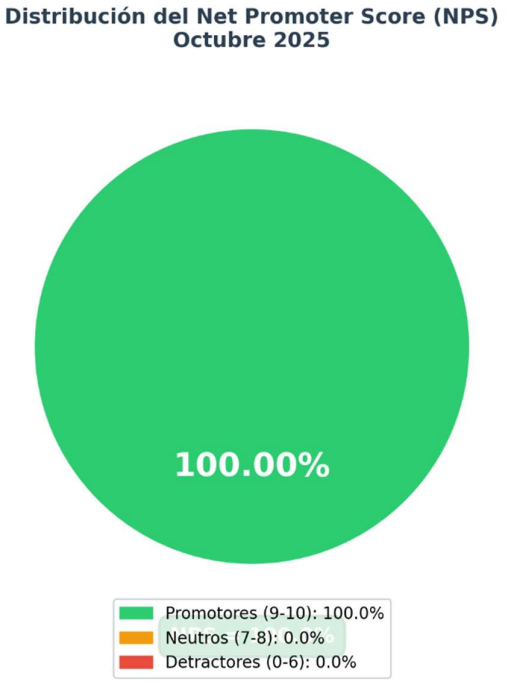
Fuente: Autores (2025).

Figura 12: *Comparación de tasa de reprocesos (etapa previa vs. posterior)*



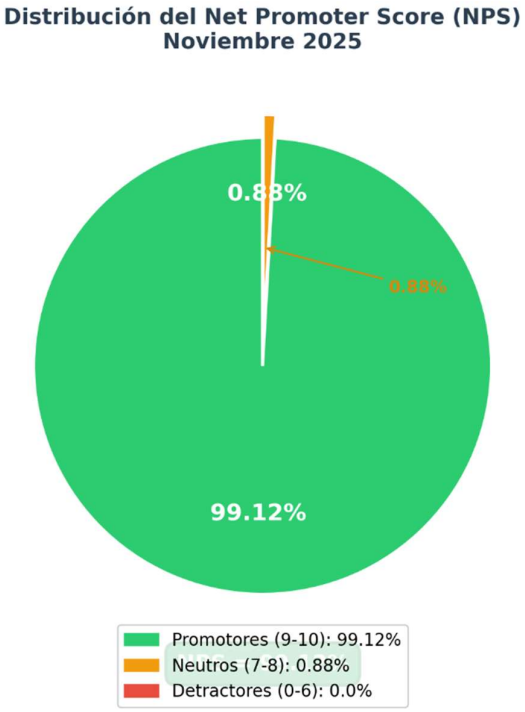
Fuente: Autores (2025).

Figura 13: *Evolución del NPS - Octubre 2025*



Fuente: Autores (2025).

Figura 14: *Evolución del NPS - Noviembre 2025*



Fuente: Autores (2025).

Estos gráficos evidencian de manera visual la mejora significativa en todos los indicadores monitoreados. La reducción del tiempo promedio de servicio en un 20.4%, la disminución de reprocesos en un 94.5%, y el incremento sostenido del NPS hasta 99.1% confirman la efectividad de la intervención implementada.

El análisis de los resultados obtenidos fue socializado y discutido en reuniones Kaizen con el equipo del taller, en las cuales se revisaron los indicadores de desempeño y se definieron compromisos y acciones orientadas a la mejora continua del proceso. Estos espacios de trabajo fomentaron la contribución del personal en la toma de decisiones y fueron documentados mediante actas formalmente firmadas, que conforman evidencia de la aplicación del modelo Kaizen y se detallan en el **Anexo 19**.

4. **Etapa 4: Análisis Comparativo**

En esta etapa se realizó la comparación integral de los indicadores obtenidos en la etapa previa (enero-agosto 2025) versus la etapa posterior (octubre-noviembre 2025), con el propósito de cuantificar el impacto de las estrategias implementadas y discutir los hallazgos en el contexto de la gestión de la calidad y la mejora continua en talleres

automotrices.

Tabla 8: *Matriz acción-resultado*

Acción específica	Metodología	Indicador impactado	Mecanismo
POE-AS-01 (10 pasos secuenciados)	ISO 9001 – Cláusula 8.5	Tiempo promedio / CV	Elimina decisiones improvisadas; estandariza secuencia
Reorganización layout unidireccional	5S – Seiton	Tiempo promedio	Suprime desplazamientos innecesarios
Verificación previa de stock (Paso 1)	Kaizen / ISO 9001 – 8.4	Tiempo promedio	Elimina espera por repuestos
Checklist inspección final (Paso 7)	ISO 9001 – Cláusula 8.6	Reprocesos	Detecta no conformidades antes de entrega
Reuniones Kaizen diarias	Kaizen	Reprocesos / CV	Corrección rápida de desviaciones recurrentes
Mantenimiento autónomo de equipos	Kaizen – Cláusula 8.5.1	Reprocesos	Reduce errores por herramientas fuera de especificación
Seguimiento post-servicio (Paso 9)	ISO 9001 – Cláusula 8.2.1	NPS	Cierra el ciclo comunicacional con el cliente
Tablero de control Kaizen visible	Kaizen / Gestión visual	Todos los indicadores	Activa correcciones en tiempo real

Fuente: Autores, elaboración propia basada en el análisis Ishikawa y resultados operativos de la intervención.

4.1. Discusión de Hallazgos y Comparación de Resultados

4.1.1. Reducción del tiempo promedio de servicio

El tiempo medio descendió de 119,81 a aproximadamente 95 minutos, equivalente a una reducción del 20.4 %. El cambio más relevante es la estabilidad del proceso: el coeficiente de variación pasó de 29,10 % a entre 3,6 % y 3,63 %, confirmando mayor previsibilidad y estandarización al eliminar cuellos de botella.

En la etapa previa (enero–agosto), el boxplot muestra amplia dispersión, con mediana cercana a 120 minutos, rangos entre 60 y 180 minutos y alta variabilidad entre órdenes de trabajo, reflejando un proceso inestable. En el periodo posterior (octubre–noviembre), la mediana desciende a unos 95 minutos y el rango intercuartílico se reduce, sin valores extremos relevantes, evidenciando uniformidad, control de tiempos improductivos y aplicación sistemática de procedimientos.

En conjunto, el boxplot confirma que la intervención redujo tanto el tiempo promedio como la variabilidad, indicador de estabilidad operacional y madurez del proceso. Aunque no demuestra causalidad estadística, aporta evidencia visual coherente con los resultados numéricos reportados.

La reducción del tiempo promedio respondió principalmente al POE-AS-01, que eliminó la variabilidad decisional en cada OT, a la reorganización del layout mediante 5S-Seiton, que suprimió desplazamientos innecesarios, y a la verificación previa de repuestos incorporada en el Paso 1, que eliminó el cuello de botella de espera más frecuente detectado en el diagnóstico inicial. La caída del CV del 29,1% al 3,61% refleja el efecto combinado de la estandarización del proceso y el monitoreo continuo mediante el tablero Kaizen.

Con el propósito de validar la estabilidad del proceso en la etapa posterior, se construyó una carta de control X-barra para el tiempo promedio de servicio. Los límites de control se calcularon a partir de los datos de octubre y noviembre 2025

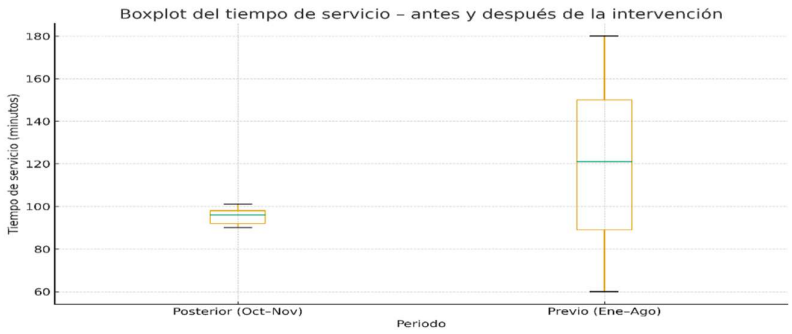
Tabla 9: *Parámetros de la carta de control X- barra para el tiempo de servicio (etapa posterior)*

Parámetro	Valor
Media ($\bar{X}$)	95,40 min
Desviación estándar (s)	3,45 min
Límite de control superior (LCS = $\bar{X}$ + 3s)	105,75 min
Límite de control inferior (LCI = $\bar{X}$ - 3s)	85,05 min
Rango observado octubre-noviembre	92,0 – 98,5 min

Fuente: Autores, elaboración propia con datos del sistema DMS, octubre-noviembre 2025.

Los valores registrados en ambos meses se mantienen dentro de los límites de control establecidos, sin puntos fuera de rango ni tendencias ascendentes, lo que indica que el proceso opera en estado de control estadístico durante la etapa posterior. Este resultado contrasta con la etapa previa, donde el CV del 29,1% evidenciaba un proceso fuera de control.

Figura 15: *Boxplot del tiempo de servicio-antes y después de la intervención*



Fuente: Autores (2025).

Este patrón resulta consistente con la implementación del Procedimiento Operativo Estándar (POE-AS-01), la reorganización física del taller mediante 5S, la instalación de tableros visuales y la estructuración de reuniones Kaizen, acciones que redujeron tiempos muertos, retrabajos y desviaciones en la secuencia del servicio.

4.1.2.Mejora en la percepción del cliente.

La reducción de reprocesos de 6,37% a 0,35% se atribuye al checklist de inspección final (ISO 9001 – cláusula 8.6), que introdujo verificación sistemática antes de la entrega, y al programa de mantenimiento autónomo Kaizen, que garantizó la operatividad de los equipos de diagnóstico. Las reuniones Kaizen diarias operaron como mecanismo de aprendizaje que evitó la repetición de errores entre turnos.

El NPS se incrementó de 88,8 % en la etapa previa a 95,4 % en octubre y 99,1 % en noviembre, evidenciando un fortalecimiento sostenido de la disposición a recomendar el servicio. Este resultado responde a tres factores específicos: la mayor previsibilidad del servicio derivada de la estandarización mediante el POE-AS-01, la transparencia comunicacional formalizada en el diagnóstico conjunto del Paso 3, y el seguimiento post-

servicio estructurado a las 24-72 horas del Paso 9, que generó en el cliente una percepción de acompañamiento más allá de la transacción técnica.

El seguimiento telefónico realizado entre las 24 y 72 horas posteriores a la entrega, conforme al Paso 9 del POE-AS-01 y la cláusula 8.2.1 de ISO 9001:2015, permitió capturar retroalimentación cualitativa complementaria al NPS. Los comentarios recurrentes registrados durante octubre y noviembre se agruparon en tres categorías principales

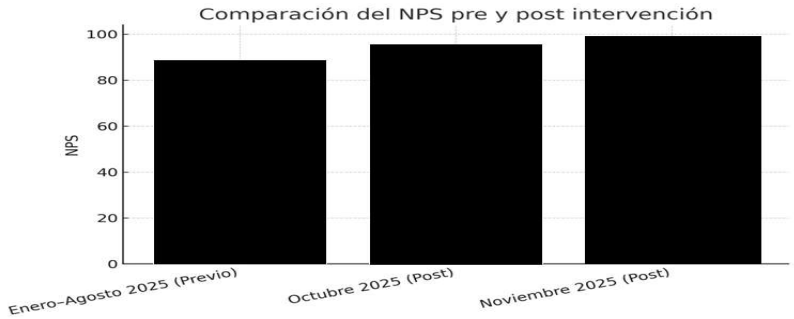
Tabla 10: *Categorías de retroalimentación cualitativa — seguimiento post-servicio*

Categoría	Comentarios frecuentes	Frecuencia relativa
Puntualidad en la entrega	"El vehículo estuvo listo en el tiempo prometido"	Alta
Comunicación técnica	"Me explicaron claramente qué se hizo al vehículo"	Alta
Orden y limpieza del taller	"El área de trabajo se veía organizada y limpia"	Media
Observaciones de mejora	"Dificultad para acceder al concesionario en horas pico"	Baja

Fuente: Autores, registros de seguimiento post-servicio, octubre-noviembre 2025 Anexo 3

Estos hallazgos cualitativos son coherentes con el incremento del NPS y refuerzan que la mejora en la percepción del cliente no responde únicamente a la reducción de tiempos, sino a una experiencia integral que incluye comunicación clara, cumplimiento de plazos y entorno de trabajo ordenado. La observación sobre accesibilidad en horas pico coincide con la amenaza A4 identificada en el análisis FODA, confirmando su vigencia como factor de riesgo no resuelto.

Figura 16: *Comparación de NPS etapa previa posterior a intervención*



Fuente: Autores (2025).

La relación entre dispersión operacional y conformidad del cliente resulta congruente con los hallazgos de la literatura especializada en gestión de calidad automotriz, donde la predictibilidad del servicio representa un componente decisivo de la confianza del usuario y, por consiguiente, de su inclinación a recomendar.

4.1.3.Síntesis interpretativa etapa posterior.

Los datos permiten afirmar que la intervención mejoró simultáneamente eficiencia, estabilidad operativa y satisfacción. Si bien el diseño cuasiexperimental no permite establecer causalidad estadística generalizable, la asociación temporal es sólida y respaldada por evidencia cuantitativa. Además, en la fase posterior se identificaron reprocesos con total trazabilidad, registrándose un caso en octubre (0,34 %) y un caso en noviembre (0,37 %), lo que completa el análisis del desempeño técnico y confirma una mejora significativa respecto al 6,37 % observado en la etapa previa.

5. Etapa 5: Retroalimentación y Mejora Continua

Como etapa final del ciclo de mejora continua, se estableció un sistema permanente de retroalimentación basado en los hallazgos del análisis comparativo. Esta etapa respalda la durabilidad de las acciones de mejora implementadas por medio del monitoreo sostenido de parámetros, reuniones sistemáticas Kaizen y modificaciones incrementales del sistema de administración de calidad.

5.1. Mecanismos de Retroalimentación Establecidos

5.1.1. Tablero de Control Continuo

El tablero Kaizen implementado en el área de servicio se mantuvo como herramienta central de seguimiento, actualizándose mensualmente con los indicadores de tiempo promedio, reprocesos y NPS. Este sistema permite identificar desviaciones tempranas y activar acciones correctivas antes de que afecten significativamente el desempeño.

El seguimiento mensual de los tres indicadores clave muestra la siguiente evolución.

Tabla 11: *Evolución mensual de indicadores clave*

Período	Tiempo promedio (min)	CV (%)	Reprocesos (%)	NPS (%)
Ene–Ago 2025 (promedio)	119,81	29,10	6,37	88,80
oct-25	95,51	3,63	0,34	100
nov-25	95,29	3,60	0,37	99,12
Meta 2026	< 100	< 5	< 1	> 95

Fuente: Autores, elaboración propia con datos del sistema DMS.

5.1.2. Reuniones de Mejora Continua

Se institucionalizaron reuniones mensuales de mejora continua con participación del equipo técnico, asesores de servicio y jefatura de taller. En estas sesiones se analizan tendencias, se documentan lecciones aprendidas y se proponen mejoras incrementales al POE-AS-01 y a los procedimientos de 5S.

5.1.3. Sistema de Auditorías Internas

De acuerdo con la cláusula 9.1 de ISO 9001:2015, se planificaron auditorías internas trimestrales para verificar el cumplimiento del POE-AS-01, la aplicación de 5S y la evolución de los indicadores clave. Estas auditorías están actualmente en fase de implementación, con el primer ciclo programado para el primer trimestre de 2026. Complementariamente, conforme a la cláusula 9.3 de la norma, la gerencia del concesionario formalizó una revisión por la dirección al cierre del período posterior, en la cual se analizaron los resultados comparativos de tiempo, reprocesos y NPS, se validaron las acciones implementadas y se

definieron los objetivos de calidad para 2026, incluyendo el mantenimiento del tiempo promedio por debajo de 100 minutos, la tasa de reprocesos inferior al 1% y el NPS superior al 95%.

5.1.4.Capacitación Continua

Se estableció un plan de capacitación trimestral para reforzar los principios de Kaizen, 5S e ISO 9001 entre el personal, asegurando la comprensión y el compromiso sostenido con la cultura de mejora continua.

5.1.5.Indicadores de Sostenibilidad

Para garantizar la permanencia de los resultados, se definieron indicadores de sostenibilidad que serán monitoreados durante el año 2026:

- Mantenimiento del tiempo promedio de servicio por debajo de 100 minutos
- Tasa de reprocesos inferior al 1%
- NPS superior al 95%
- Cumplimiento de auditorías 5S superior al 85%
- Tasa de participación en reuniones Kaizen superior al 90%

5.2. Ajustes y Optimización de Procesos

Con base en el desempeño observado durante los meses iniciales del nuevo régimen, se establecieron posibilidades de optimización complementaria:

5.2.1.Optimización del POE-AS-01

Se desarrollaron ajustes puntuales al procedimiento operativo estándar basados en el feedback del equipo técnico, optimizando algunos pasos sin deteriorar la calidad de la atención.

5.2.2.Mejora en la Gestión de Repuestos

Se fortaleció la coordinación con el área de repuestos para reducir aún más los tiempos de espera, implementando un sistema de pre alertas para partes de alta rotación.

5.2.3. Digitalización de Registros

Se inició la digitalización de las listas de verificación 5S y de los registros de calibración, facilitando la trazabilidad y el análisis de tendencias históricas.

5.2.4. Compromiso Organizacional con la Mejora Continua

La alta dirección del concesionario formalizó su compromiso con la sostenibilidad del sistema mediante:

- Asignación de recursos para el mantenimiento del programa
- Reconocimiento periódico al personal por logros en mejora continua
- Integración de parámetros de calidad en la evaluación de rendimiento
- Apoyo a la certificación ISO 9001:2015 del taller

Este período final concluye el ciclo de mejoramiento, pero paralelamente establece los fundamentos para el desarrollo sostenido del sistema de administración de calidad, asegurando que los logros alcanzados no constituyan un suceso puntual sino el comienzo de una mentalidad organizacional dirigida hacia la excelencia operacional.

CONCLUSIONES

La implementación articulada de Kaizen, 5S e ISO 9001:2015 fortaleció la eficiencia operativa del taller concesionario, evidenciada en la reducción del tiempo promedio de servicio de 119,81 a cerca de 95 minutos. Más relevante aún, la disminución del coeficiente de variación del 29,10 % al 3,6 % confirma que el proceso pasó de ser inestable y poco predecible a estar estandarizado y controlado.

La mejora operativa se reflejó directamente en la experiencia del cliente, lo cual se evidencia en el incremento sostenido del Net Promoter Score (NPS) 88,8 % en la etapa previa, 95,4 % en octubre y 99,1 % en noviembre. Esto sugiere que la estabilidad en tiempos, el orden del taller, la comunicación técnica y la trazabilidad del servicio generan mayor confianza y disposición a recomendar.

El Procedimiento Operativo Estándar (POE-AS-01), la gestión visual y las rutinas Kaizen demostraron ser herramientas efectivas para disminuir desperdicios, tiempos

muertos y variabilidad, lo que refuerza la relevancia de integrar metodologías de mejora continua en la postventa automotriz, más allá de iniciativas puntuales o correctivas.

El uso combinado de indicadores tiempo promedio, coeficiente de variación, reprocesos y el NPS constituye un fundamento sólido para la toma de decisiones gerenciales, al permitir evaluar simultáneamente desempeño técnico, eficiencia del proceso y percepción del cliente. Su monitoreo periódico favorece la sostenibilidad del sistema de gestión de la calidad.

El esquema de rol dual técnico-asesor, si bien genera una carga operativa que concentra el 46% del tiempo en funciones no técnicas, demostró ser viable bajo condiciones de proceso estandarizado. La implementación del POE-AS-01 actuó como mecanismo compensador, estructurando las tareas administrativas y de atención dentro de la secuencia técnica sin generar interferencias que deterioraran la calidad del servicio.

El análisis ratifica que el mejoramiento continuo no se sustenta exclusivamente en recursos materiales o tecnológicos, sino en la mentalidad organizacional, el involucramiento del equipo, la rigurosidad operativa y el liderazgo enfocado en procedimientos. En ausencia de tales componentes, los progresos podrían desvanecerse con el tiempo.

La investigación presenta como limitación principal el período posterior relativamente corto (dos meses), lo que restringe la capacidad de confirmar la sostenibilidad a largo plazo. Para mitigar esta limitación, se construyó una carta de control estadístico que confirma que el proceso opera dentro de límites de control en la etapa posterior. No obstante, futuros estudios deberían incorporar ventanas temporales de al menos seis meses, análisis de cartas de control con datos mensuales continuos y pruebas de significancia estadística para fortalecer la validez de los hallazgos.

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ANEXOS

ANEXO 1

AGENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT
LABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@l	L13012
LABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042
LABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160
LABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspr	L13250
LABRADOR	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350
LABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373
LABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531
LABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546
LABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacon	L13626
LABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670
LABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotn	L12964
LABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@	L12845
LABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954
LABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055
LABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161
LABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZI	L13220
LABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322
LABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1	L13346
LABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473
LABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607
LABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.(	L13676
LABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589
LABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862
LABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969
LABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias	L13079
LABRADOR	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano@	L13167
LABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconta	L13226
LABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319
LABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491
LABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517
LABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654
LABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@	L13717
LABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304
LABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotm	L12890
LABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931
LABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126
LABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155
LABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hotı	L13243
LABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotı	L13338
LABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_9	L13423
LABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandre	L13500
LABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIMA	L13596
LABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673
LABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662
LABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924

ANEXO 2

CLIENTE	TELEFONO	EMAIL	NUMERO OT	REPROCESO	FUENTE DE ING	AREA DEL USUA	USUARIO QUE I	FECHA DOCUME	CALIFICACION
PINTO BLACIO JUAN CARLOS	0993333833	juancaju01@hotmail.c	L13459	Si	NPS	CONCESIONARIO	JORGE LASSO	21/11/2025	8
TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@hotmail	L13012	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	
GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.com	L13042	No	NPS	CONCESIONARIO	EDWIN SANGUÑA	1/10/2025	10
SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotmail.com	L13160	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	
COOPERATIVA DE AHORRO Y CREDITO DE LOS SERVIDORES PUB	0992870120	dorisr@cacspmec.fin	L13250	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	
RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte@yahc	L13350	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	10
POZO SACA JAIME RODOLFO	0990133517	jrps0301@hotmail.co	L13373	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	10
NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercias.gob.(	L13531	No	NPS	CONCESIONARIO	EDUARDO GUEVAR	1/10/2025	
SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanchez@cel	L13546	No	NPS	CONCESIONARIO	DARIO PADILLA	1/10/2025	
ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacome@ho	L13626	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	10
ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@hotma	L13670	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	
CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@yahoo.(	L12845	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	10
TORRES JIMENEZ DIEGO FERNANDO	0983048421	diferti@hotmail.com	L12954	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	
RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@hotmail.(	L13055	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	10
HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gmail.com	L13161	No	NPS	CONCESIONARIO	DARIO PADILLA	2/10/2025	
ORTIZ ESCOBAR DARWIN HERNAN	0988092588	DARWINORTIZESC(	L13220	No	NPS	CONCESIONARIO	DARIO PADILLA	2/10/2025	
ARMIJOS FUENTES MARIA CRISTINA	0958871329	oriza_17@hotmail.cor	L13322	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	10
CARVAJAL CESAR	0998442289	cesar.carvajal1311@(	L13346	No	NPS	CONCESIONARIO	DARIO PADILLA	2/10/2025	
DAVILA PAUL	0995680735	pauldavila1991@gma	L13473	No	NPS	CONCESIONARIO	EDUARDO GUEVAR	2/10/2025	
SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotmail.cor	L12964	No	NPS	CONCESIONARIO	JORGE LASSO	1/10/2025	9
SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos@aser	L13607	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	10
LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.com	L13676	No	NPS	CONCESIONARIO	JORGE LASSO	2/10/2025	10
GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagoldenlux1@(	L12862	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	
YEROVI MELISSA	0983332731	meliyerovi@hotmail.c	L12969	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	10
GARCIA SEVILLA MIGUEL HORACIO	0999028365	miguelhgarcias75@hc	L13079	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	10
URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano@hotma	L13167	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	
PADILLA MORA EDGAR RENE	0997143968	asesoriascontablesrp	L13226	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	
JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail.com	L13589	No	NPS	CONCESIONARIO	DARIO PADILLA	2/10/2025	9
PORRAS MERA MAGDALENA	0979292018	winslerdelgado@gmai	L13319	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	
LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gmail.cor	L13491	No	NPS	CONCESIONARIO	EDUARDO GUEVAR	3/10/2025	10
MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HOTMAIL	L13517	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	10
QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza070913@gm	L13654	No	NPS	CONCESIONARIO	EDUARDO GUEVAR	3/10/2025	10
MALES DORADO DIEGO GONZALO	0984266486	diegolivestyle@hotm	L13717	No	NPS	CONCESIONARIO	JORGE LASSO	3/10/2025	10
GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotmail.cor	L12890	No	NPS	CONCESIONARIO	EDWIN SANGUÑA	4/10/2025	10
SILVA MOYON BRYAN XAVIER	0979060418	bryantremolo@gmail.	L12931	No	NPS	CONCESIONARIO	JORGE LASSO	4/10/2025	
SISACORP TECH TECNOLOGIA PARA AGRICULTURA CIA. LTDA.	0999666013	contabilidad@sisacor	L13126	No	NPS	CONCESIONARIO	JORGE LASSO	4/10/2025	10
DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@hotmai	L13155	No	NPS	CONCESIONARIO	DARIO PADILLA	4/10/2025	10
PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hotmail.c	L13243	No	NPS	CONCESIONARIO	JORGE LASSO	4/10/2025	10
BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotmail.co	L13338	No	NPS	CONCESIONARIO	EDWIN SANGUÑA	4/10/2025	

ANEXO 3

AGENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT	FECHA DE CONTACTO 1	RESPUESTA CONTACTO 1
LABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@l	L13012	2/10/2025	NO
LABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042	2/10/2025	SI
LABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160	2/10/2025	SI
LABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspr	L13250	2/10/2025	SI
LABRADOR	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350	2/10/2025	SI
LABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373	2/10/2025	SI
LABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531	2/10/2025	SI
LABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546	2/10/2025	SI
LABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacon	L13626	2/10/2025	SI
LABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670	2/10/2025	SI
LABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotn	L12964	2/10/2025	SI
LABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@	L12845	3/10/2025	SI
LABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954	3/10/2025	SI
LABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055	3/10/2025	SI
LABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161	3/10/2025	SI
LABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZI	L13220	3/10/2025	SI
LABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322	3/10/2025	SI
LABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1	L13346	3/10/2025	SI
LABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473	3/10/2025	SI
LABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607	3/10/2025	SI
LABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.	L13676	3/10/2025	NO
LABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589	3/10/2025	SI
LABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862	4/10/2025	SI
LABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969	4/10/2025	SI
LABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias	L13079	4/10/2025	SI
LABRADOR	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano@	L13167	4/10/2025	SI
LABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconta	L13226	4/10/2025	SI
LABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319	4/10/2025	SI
LABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491	4/10/2025	SI
LABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517	4/10/2025	SI
LABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654	4/10/2025	SI
LABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@	L13717	4/10/2025	SI
LABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304	4/10/2025	SI
LABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotm	L12890	6/10/2025	SI
LABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931	6/10/2025	SI
LABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126	6/10/2025	SI
LABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155	6/10/2025	SI
LABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hotı	L13243	6/10/2025	SI
LABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotı	L13338	6/10/2025	SI
LABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_9	L13423	6/10/2025	SI
LABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandre	L13500	6/10/2025	SI
LABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIMA	L13596	6/10/2025	SI
LABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673	6/10/2025	SI
LABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662	6/10/2025	SI
LABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924	7/10/2025	SI

ANEXO 4

ACUERDO DE GESTIÓN	
NOMBRE DEL CARGO:	ASESOR DE SERVICIO
DIVISIÓN:	Concesionario
ÁREA:	Postventa
CARGO AL QUE REPORTA:	Coach de Servicios / Jefe de Taller
CARGOS A LOS QUE SUPERVISA:	Técnico de Servicio Mecánico
BACK UP DE:	

OBJETIVO
(Razón de ser del cargo - Asegura el enfoque de gestión)

Garantizar una atención eficiente y orientada al cliente, gestionando correctamente las Órdenes de Trabajo (OT), el proceso de recepción, seguimiento, comunicación y entrega del vehículo, asegurando la calidad del servicio y el cumplimiento de los estándares.

RESPONSABILIDADES DEL CARGO

PRINCIPALES RESPONSABILIDADES Y AUTORIDAD (Qué hace)	PRINCIPALES ACTIVIDADES (relacionadas a las Responsabilidades y Autoridad)	RESULTADO FINAL ESPERADO (Para qué lo hace)	INDICADOR DE GESTIÓN (En valores: % etc.)
Recepción profesional del cliente	1. Saludar y recibir al cliente siguiendo el protocolo de bienvenida. 2. Registrar datos en la OT dentro del sistema S3S/DMS. 3. Realizar inspección visual y checklist con el cliente. 4. Identificar necesidades y motivo de ingreso. 5. Explicar alcances del servicio, tiempos y costos.	Generar confianza y claridad desde el inicio del proceso.	Tiempo promedio de atención % OTs correctamente aperturadas
Monitorear el avance del servicio	1. Verificar el estado del vehículo en taller. 2. Mantener comunicación activa con técnico y jefe de taller. 3. Validar adicionales antes de ejecutar. 4. Mantener informado al cliente con transparencia.	Evitar retrasos, reclamos y sorpresas en el cliente.	KPI (Cumplimiento de metas)
Mantener informado al cliente	1. Enviar actualizaciones vía WhatsApp, llamada o correo. 2. Informar hallazgos y recomendar mantenimientos preventivos. 3. Gestionar aprobaciones de manera documentada. 4. Explicar riesgos si no se autoriza un trabajo crítico.	Cliente informado, seguro y satisfecho.	NPS % de clientes que reciben actualización intermedia
Validar la calidad del servicio antes de entregar	1. Revisar OT, repuestos y trabajos ejecutados. 2. Realizar mini-PDI o control de calidad básico. 3. Agendar próxima visita de mantenimiento. 4. Explicar factura y trabajo realizado	Entrega clara, profesional y sin reclamos.	% Entregas a tiempo % OTs sin reprocesos
Promover servicios y repuestos necesarios	1. Explicar beneficios de servicios preventivos. 2. Ofrecer paquetes de mantenimiento y promociones vigentes. 3. Mantener historiales actualizados en el DMS. 4. Hacer seguimiento post-entrega.	Aumentar rentabilidad y fidelizar al cliente.	Ticket Promedio Venta Adicional (Up Selling / Cross Selling)
Gestionar casos de garantía y reclamos	1. Explicar beneficios de servicios preventivos. 2. Ofrecer paquetes de mantenimiento y promociones vigentes. 3. Mantener historiales actualizados en el DMS. 4. Hacer seguimiento post-entrega.	Gestión efectiva y reducción de insatisfacción.	% Reclamos resueltos % Garantías aprobadas

PROFESIOGRAMA			
Disponible en el Manual de Profesiogramas publicado en el sistema de la organización.			
TIPO DE EXÁMENES MÉDICOS REQUERIDOS PREVIA CONTRATACIÓN:			
Según Manual de Salud Ocupacional.			
DOTACIÓN DE IMPLEMENTOS / MATERIALES / EQUIPOS:			
Implementos de acuerdo con el cargo.			
UBICACIÓN DEL CARGO EN LA ESTRUCTURA ORGANIZACIONAL			
• Gerente de Puntos de Venta • Coach de Servicios • Jefe de Taller			
PERFIL DEL CARGO IDEAL – A			
FORMACIÓN ACADÉMICA Validado en Entrevista / CV / Pensum Universitario		**CONOCIMIENTOS NECESARIOS**	
NIVEL EDUCATIVO	**ESPECIALIZACIÓN**	**DESCRIPCIÓN**	**NIVEL**
Tecnología / Ingeniería	Mecánica Automotriz / Electromecánica / Administración Automotriz	Conocimiento en procesos de posventa, atención al cliente y sistemas DMS.	Alto
		• Atención al cliente y técnicas de venta consultiva • Dominio de procesos de taller • Manejo de sistemas S3S / DMS • Conocimiento básico de mecánica automotriz • Gestión documental, OT y facturación	Alto
EXPERIENCIA LABORAL		**PERFIL DE COMPETENCIAS**	
AÑOS DE EXPERIENCIA	**TIPO DE EXPERIENCIA**	**DESCRIPCIÓN**	**NIVEL**
1–2 años	Atención al cliente automotriz, recepción de taller, venta consultiva	Orientación al cliente	Alto
		Comunicación efectiva	Alto
		Gestión del tiempo	Alto
		Trabajo en equipo	Alto
		Resolución de problemas	Alto
		Proactividad	Alto
NOMBRE Y FIRMA ACEPTACIÓN COLABORADOR		**NOMBRE Y FIRMA DE LA LINEA DE SUPERVISIÓN**	

ANEXO 5

ACUERDO DE GESTIÓN	
NOMBRE DEL CARGO:	TÉCNICO MECÁNICO
DIVISIÓN:	Concesionario
ÁREA:	Postventa
CARGO AL QUE REPORTA:	Coach de Servicios / Jefe de Taller / Asesor de Servicio
CARGOS A LOS QUE SUPERVISA:	-
BACK UP DE:	Técnico Mecánico Express B

OBJETIVO
(Razón de ser del cargo - Asegura el enfoque de gestión)

Realizar el diagnóstico, mantenimiento y reparación de vehículos conforme a los estándares, garantizando seguridad, calidad del servicio y cumplimiento de los tiempos establecidos para brindar una experiencia satisfactoria al cliente.

RESPONSABILIDADES DEL CARGO

PRINCIPALES RESPONSABILIDADES Y AUTORIDAD (Qué hace)	PRINCIPALES ACTIVIDADES (relacionadas a las Responsabilidades y Autoridad)	RESULTADO FINAL ESPERADO (Para qué lo hace)	INDICADOR DE GESTIÓN (En valores: % etc.)
Realizar diagnóstico acertado de fallas	1. Revisar síntomas reportados por el asesor de servicio. 2. Realizar inspección visual interna y externa. 3. Utilizar scanner automotriz según protocolo del fabricante. 4. Registrar hallazgos técnicos en la OT. 5. Realizar pruebas de ruta cuando sea necesario.	Vehículos operando en condiciones seguras.	% Cumplimiento de tiempos % Checklists completados
Realizar reparaciones mecánicas y eléctricas	1. Realizar cambio de aceite y filtros. 2. Revisión de frenos, suspensión, dirección, niveles, luces, batería. 3. Ajustes y lubricación según pauta del fabricante. 4. Completar checklist PDI o MPX según modelo.	Vehículos operando en condiciones seguras.	% Cumplimiento de tiempos % Checklists completados
Realizar reparaciones mecánicas y eléctricas	1. Desmontar y montar componentes (frenos, suspensión, dirección). 2. Reparación de motor: sellos, empaques, tiempos, sincronización. 3. Reparación eléctrica básica: luces, sensores, actuadores. 4. Aplicar torque según manual técnico.	Reparaciones seguras y dentro de estándar.	% Reprocesos % Trabajos con torque validado
Cuidar herramientas y usar equipo correctamente	1. Uso correcto de elevador, torquímetro, multímetro, escáner, etc. 2. Reportar fallos en herramientas. 3. Mantener área de trabajo ordenada (5S). 4. Cumplir protocolos de seguridad y EPP.	Seguridad operativa y orden en taller.	% Cumplimiento de 5S Cero accidentes
Verificar trabajos antes del cierre de OT	1. Revisar que todo lo solicitado esté ejecutado. 2. Validar que no haya fugas, códigos de falla o anomalías. 3. Comprobar niveles y funcionamiento general. 4. Realizar prueba de ruta si se requiere.	Vehículos sin reprocesos ni reclamos.	% OTs sin retorno KPI de calidad interna
Realizar trabajos de garantía y PDI	1. Verificar kilometraje y condiciones de garantía. 2. Documentar fallas conforme protocolo de fábrica. 3. Ejecución precisa de PDI en vehículos nuevos. 4. Realizar pruebas funcionales finales.	Procesos de garantía sin rechazos y PDI sin observaciones.	% Garantías aprobadas % PDIs correctos a la primera

Informar hallazgos y avances	1. Reportar hallazgos adicionales. 2. Explicar necesidades críticas del vehículo. 3. Brindar información técnica para mejorar la comunicación al cliente. 4. Informar retrasos o imprevistos.	Correcta comunicación técnica y flujos claros.	% Información entregada a tiempo

PROFESIOGRAMA

Disponible en el Manual de Profesiogramas publicado en el sistema de la organización.

TIPO DE EXÁMENES MÉDICOS REQUERIDOS PREVIA CONTRATACIÓN:

Según Manual de Salud Ocupacional.

DOTACIÓN DE IMPLEMENTOS / MATERIALES / EQUIPOS:

Dotación según cargo: EPP, herramientas, uniformes y equipos específicos.

UBICACIÓN DEL CARGO EN LA ESTRUCTURA ORGANIZACIONAL

- Gerente de Puntos de Venta
  - Coach de Servicios
    - Jefe de Taller
  - Asesor de Servicio
  - Técnico Mecánico

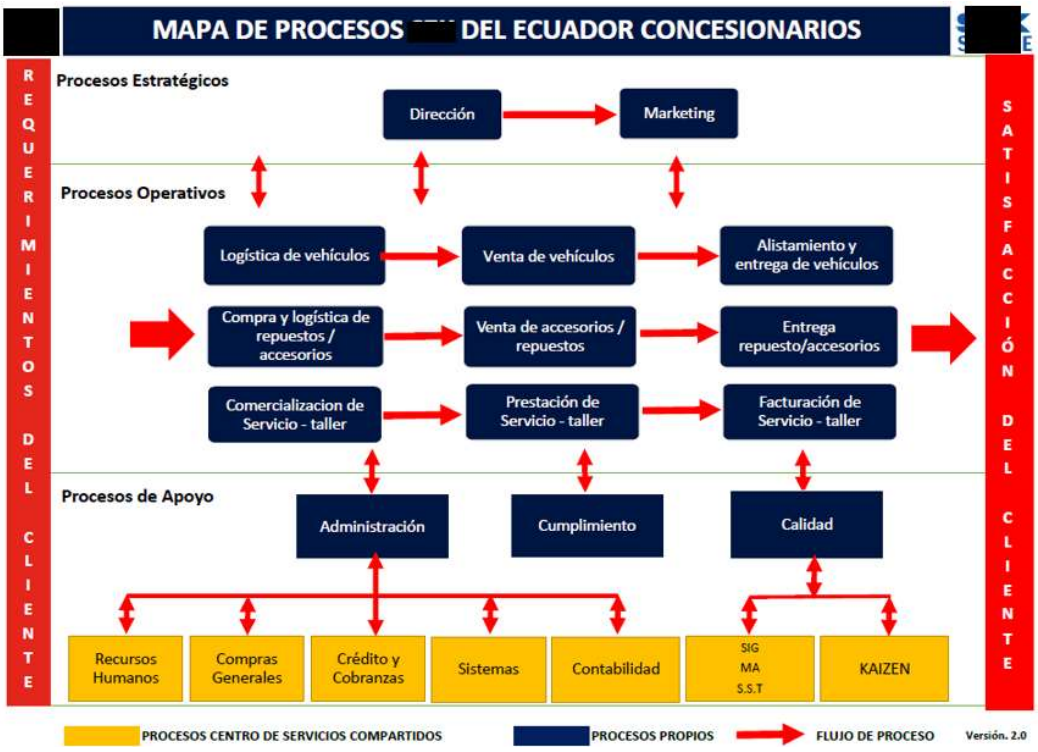
PERFIL DEL CARGO IDEAL – A

FORMACIÓN ACADÉMICA Validado en Entrevista / CV / Pensum Universitario		CONOCIMIENTOS NECESARIOS	
NIVEL EDUCATIVO	ESPECIALIZACIÓN	DESCRIPCIÓN	NIVEL
Tecnología / Bachillerato Técnico	Mecánica Automotriz / Electromecánico	Conocimiento en mantenimiento, diagnóstico y reparación automotriz.	Alto
		• Mecánica Automotriz Sistemas de inyección, frenos, suspensión • Electricidad automotriz básica • Uso de scanner y equipos de diagnóstico • Torque y procedimientos del fabricante • 5S y seguridad industrial	Alto

EXPERIENCIA LABORAL		PERFIL DE COMPETENCIAS	
AÑOS DE EXPERIENCIA	TIPO DE EXPERIENCIA	DESCRIPCIÓN	NIVEL
1–3 años	Mantenimiento y reparación de vehículos livianos y pesados	Responsabilidad	Alto
		Calidad de trabajo	Alto
		Gestión del tiempo	Alto
		Orden y disciplina	Alto
		Proactividad	Alto
		Trabajo en equipo	Alto

NOMBRE Y FIRMA ACEPTACIÓN COLABORADOR	NOMBRE Y FIRMA DE LA LINEA DE SUPERVISIÓN

ANEXO 6


MAPA DE PROCESOS [redacted] DEL ECUADOR CONCESIONARIOS
REQUERIMIENTOS DEL CLIENTE
SATISFACCIÓN DEL CLIENTE
Procesos Estratégicos
Dirección
Marketing
Procesos Operativos
Logística de vehículos
Venta de vehículos
Alistamiento y entrega de vehículos
Compra y logística de repuestos / accesorios
Venta de accesorios / repuestos
Entrega repuesto/accesorios
Comercializacion de Servicio - taller
Prestación de Servicio - taller
Facturación de Servicio - taller
Procesos de Apoyo
Administración
Cumplimiento
Calidad
Recursos Humanos
Compras Generales
Crédito y Cobranzas
Sistemas
Contabilidad
SIG MA S.S.T
KAIZEN
PROCESOS CENTRO DE SERVICIOS COMPARTIDOS
PROCESOS PROPIOS
FLUJO DE PROCESO
Versión. 2.0

ANEXO 7

EMAIL	CLIENTE	AREA DEL USUARIO QUE INGRESO	USUARIO QUE INGRESO EL CASO	FECHA DE CITA	FUE ATENDIDO POR	LINEA	AREA	FUENTE DE REGISTRO	PLACA	SERVICIO	NUMERO WHATSAPP	CORREO WHATSAPP
juancaju01@hotmail.com	PINTO BLACIO J	CONCESIONARIO	JORGE LASSO	20/11/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFE2943	MANTENIMIENTO	0993333833	juancaju01@hotmail.com
erikalucia77@hotmail.com	TUMIPAMBA SO	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFK4723	MANTENIMIENTO	0999557201	erikalucia77@hotmail.com
jcgn70@gmail.com	GARCIA NAVAS ,	CONCESIONARIO	EDWIN SANGUÑA	30/09/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	LLAMADA	PFE9984	MANTENIMIENTO	0995611864	jcgn70@gmail.com
jsss_3@hotmail.com	SAAVEDRA SAL(	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFL2287	MANTENIMIENTO	0998050593	jsss_3@hotmail.com
dorisr@cacspmec.fin.ec	COOPERATIVA (	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFJ7773	MANTENIMIENTO	0995255714	anam@cacspmec.fin.ec
marco.ricaurte@yahoo.es	RICAURTE MART	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFN6426	MANTENIMIENTO	0999555730	marco.ricaurte@yahoo.es
jrps0301@hotmail.com	POZO SACA JAI	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFK2470	MANTENIMIENTO	0990133517	jrps0301@hotmail.com
jann@supercias.gob.ec	NARVAEZ MATH	CONCESIONARIO	EDUARDO GUEVARA	30/09/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	MAIL 1	PDY6373	MANTENIMIENTO	0982201646	jhon.drakeph@gmail.com
rolando.sanchez@celec.gob.	SANCHEZ VELA	CONCESIONARIO	DARIO PADILLA	30/09/2025	DARIO PADILLA	SERVICIO I	TALLER	MAIL 2	PFF5617	MANTENIMIENTO	0980818301	silviosave@gmail.com
fliaarmasjacome@hotmail.co	ARMAS JACOME	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFM9780	MANTENIMIENTO	0998238662	fliaarmasjacome@hotmail.com
jeff_666_999@hotmail.com	ARIAS NAVARRE	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PD06573	MANTENIMIENTO	0988452763	jeff_666_999@hotmail.com
ineshcerdab@yahoo.com	CERDA BASTIDA	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFC4044	MANTENIMIENTO	0999784414	ineshcerdab@yahoo.com
difertj@hotmail.com	TORRES JIMENE	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFI4537	MANTENIMIENTO	0983048421	difertj@hotmail.com
raulra.1977@hotmail.com	RAMOS RAMOS	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFH8752	MANTENIMIENTO	0984642202	raulra.1977@hotmail.com
aharnisth@gmail.com	HARNISTH RIVA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	MAIL 2	PFK5117	MANTENIMIENTO	0984683316	aharnisth@gmail.com
DARWINORTIZESCOBAR@O	ORTIZ ESCOBAI	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	LLAMADA	PFK2340	MANTENIMIENTO	0989092588	vickymontiel81@gmail.com
criza_17@hotmail.com	ARMIJOS FUENT	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFB7968	MANTENIMIENTO	0958871329	criza_17@hotmail.com
cesar.carvajal1311@gmail.co	CARVAJAL CESA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	LLAMADA	IBD4242	MANTENIMIENTO	0998442289	cesar.carvajal1311@gmail.com
pauldavila1991@gmail.com	DAVILA PAUL	CONCESIONARIO	EDUARDO GUEVARA	01/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	MAIL 2	PCL5216	MANTENIMIENTO	0995680735	pauldavila1991@gmail.com
galovas@hotmail.com	SILVA ARTAGA	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PKR0370	MANTENIMIENTO	0961743989	galovas@hotmail.com
cristian.santos@asertia.com	SANTOS GARCI	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PDI1652	MANTENIMIENTO	0997387463	cristian.santos@asertia.com.ec
rleon3@gmail.com	LEON VASQUEZ	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFD7123	MANTENIMIENTO	0982241833	rleon30@gmail.com
gerenciagoldenlux1@hotmai	GOLDENLUX EL	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFI5203	MANTENIMIENTO	0995802271	gerenciagoldenlux1@hotmail.com
meliyerovi@hotmail.com	YEROVI MELISS	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFH4952	MANTENIMIENTO	0983332731	meliyerovi@hotmail.com
miguelhgarcias75@hotmail.(	GARCIA SEVILL	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFD8682	MANTENIMIENTO	0999026365	miguelhgarcias@gmail.com
judith.urbano@hotmail.com	URBANO BORJA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFM8142	MANTENIMIENTO	0987908060	judith.urbano@hotmail.com
asesoriascontablesrp@gmai	PADILLA MORA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFE6764	MANTENIMIENTO	0997143968	asesoriascontablesrp@gmail.com
dfjv003@gmail.com	JIMÉNEZ VEGA I	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	PFD9865	MANTENIMIENTO	0983393916	dfjv003@gmail.com
winslerdelgado@gmail.com	PORRAS MERA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFN1191	MANTENIMIENTO	0979292018	winslerdelgado@gmail.com
ronnyll214@gmail.com	LLUMIQUINGA L	CONCESIONARIO	EDUARDO GUEVARA	02/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	WHATSAPP	PFP5129	MANTENIMIENTO	0987345710	ronnyll214@gmail.com
MAD1346@HOTMAIL.COM	MORALES MOR	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFM7016	MANTENIMIENTO	0992559543	mmaad1346@hottmmail.com
jesyeliza070913@gmail.com	QUISHPE TACO	CONCESIONARIO	EDUARDO GUEVARA	02/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	WHATSAPP	PFN7873	MANTENIMIENTO	0987699296	jesyeliza070913@gmail.com
diegolivestyle@hotmail.com	MALES DORAD	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFF2351	MANTENIMIENTO	0984256486	diego.livestyle@gmail.com
guevi15@hotmail.com	GUERRERO VILL	CONCESIONARIO	EDWIN SANGUÑA	03/10/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	LLAMADA	PFI2527	MANTENIMIENTO	0994058404	guevi15@hotmail.com
bryantremolo@gmail.com	SILVA MOYON B	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFD6611	MANTENIMIENTO	0979060416	bryantremolo@gmail.com
contabilidad@sisacorp.com	SISACORP TECI	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFN7649	MANTENIMIENTO	0999666013	contabilidad@sisacorp.com
aidasando22@hotmail.com	DE LA TORRE SA	CONCESIONARIO	DARIO PADILLA	03/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	PDF2203	MANTENIMIENTO	0982859983	aidasando22@hotmail.com
mickyyec@hotmail.com	PEREZ MONCAY	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PCB5018	MANTENIMIENTO	0992806500	mickyyec@hotmail.com
dr_mdba@hotmail.com	BARRIONUEVO	CONCESIONARIO	EDWIN SANGUÑA	03/10/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	MAIL 1	PFH6313	MANTENIMIENTO	0958606131	dr_mdba@hotmail.com
radiomusical_967fm@hotm	TAYUPANTA ZUI	CONCESIONARIO	DARIO PADILLA	03/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	QBA1140	MANTENIMIENTO	0988997938	radiomusica_967fm@hotmal.com
santiagoandresmejiay@gmai	MEJIA YEPEZ SA	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PDD9237	MANTENIMIENTO	0984071374	santiagoandresmejiay@gmail.com

ANEXO 8

EMAIL	CLIENTE	AREA DEL USUARIO QUE INGRESO	USUARIO QUE INGRESO EL CASO	FECHA DE CITA	FUE ATENDIDO POR	LINEA	AREA	FUENTE DE REGISTRO	PLACA	SERVICIO	NUMERO WHATSAPP	CORREO WHATSAPP
juancaju01@hotmail.com	PINTO BLACIO J	CONCESIONARIO	JORGE LASSO	20/11/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFE2943	MANTENIMIENTO	0993333833	juancaju01@hotmail.com
erikalucia77@hotmail.com	TUMIPAMBA SO	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFK4723	MANTENIMIENTO	0999557201	erikalucia77@hotmail.com
jcgn70@gmail.com	GARCIA NAVAS ,	CONCESIONARIO	EDWIN SANGUÑA	30/09/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	LLAMADA	PFE9984	MANTENIMIENTO	0995611864	jcgn70@gmail.com
jsss_3@hotmail.com	SAAVEDRA SALI	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFL2287	MANTENIMIENTO	0998050593	jsss_3@hotmail.com
dorisr@cacspmec.fin.ec	COOPERATIVA I	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFJ7773	MANTENIMIENTO	0995255714	anam@cacspmec.fin.ec
marco.ricaurte@yahoo.es	RICAURTE MARI	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFN6426	MANTENIMIENTO	0999555730	marco.ricaurte@yahoo.es
jrps0301@hotmail.com	POZO SACA JAI	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFK2470	MANTENIMIENTO	0990133517	jrps0301@hotmail.com
jann@supercias.gob.ec	NARVAEZ MATH	CONCESIONARIO	EDUARDO GUEVARA	30/09/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	MAIL 1	PDY6373	MANTENIMIENTO	0982201646	jhon.drakeph@gmail.com
rolando.sanchez@celec.gob.	SANCHEZ VELA	CONCESIONARIO	DARIO PADILLA	30/09/2025	DARIO PADILLA	SERVICIO I	TALLER	MAIL 2	PFF5617	MANTENIMIENTO	0980818301	silviosave@gmail.com
fliaarmasjacome@hotmail.cc	ARMAS JACOME	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFM9780	MANTENIMIENTO	0998238662	fliaarmasjacome@hotmail.com
jeff_666_999@hotmail.com	ARIAS NAVARRE	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PDD6573	MANTENIMIENTO	0988452763	jeff_666_999@hotmail.com
ineshcerdab@yahoo.com	CERDA BASTID	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFC4044	MANTENIMIENTO	0999784414	ineshcerdab@yahoo.com
difertj@hotmail.com	TORRES JIMENE	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFI4537	MANTENIMIENTO	0983048421	difertj@hotmail.com
raulra.1977@hotmail.com	RAMOS RAMOS	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFH8752	MANTENIMIENTO	0984642202	raulra.1977@hotmail.com
aharnisth@gmail.com	HARNISTH RIVA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	MAIL 2	PFK5117	MANTENIMIENTO	0984683316	aharnisth@gmail.com
DARWINORTIZESCOBAR@OI	ORTIZ ESCOBA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	LLAMADA	PFK2340	MANTENIMIENTO	0989092588	vickymontiel81@gmail.com
criza_17@hotmail.com	ARMIJOS FUENT	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFB7968	MANTENIMIENTO	0958871329	criza_17@hotmail.com
cesar.carvajal1311@gmail.cc	CARVAJAL CESA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	LLAMADA	IBD4242	MANTENIMIENTO	0998442289	cesar.carvajal1311@gmail.com
pauldavila1991@gmail.com	DAVILA PAUL	CONCESIONARIO	EDUARDO GUEVARA	01/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	MAIL 2	PCL5216	MANTENIMIENTO	0995680735	pauldavila1991@gmail.com
galosaid@hotmail.com	SILVA ARTEAGA	CONCESIONARIO	JORGE LASSO	30/09/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PKB0370	MANTENIMIENTO	0991343889	galosaid@hotmail.com
cristian.santos@asertia.com	SANTOS GARCI	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PDI1652	MANTENIMIENTO	0997387463	cristian.santos@asertia.com.ec
rleon3@gmail.com	LEON VASQUEZ	CONCESIONARIO	JORGE LASSO	01/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PHJ7123	MANTENIMIENTO	0982241833	rleon3@gmail.com
gerenciagoldenlux1@hotmai	GOLDENLUX EL	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFI5203	MANTENIMIENTO	0995802271	gerenciagoldenlux1@hotmail.com
meliyerovi@hotmail.com	YEROVI MELISS	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFH4952	MANTENIMIENTO	0983332731	meliyerovi@hotmail.com
miguelhgarcias75@hotmail.c	GARCIA SEVILL	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFD8682	MANTENIMIENTO	0999026365	miguelhgarcias@gmail.com
judith.urbano@hotmail.com	URBANO BORJA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFM8142	MANTENIMIENTO	0987908060	judith.urbano@hotmail.com
asesoriascontablesrp@gmai	PADILLA MORA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFE6764	MANTENIMIENTO	0997143968	asesoriascontablesrp@gmail.com
dfjv003@gmail.com	JIMÉNEZ VEGA	CONCESIONARIO	DARIO PADILLA	01/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	PFD9865	MANTENIMIENTO	0983393916	dfjv003@gmail.com
winslerdelgado@gmail.com	PORRAS MERA	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFN1191	MANTENIMIENTO	0979292018	winslerdelgado@gmail.com
ronnyll214@gmail.com	LLUMIQUINGA L	CONCESIONARIO	EDUARDO GUEVARA	02/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	WHATSAPP	PFP5129	MANTENIMIENTO	0987345710	ronnyll214@gmail.com
MAD1346@HOTMAIL.COM	MORALES MOR	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFM7016	MANTENIMIENTO	0992559543	mmaad1346@hottmmail.com
jesyeliza070913@gmail.com	QUISHPE TACO	CONCESIONARIO	EDUARDO GUEVARA	02/10/2025	EDUARDO GUEVAR	SERVICIO I	TALLER	WHATSAPP	PFN7873	MANTENIMIENTO	0987699296	jesyeliza070913@gmail.com
diegolivestyle@hotmail.com	MALES DORADO	CONCESIONARIO	JORGE LASSO	02/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PFT2351	MANTENIMIENTO	0984256486	diego.livestyle@gmail.com
guev15@hotmail.com	GUERRERO VILL	CONCESIONARIO	EDWIN SANGUÑA	03/10/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	LLAMADA	PFI2527	MANTENIMIENTO	0994058404	guev15@hotmail.com
bryantremolo@gmail.com	SILVA MOYON B	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 2	PFD6611	MANTENIMIENTO	0979060416	bryantremolo@gmail.com
contabilidad@sisacorp.com	SISACORP TEC	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFN7649	MANTENIMIENTO	0999666013	contabilidad@sisacorp.com
aidasando22@hotmail.com	DE LA TORRE SA	CONCESIONARIO	DARIO PADILLA	03/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	PDF2203	MANTENIMIENTO	0982859983	aidasando22@hotmail.com
mickyyec@hotmail.com	PEREZ MONCAY	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PCB5018	MANTENIMIENTO	0992806500	mickyyec@hotmail.com
dr_mdba@hotmail.com	BARRIONUEVO	CONCESIONARIO	EDWIN SANGUÑA	03/10/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	MAIL 1	PFH6313	MANTENIMIENTO	0958606131	dr_mdba@hotmail.com
radiomusical_967fm@hotm	TAYUPANTA ZUF	CONCESIONARIO	DARIO PADILLA	03/10/2025	DARIO PADILLA	SERVICIO I	TALLER	WHATSAPP	QBA1140	MANTENIMIENTO	0988997938	radiomusica_967fm@hotmal.com
santiagoandresmejiay@gmai	MEJIA YEPEZ SA	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	MAIL 1	PDD9237	MANTENIMIENTO	0984071374	santiagoandresmejiay@gmail.com
JAIROSISALIMA@GMAIL.COM	SISALIMA ABAD	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	LLAMADA	PFP9726	MANTENIMIENTO	0997567115	jairosisalima@gmail.com
WILSONMANTILLAR@GMAIL.	MANTILLA RUIZ	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFL4308	MANTENIMIENTO	0997000252	wilsonmantillar@gmail.com
crvp_1799@yahoo.com	VELASCO PROA	CONCESIONARIO	JORGE LASSO	03/10/2025	JORGE LASSO	SERVICIO I	TALLER	WHATSAPP	PFM9670	MANTENIMIENTO	0982649203	crvp_1799@yahoo.com
[illegible]	AGRO COMERC	CONCESIONARIO	EDWIN SANGUÑA	04/10/2025	EDWIN SANGUÑA	SERVICIO I	TALLER	MAIL 2	PFJ2166	MANTENIMIENTO	0999047311	[illegible]

ANEXO 9

[redacted]

Orden de Trabajo N° L13055

DATOS GENERALES:

Fecha Recepción	: Jueves, 02 de Octubre del 2025	Hora de Recepción:	[redacted]
Fecha Estimada Entrega	: Jueves, 02 de Octubre del 2025	Hora de Entrega:	[redacted]
Agencia	: AGENCIA LABRADOR [redacted]		
Dirección	: [redacted]		
Sección	: MECANICA	Tipo trabajo : MP	

DATOS CLIENTE:

Nombre	: (101058) RAMOS RAMOS RAUL ORLANDO		
CEDULA	: 1713734877		
Dirección	: AV. PICHINCHA SNJOSE MIRES		
Teléfonos	: 098[redacted]	Forma pago	: EFECTIVO
Celular	: 098[redacted]	Email	: raulra.[redacted].com
Requiere taxi	: SI	Tuvo cita	: SI

DATOS VEHICULO:

Vehículo	: [redacted]	Color	: PLATEADO	Placa	: [redacted]
Chasis	: [redacted]	Motor	: [redacted]	Cono	: 0
Kilometraje	: 29,976	Nivel	: 1/4	SRG/RMP/CAMP	:

TRABAJOS SOLICITADOS:

MANTENIMIENTO DE 30.0000 KM + LAVADO EXPRESS + VALOR [redacted] AUTO SE SIENTE QUE NO ACELERA BIEN

SINTOMAS Y CONDICIONES:

¿Desde cuándo?: Hace 2 días

¿Qué tan frecuente?: Al encender el vehículo

¿En qué lugar del vehículo?: Al conducir

¿Alguna luz encendida en el tablero?: No

OBSERVACIONES REALIZADAS:

AUTO INGRESA EMPOLVADO, PUEDE CONTENER RAYONES O GOLPES INPERSEPTIBLES EN LAS FOTOGRAFIAS, ASIAUTO NO SE HARA RESPONSABLE POR DAÑOS QUE NO SE APRECIEN EN LAS FOTOGRAFIAS

ACTIVIDADES A REALIZARSE EN SU MANTENIMIENTO AUTORIZADO : Revisión 30,000 Km.

__CAMBIO ACEITE DE MOTOR
__CAMBIO FILTRO DE ACEITE
__DIAGNÓSTICO DE BATERÍA 12 VOLTIOS
__INSPECCIÓN VISUAL DE SISTEMAS Y MECANISMOS
__REVISIÓN Y REGULACIÓN DE LUCES
__REVISIÓN DE NIVELES
__REVISIÓN DE TENSIÓN DE BANDAS
__REVISIÓN PRESIÓN DE AIRE DE NEUMÁTICOS
__CAMBIO DE FILTRO DE AIRE
__CAMBIO DE FILTRO DE AIRE ACONDICIONADO
__CAMBIO FILTRO DE COMBUSTIBLE (*)
__DIAGNÓSTICO COMPUTARIZADO
__LIMPIEZA CUERPO DE ACELERACIÓN
__LIMPIEZA Y/O CAMBIO DE FRENOS DELANTEROS Y POSTERIORES
__LUBRICACIÓN DE CERRADURAS Y BISAGRAS DE PUERTAS
__REAJUSTE DE SUSPENSIÓN
__REGULACIÓN FRENO DE ESTACIONAMIENTO
__ROTACIÓN DE NEUMÁTICOS
__LIMPIEZA INTERIOR Y EXTERIOR DEL VEHÍCULO

Valor estimado mantenimiento : [redacted]
Valor estimado otras tareas : [redacted]

DATOS ASESOR DE SERVICIO:

Nombre	: JORGE LASSO	Telf:	[redacted]
Creado por	: Jorge Lasso 02/10/25		
07:49:52.353 Email	: [redacted]ec		

1 Autorizo a realizar los trabajos, usar los materiales y los repuestos necesarios para reparar los daños o fallas descritas en esta orden de trabajo. 2. Autorizo a realizar fuera de su taller las pruebas que juzgue convenientes para asegurarse de la efectividad del trabajo hecho en mi vehículo. 3. Acepto cancelar de contado el valor de la factura de las reparaciones antes de retirar mi vehículo en caso de no hacerlo después de dos días de recibir la notificación del trabajo terminado, cancelaré los valores de bodegaje y los intereses de la ley sobre el valor de la factura, según mi demora en el pago y en el retiro de la obra. 4. El taller de servicio no asume responsabilidad de ninguna clase por daño o pérdida en los vehículos en reparación o en prueba, dentro o fuera del taller debido a fenómenos fuera de su control como accidentes, incendio, asaltos, derrumbes, terremoto, inundación, etc. 5. No se asume responsabilidad sobre objetos dejados en el vehículo, que no sean parte de este y que consta en la sección "observaciones" de esta orden de trabajo. 6. Cualquier reclamo con los servicios obtenidos deberán ser presentados dentro de un plazo máximo de 10 días. 7. Las presentes condiciones son igualmente válidas si el cliente emite su propia orden de trabajo u orden por teléfono, e mail y se considera conocidas y aceptadas de mi exacta indicación escrita en contrario. 8. [redacted] le informa que, al momento de consignar sus datos personales de este documento, usted, nos autoriza al tratamiento, con la finalidad de brindar el seguimiento oportuno y completo que merece como nuestro cliente. El seguimiento incluye: i) llamadas recordatorias para la revisión de su vehículo, ii) mensajes de texto en donde se comparta una encuesta para medir el nivel de satisfacción del servicio brindado, iii) publicidades acerca de nuevos productos o servicios de [redacted]. Estimado cliente: Al dejar su vehículo en nuestro taller acepta los siguientes términos: 1. Autorización de trabajos: [redacted] informa. Si no recibimos su autorización expresa dentro de 48 horas posteriores a la notificación (vía llamada, SMS, correo u otro medio digital), de los trabajos a realizar sea estos por servicios mantenimiento reparación o garantía se aplicará un cargo de $5 USD diarios por almacenaje. 2. Robo del vehículo [redacted] incluso [illegible] sea sin aviso si el servicio, si el vehículo no se retirado dentro de 5 días hábiles tras la notificación, será trasladado a bodega con un costo de $15 USD diarios, calculados desde la fecha de notificación. Importante: * Los cargos se aplicarán automáticamente a la facturación por incumplimiento de los plazos.* La notificación se considerará efectiva al envío por los medios de comunicación digital registrados.

Firma Cliente

Orden de Trabajo N° L13055 Agencia : AGENCIA [redacted]

DETALLE DE ACTIVIDADES REALIZADAS

CANTIDAD	DESCRIPCION	CÓDIGO	TIEMPO
1	Filtro de Aceite		
1	" " Aire		
4	" " Combustible		
4	Kit de Reparo		
1	Spray de Frenos		
1	Spray de pulso		
	Revisión de mangueras y DOC de motor, limpieza de inyectores		

FIRMA DE JEFE DE TALLER

FIRMA DEL TÉCNICO

ANEXO 10

GENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT	REPROCESO	OBSERVACIONES OT	REGISTRO DE ACTIVI	CONTROL DE OPE	CONTROL I	OBSERVACION D
ABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@	L13012	No	valores adaptativos ECU	SI	SI	SI	Neumáticos 80%
ABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042	No	nido en el área de motor	SI	SI	SI	Suspensión norm
ABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160	No	le sonido en suspensión	SI	SI	SI	Estado de pastill
ABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspr	L13250	No	de filtro de combustible	SI	SI	SI	Estado de pastill
ABRADOR	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350	No	do de frenos, ABC motor	SI	SI	SI	Estado de pastill
ABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373	No	valores adaptativos ECU	SI	SI	SI	Estado de pastill
ABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531	No	de filtro de combustible	SI	SI	SI	Neumáticos al 30
ABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546	No	, Cambio de refrigerante	SI	SI	SI	Estado de pastill
ABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacon	L13626	No	bio de líquido de frenos	SI	SI	SI	Suspensión norm
ABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670	No	de filtro de combustible	SI	SI	SI	Se requiere revisi
ABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotr	L12964	No	le sonido en suspensión	SI	SI	SI	Se requiere revisi
ABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@	L12845	No	valores adaptativos ECU	SI	SI	SI	Estado de pastill
ABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954	No	de filtro de combustible	SI	SI	SI	Se requiere revisi
ABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055	No	le sonido en suspensión	SI	SI	SI	Se requiere revisi
ABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161	No	valores adaptativos ECU	SI	SI	SI	Neumáticos 80%
ABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZI	L13220	No	valores adaptativos ECU	SI	SI	SI	Neumáticos al 30
ABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322	No	rea de motor, ABC motor	SI	SI	SI	Estado de pastill
ABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1	L13346	No	de filtro de combustible	SI	SI	SI	Estado de pastill
ABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473	No	rea de motor, ABC motor	SI	SI	SI	Suspensión norm
ABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607	No	de filtro de combustible	SI	SI	SI	Estado de pastill
ABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.(	L13676	No	le sonido en suspensión	SI	SI	SI	Neumáticos 50%
ABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589	No	bio de líquido de frenos	SI	SI	SI	Neumáticos 80%
ABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862	No	valores adaptativos ECU	SI	SI	SI	Estado de pastill
ABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969	No	le sonido en suspensión	SI	SI	SI	Se requiere revisi
ABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias	L13079	No	, Cambio de refrigerante	SI	SI	SI	Neumáticos 50%
ABRADOR	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano(	L13167	No	bio de líquido de frenos	SI	SI	SI	Neumáticos 80%
ABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconta	L13226	No	valores adaptativos ECU	SI	SI	SI	Suspensión norm
ABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319	No	bio de líquido de frenos	SI	SI	SI	Estado de pastill
ABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491	No	valores adaptativos ECU	SI	SI	SI	Se requiere revisi
ABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517	No	, Cambio de refrigerante	SI	SI	SI	Se requiere revisi
ABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654	No	do de frenos, ABC motor	SI	SI	SI	Estado de pastill
ABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@	L13717	No	nbustible, ABC de frenos	SI	SI	SI	Neumáticos al 30
ABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304	No	valores adaptativos ECU	SI	SI	SI	Estado de pastill
ABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotm	L12890	No	bio de líquido de frenos	SI	SI	SI	Neumáticos al 30
ABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931	No	valores adaptativos ECU	SI	SI	SI	Neumáticos 80%
ABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126	No	nido en el área de motor	SI	SI	SI	Estado de pastill
ABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155	No	bio de líquido de frenos	SI	SI	SI	Neumáticos 80%
ABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hotr	L13243	No	, Cambio de refrigerante	SI	SI	SI	Estado de pastill
ABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotr	L13338	No	spensión, ABC de frenos	SI	SI	SI	Estado de pastill
ABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_(	L13423	No	valores adaptativos ECU	SI	SI	SI	Neumáticos 50%
ABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandre	L13500	No	le sonido en suspensión	SI	SI	SI	Neumáticos 80%
ABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIM/	L13596	No	rea de motor, ABC motor	SI	SI	SI	Neumáticos al 30
ABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673	No	, Cambio de refrigerante	SI	SI	SI	Estado de pastill
ABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662	No	ptativos ECU, ABC motor	SI	SI	SI	Se requiere revisi
ABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924	No	bio de líquido de frenos	SI	SI	SI	Neumáticos 80%

ANEXO 11

AGENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT	REPROCESO	CONTROL DE OPERACIÓN
LABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@	L13012	No	SI
LABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042	No	SI
LABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160	No	SI
LABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspn	L13250	No	SI
LABRADOR	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350	No	SI
LABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373	No	SI
LABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531	No	SI
LABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546	No	SI
LABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacon	L13626	No	SI
LABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670	No	SI
LABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotn	L12964	No	SI
LABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@	L12845	No	SI
LABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954	No	SI
LABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055	No	SI
LABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161	No	SI
LABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZI	L13220	No	SI
LABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322	No	SI
LABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1	L13346	No	SI
LABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473	No	SI
LABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607	No	SI
LABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.	L13676	No	SI
LABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589	No	SI
LABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862	No	SI
LABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969	No	SI
LABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias	L13079	No	SI
LABRADOR	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano@	L13167	No	SI
LABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconta	L13226	No	SI
LABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319	No	SI
LABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491	No	SI
LABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517	No	SI
LABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654	No	SI
LABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@	L13717	No	SI
LABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304	No	SI
LABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotm	L12890	No	SI
LABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931	No	SI
LABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126	No	SI
LABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155	No	SI
LABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hot	L13243	No	SI
LABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hot	L13338	No	SI
LABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_9	L13423	No	SI
LABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandres	L13500	No	SI
LABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIMA	L13596	No	SI
LABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673	No	SI
LABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662	No	SI
LABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924	No	SI

ANEXO 12

AGENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT	REPROCESO	CONTROL DE CALIDAD	OBSERVACION DE CALIDAD
LABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@l	L13012	No	SI	Neumáticos 80% de desgaste
LABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042	No	SI	Suspensión normal
LABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspr	L13250	No	SI	Estado de pastillas 80% de desgaste
LABRADOR	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373	No	SI	Estado de pastillas 80% de desgaste
LABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531	No	SI	Neumáticos al 30% de desgaste
LABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacor	L13626	No	SI	Suspensión normal
LABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotr	L12964	No	SI	Se requiere revisión del estado de amortiguadores delanteros
LABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@l	L12845	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055	No	SI	Se requiere revisión del estado de amortiguadores delanteros
LABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161	No	SI	Neumáticos 80% de desgaste
LABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZ	L13220	No	SI	Neumáticos al 30% de desgaste
LABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1	L13346	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473	No	SI	Suspensión normal
LABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.(	L13676	No	SI	Neumáticos 50% de desgaste
LABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589	No	SI	Neumáticos 80% de desgaste
LABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862	No	SI	Estado de pastillas 80% de desgaste
LABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias	L13079	No	SI	Neumáticos 50% de desgaste
LABRADOR	1721643748	URBANO BORIA CARMEN JUDITH	0987908060	judith.urbano(	L13167	No	SI	Neumáticos 80% de desgaste
LABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconte	L13226	No	SI	Suspensión normal
LABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@	L13717	No	SI	Neumáticos al 30% de desgaste
LABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guewi15@hotr	L12890	No	SI	Neumáticos al 30% de desgaste
LABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931	No	SI	Neumáticos 80% de desgaste
LABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155	No	SI	Neumáticos 80% de desgaste
LABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hotı	L13243	No	SI	Estado de pastillas 50% de desgaste
LABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotr	L13338	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_5	L13423	No	SI	Neumáticos 50% de desgaste
LABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandre	L13500	No	SI	Neumáticos 80% de desgaste
LABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIMA	L13596	No	SI	Neumáticos al 30% de desgaste
LABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673	No	SI	Estado de pastillas 30% de desgaste
LABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662	No	SI	Se requiere revisión del estado de amortiguadores posteriores
LABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924	No	SI	Neumáticos 80% de desgaste

ANEXO 13

AGENCIA	IDENTIFICA	CLIENTE	TELEFONO	EMAIL	NUMERO OT	REPROCESO	AREA DEL USUA	USUARIO Q	CHA DOCUM	FUE ATEND	LINEA	CONFORMI	REGISTRO CONF
LABRADOR	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@l	L13012	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	16:20	SI
LABRADOR	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.	L13042	No	CONCESIONARIO	EDWIN SANGU	1/10/2025	EDWIN SANGU	SERVICIO	15:54	SI
LABRADOR	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotma	L13160	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	16:51	SI
LABRADOR	17909790160	COOPERATIVA DE AHORRO Y CREDITO DE LOS SER	0992870120	dorisr@cacspr	L13250	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	14:03	SI
LABRADOR	1711586960	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte	L13350	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	17:35	SI
LABRADOR	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hot	L13373	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	15:39	SI
LABRADOR	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercia	L13531	No	CONCESIONARIO	EDUARDO GUE	1/10/2025	EDUARDO GUE	SERVICIO	17:07	SI
LABRADOR	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanch	L13546	No	CONCESIONARIO	DARIO PADILL	1/10/2025	DARIO PADILL	SERVICIO	17:14	SI
LABRADOR	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacon	L13626	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	16:50	SI
LABRADOR	17249795780	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_666_999@	L13670	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	17:29	SI
LABRADOR	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotr	L12964	No	CONCESIONARIO	JORGE LASSO	1/10/2025	JORGE LASSO	SERVICIO	16:20	SI
LABRADOR	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@	L12845	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	17:30	SI
LABRADOR	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmai	L12954	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	14:16	SI
LABRADOR	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@h	L13055	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	14:18	SI
LABRADOR	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gm	L13161	No	CONCESIONARIO	DARIO PADILL	2/10/2025	DARIO PADILL	SERVICIO	14:54	SI
LABRADOR	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZ	L13220	No	CONCESIONARIO	DARIO PADILL	2/10/2025	DARIO PADILL	SERVICIO	15:35	SI
LABRADOR	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	criza_17@hotn	L13322	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	15:59	SI
LABRADOR	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal	L13346	No	CONCESIONARIO	DARIO PADILL	2/10/2025	DARIO PADILL	SERVICIO	15:26	SI
LABRADOR	1725500423	DAVILA PAUL	0995680735	pauldavila199	L13473	No	CONCESIONARIO	EDUARDO GUE	2/10/2025	EDUARDO GUE	SERVICIO	14:31	SI
LABRADOR	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos	L13607	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	15:15	SI
LABRADOR	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.	L13676	No	CONCESIONARIO	JORGE LASSO	2/10/2025	JORGE LASSO	SERVICIO	16:06	SI
LABRADOR	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail	L13589	No	CONCESIONARIO	DARIO PADILL	2/10/2025	DARIO PADILL	SERVICIO	16:05	SI
LABRADOR	17924170070	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995802271	gerenciagolder	L12862	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	17:59	SI
LABRADOR	1725297806	YEROVI MELISSA	0983332731	meliyerovi@ho	L12969	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	14:47	SI
LABRADOR	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcia	L13079	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	16:49	SI
LABRADOR	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano(	L13167	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	17:31	SI
LABRADOR	10016625250	PADILLA MORA EDGAR RENE	0997143968	asesoriasconta	L13226	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	14:38	SI
LABRADOR	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgadc	L13319	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	14:29	SI
LABRADOR	17204830390	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gr	L13491	No	CONCESIONARIO	EDUARDO GUE	3/10/2025	EDUARDO GUE	SERVICIO	15:52	SI
LABRADOR	17166049860	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HC	L13517	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	15:37	SI
LABRADOR	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza07091	L13654	No	CONCESIONARIO	EDUARDO GUE	3/10/2025	EDUARDO GUE	SERVICIO	16:22	SI
LABRADOR	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle(	L13717	No	CONCESIONARIO	JORGE LASSO	3/10/2025	JORGE LASSO	SERVICIO	16:08	SI
LABRADOR	1700547753	COLLANTES YANEZ CRISTOBAL LEONARDO	0994650170	collantescris_2	L13304	No	CONCESIONARIO	EDWIN SANGU	3/10/2025	EDWIN SANGU	SERVICIO	17:45	SI
LABRADOR	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotm	L12890	No	CONCESIONARIO	EDWIN SANGU	4/10/2025	EDWIN SANGU	SERVICIO	14:30	SI
LABRADOR	17250079650	SILVA MOYON BRYAN XAVIER	0979060416	bryantremolo@	L12931	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	14:38	SI
LABRADOR	17927237600	SISACORP TECH TECNOLOGIA PARA AGRICULTURA	0999666013	contabilidad@	L13126	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	16:08	SI
LABRADOR	0603027954	DE LA TORRE SANDO AIDA DE LOURDES	0982859983	aidasando22@	L13155	No	CONCESIONARIO	DARIO PADILL	4/10/2025	DARIO PADILL	SERVICIO	14:51	SI
LABRADOR	1717722332	PEREZ MONCAYO MIGUEL ANGEL	0992806500	mickyyec@hot	L13243	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	16:43	SI
LABRADOR	1712760733	BARRIONUEVO AVALOS MARCO DANIEL	0958606131	dr_mdba@hotr	L13338	No	CONCESIONARIO	EDWIN SANGU	4/10/2025	EDWIN SANGU	SERVICIO	17:44	SI
LABRADOR	1700069329	TAYUPANTA ZURITA AUGUSTO POLIVIO	0988997938	radiomusical_5	L13423	No	CONCESIONARIO	DARIO PADILL	4/10/2025	DARIO PADILL	SERVICIO	15:53	SI
LABRADOR	17226549260	MEJIA YEPEZ SANTIAGO ANDRES	0984071374	santiagoandre	L13500	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	15:19	SI
LABRADOR	1721818266	SISALIMA ABAD JAIRO VICENTE	0997567115	JAIROSISALIMA	L13596	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	14:32	SI
LABRADOR	17000229300	MANTILLA RUIZ WILSON HERNAN	0997000252	WILSONMANTI	L13673	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	15:53	SI
LABRADOR	1708636129	VELASCO PROAÑO CATALINA DEL ROCIO	0982649203	crvp_1799@ya	L13662	No	CONCESIONARIO	JORGE LASSO	4/10/2025	JORGE LASSO	SERVICIO	17:57	SI
LABRADOR	17900089590	ACERO COMERCIAL ECUATORIANO S.A.	0995144119	dmerino@acer	L12924	No	CONCESIONARIO	EDWIN SANGU	6/10/2025	EDWIN SANGU	SERVICIO	16:25	SI

ANEXO 14

FORMULARIO DE ACCIONES CORRECTIVAS – ISO 9001:2015 (10.2)

1. IDENTIFICACIÓN DE LA NO CONFORMIDAD	
Código acción correctiva	AC-003
Fecha detección	1/10/2025
Área / Proceso	Bahía de mantenimiento general
Fuente de detección	Hoja de verificación 5S
Descripción de la no conformidad	Presencia de residuos de aceite y filtros usados fuera de contenedores designados.

2. CORRECCIÓN INMEDIATA	
Acción inmediata aplicada	Recolección de residuos y disposición en contenedores autorizados.
Responsable	Técnico asignado a la bahía
Fecha	17/10/2025

3. ANÁLISIS DE CAUSA RAÍZ	
Método utilizado	5 Porqués
Causa raíz identificada	No se encontraba claramente definido el procedimiento de disposición de residuos al cierre de la OT.

4. ACCIÓN CORRECTIVA	
Acción correctiva definida	Actualizar el procedimiento de cierre de OT incorporando la disposición obligatoria de residuos.
Responsable	Jefe de taller
Fecha compromiso	24/10/2025

5. IMPLEMENTACIÓN Y SEGUIMIENTO	
Fecha de ejecución	23/10/2025
Evidencia generada	Procedimiento actualizado y comunicado al personal técnico.
Responsable ejecución	Jefe de taller

6. VERIFICACIÓN DE EFICACIA	
Criterio de verificación	Revisión posterior de hojas 5S sin reincidencia de residuos fuera de contenedores.
Resultado	Eficaz
Fecha verificación	30/10/2025

7. CIERRE DE LA ACCIÓN	
Estado	Cerrada
Fecha cierre	30/10/2025
Responsable cierre	Coordinador de calidad

ANEXO 15

FORMULARIO DE OBSERVACIÓN INTERNA – MEJORA CONTINUA (Kaizen / ISO 9001:2015 – 10.3)	
1. IDENTIFICACIÓN DE LA OBSERVACIÓN	
Código de observación	OI-001
Fecha de observación	16/11/2025
Área / Proceso	Bahía de mantenimiento general
Observador	Supervisor de taller
2. INCIDENCIA DETECTADA	
Descripción de la incidencia	Se observa acumulación de trapos impregnados de aceite fuera del contenedor designado al final de la jornada.
Tipo de observación	Incidencia leve / Riesgo potencial
Impacto potencial	Puede generar desorden, riesgo de contaminación del área y posibles incidentes menores.
3. ACCIÓN DE MEJORA O PREVENCIÓN PROPUESTA	
Acción propuesta	Incorporar verificación rápida de orden y disposición de residuos como parte del cierre de la OT.
Responsable sugerido	Jefe de taller
Fecha estimada	20/11/2025
4. SEGUIMIENTO / RESULTADO (SI APLICA)	
Resultado del seguimiento	En verificaciones posteriores no se evidenció reincidencia de la incidencia.
Estado de la observación	Cerrada
Fecha de cierre	25/11/2025
Responsable del cierre	Coordinador de calidad

ANEXO 16

REGISTRO DE VERIFICACIÓN 5S

Registro Formato Lab.-Ta01

Area: Posventa / Taller
Agencia: Labrador
Fecha: 03/10/2025
Responsable: Eduardo Guevara

BAHÍA DE TRABAJO 1

	SI	NO
Clasificación / Orden (Seiri – Seiton)		
Herramientas ubicadas en su lugar asignado	✓	
Equipos identificados y accesibles	✓	
Ausencia de objetos innecesarios en el área	✓	
Materiales ordenados según uso/frecuencia	✓	
Señalética y control visual (Seiketsu)		
Señalización visible de seguridad		
Marcación de áreas (bahías, pasillos)		
Colores normalizados en piso y paredes		
Avisos de EPP visibles y legibles		

	SI	NO
Limpieza (Seiso)		
Piso limpio y libre de derrames	✓	
Superficies de trabajo limpias	✓	
Ausencia de residuos peligrosos fuera de contenedores	✓	
Contenedores de desechos identificados y en buen estado	✓	
Disciplina / Sostenimiento (Shitsuke)		
Cumplimiento general del orden establecido		
Uso adecuado de señalética		
Condiciones mantenidas respecto a verificaciones previas		

BAHÍA DE TRABAJO 2

	SI	NO
Clasificación / Orden (Seiri – Seiton)		
Herramientas ubicadas en su lugar asignado	✓	
Equipos identificados y accesibles	✓	
Ausencia de objetos innecesarios en el área	✓	
Materiales ordenados según uso/frecuencia	✓	
Señalética y control visual (Seiketsu)		
Señalización visible de seguridad		
Marcación de áreas (bahías, pasillos)		
Colores normalizados en piso y paredes		
Avisos de EPP visibles y legibles		

	SI	NO
Limpieza (Seiso)		
Piso limpio y libre de derrames	✓	
Superficies de trabajo limpias	✓	
Ausencia de residuos peligrosos fuera de contenedores	✓	
Contenedores de desechos identificados y en buen estado	✓	
Disciplina / Sostenimiento (Shitsuke)		
Cumplimiento general del orden establecido		
Uso adecuado de señalética		
Condiciones mantenidas respecto a verificaciones previas		

BAHÍA DE TRABAJO 3

	SI	NO
Clasificación / Orden (Seiri – Seiton)		
Herramientas ubicadas en su lugar asignado	✓	
Equipos identificados y accesibles	✓	
Ausencia de objetos innecesarios en el área	✓	
Materiales ordenados según uso/frecuencia	✓	
Señalética y control visual (Seiketsu)		
Señalización visible de seguridad		
Marcación de áreas (bahías, pasillos)		
Colores normalizados en piso y paredes		
Avisos de EPP visibles y legibles		

	SI	NO
Limpieza (Seiso)		
Piso limpio y libre de derrames	✓	
Superficies de trabajo limpias	✓	
Ausencia de residuos peligrosos fuera de contenedores	✓	
Contenedores de desechos identificados y en buen estado	✓	
Disciplina / Sostenimiento (Shitsuke)		
Cumplimiento general del orden establecido		
Uso adecuado de señalética		
Condiciones mantenidas respecto a verificaciones previas		

BAHÍAS PULMON

	SI	NO
Clasificación / Orden (Seiri – Seiton)		
Herramientas ubicadas en su lugar asignado	✓	
Equipos identificados y accesibles	✓	
Ausencia de objetos innecesarios en el área	✓	
Materiales ordenados según uso/frecuencia	✓	
Señalética y control visual (Seiketsu)		
Señalización visible de seguridad		
Marcación de áreas (bahías, pasillos)		
Colores normalizados en piso y paredes		
Avisos de EPP visibles y legibles		

	SI	NO
Limpieza (Seiso)		
Piso limpio y libre de derrames	✓	
Superficies de trabajo limpias	✓	
Ausencia de residuos peligrosos fuera de contenedores	✓	
Contenedores de desechos identificados y en buen estado	✓	
Disciplina / Sostenimiento (Shitsuke)		
Cumplimiento general del orden establecido		
Uso adecuado de señalética		
Condiciones mantenidas respecto a verificaciones previas		

FIRMA / CI

ANEXO 17

PLANILLA DE MANTENIMIENTO Y LIMPIEZA – 5S (SEISO / SEIKETSU)

Área / Sector:	Posventa
Fecha:	16/11/2025
Bahía	Servicio Mecánico 1
Responsable:	Técnico asignado

#	Actividad / Rutina	Frecuencia	Responsable	Cumple	No cumple	N/A	Observaciones
1	Limpieza de piso del área de trabajo	Diaria	Técnico	✓			
2	Limpieza de banco de trabajo	Diaria	Técnico	✓			
3	Orden y ubicación de herramientas	Diaria	Técnico	✓			
4	Revisión de contenedores de residuos	Diaria	Técnico	✓			
5	Verificación de señalética visible	Semanal	Supervisor	✓			
6	Limpieza general del área	Semanal	Equipo de taller	✓			



Firma responsable:

ANEXO 18

AGENCIA	NUMERO DE CAS	TIPO COMENTAR	IDENTIFICACION	CLIENTE	TELEFONO	EMAIL	CALIFICACION	FUENTE DE REG
LABRADOR	378724	QUEJA	1716964893	PINTO BLACIO JUAN CARLOS	0993333833	juancaju01@hotmail.	8	WHATSAPP
LABRADOR	375330	NO DEFINIDO	1710984582	TUMIPAMBA SOBERON ERIKA LUCIA	0999557201	erikalucia77@hotmail.com		CLIENTE NO CONTA
LABRADOR	376116	FELICITACION	1001714177	GARCIA NAVAS JUAN CARLOS	0995611864	jcgn70@gmail.com	10	LLAMADA
LABRADOR	376709	NO DEFINIDO	1711995371	SAAVEDRA SALCEDO JAIME SANTIAGO	0998050593	jsss_3@hotmail.com		CLIENTE NO CONTA
LABRADOR	377076	NO DEFINIDO	1790979016001	COOPERATIVA DE AHORRO Y CREDITO DE LOS SERVIDORES PUBLI	0992870120	dorisr@cacspmec.fin.ec		CLIENTE NO CONTA
LABRADOR	377635	FELICITACION	1711586980	RICAURTE MARTINEZ MARCO AURELIO	0999555730	marco.ricaurte@yaho	10	WHATSAPP
LABRADOR	378165	FELICITACION	1720489358	POZO SACA JAIME RODOLFO	0990133517	jrps0301@hotmail.co	10	MAIL 1
LABRADOR	378854	NO DEFINIDO	1709396186	NARVAEZ MATHEUS JAN MAURICIO	0995097659	jann@supercias.gob.ec		CLIENTE NO CONTA
LABRADOR	379347	NO DEFINIDO	1705692604	SANCHEZ VELASTEGUI SILVIO ROLANDO	0997315260	rolando.sanchez@celec.gob.ec		CLIENTE NO CONTA
LABRADOR	379935	FELICITACION	1703972495	ARMAS JACOME SEGUNDO RAMIRO	0998238662	fliaarmasjacome@ho	10	MAIL 1
LABRADOR	380314	NO DEFINIDO	1724979578001	ARIAS NAVARRETE JEFFERSON JAVIER	0988452763	jeff_686_999@hotmail.com		CLIENTE NO CONTA
LABRADOR	374687	FELICITACION	1703435873	CERDA BASTIDAS INES HAYDEE	0999784414	ineshcerdab@yahoo.(	10	MAIL 1
LABRADOR	375306	NO DEFINIDO	1718275488	TORRES JIMENEZ DIEGO FERNANDO	0983048421	difertj@hotmail.com		CLIENTE NO CONTA
LABRADOR	376115	FELICITACION	1713734877	RAMOS RAMOS RAUL ORLANDO	0984642202	raulra.1977@hotmail.	10	LLAMADA
LABRADOR	376707	NO DEFINIDO	0604046805	HARNISTH RIVADENEIRA ALEX DAVID	0984683316	aharnisth@gmail.com		CLIENTE NO CONTA
LABRADOR	377066	NO DEFINIDO	1206509497	ORTIZ ESCOBAR DARWIN HERNAN	0989092588	DARWINORTIZESCOBAR@OUTLOOK.ES		CLIENTE NO CONTA
LABRADOR	377624	FELICITACION	1003428107	ARMIJOS FUENTES MARIA CRISTINA	0958871329	oriza_17@hotmail.co	10	WHATSAPP
LABRADOR	378161	NO DEFINIDO	1724185648	CARVAJAL CESAR	0998442289	cesar.carvajal1311@gmail.com		CLIENTE NO CONTA
LABRADOR	378850	NO DEFINIDO	1725500423	DAVILA PAUL	0995680735	pauldavila1991@gmail.com		CLIENTE NO CONTA
LABRADOR	374714	SUGERENCIA	1710317015	SILVA ARTEAGA GALO SANTIAGO	0991343889	galosaid@hotmail.co	9	LLAMADA
LABRADOR	379929	FELICITACION	1309931804	SANTOS GARCIA CRISTIAN DANIEL	0997387463	cristian.santos@aserti	10	WHATSAPP
LABRADOR	380298	FELICITACION	1801654284	LEON VASQUEZ RUBEN DARIO	0982241834	rleon3@gmail.com	10	MAIL 1
LABRADOR	374684	NO PROCEDE	1792417007001	GOLDENLUX ELECTRODOMESTICOS CIA. LTDA.	0995602271	gerenciagoldenlux1@hotmail.com		LLAMADA NO PROCI
LABRADOR	375303	FELICITACION	1725297806	YEROVI MELISSA	0983332731	meliyerovi@hotmail.(	10	MAIL 2
LABRADOR	376114	FELICITACION	1712549151	GARCIA SEVILLA MIGUEL HORACIO	0999026365	miguelhgarcias75@h	10	LLAMADA
LABRADOR	376705	NO DEFINIDO	1721643748	URBANO BORJA CARMEN JUDITH	0987908060	judith.urbano@hotmail.com		CLIENTE NO CONTA
LABRADOR	377059	NO DEFINIDO	1001662525001	PADILLA MORA EDGAR RENE	0997143968	asesoriascontablesrp@gmail.com		CLIENTE NO CONTA
LABRADOR	379343	SUGERENCIA	1715848873	JIMÉNEZ VEGA DIEGO FERNANDO	0983393916	dfjv003@gmail.com	9	WHATSAPP
LABRADOR	378148	NO DEFINIDO	1705463923	PORRAS MERA MAGDALENA	0979292018	winslerdelgado@gmail.com		CLIENTE NO CONTA
LABRADOR	378848	FELICITACION	1720483039001	LLUMIQUINGA LEON RONNY SANTIAGO	0987345710	ronnyll214@gmail.co	10	WHATSAPP
LABRADOR	379483	FELICITACION	1716604986001	MORALES MORALES DANIEL ALEXANDER	0992559543	MAD1346@HOTMAIL	10	WHATSAPP
LABRADOR	379922	FELICITACION	1724591589	QUISHPE TACO JESSICA ELIZABETH	0987699296	jesyeliza070913@gm	10	WHATSAPP
LABRADOR	380452	FELICITACION	1718515685	MALES DORADO DIEGO GONZALO	0984256486	diegolivestyle@hotm	10	MAIL 1
LABRADOR	374682	FELICITACION	1801848696	GUERRERO VILLACIS XIMENA DEL ROCIO	0995450924	guevi15@hotmail.cor	10	LLAMADA

ANEXO 19

FORMULARIO DE ACCIONES CORRECTIVAS – ISO 9001:2015 (10.2)

1. IDENTIFICACIÓN DE LA NO CONFORMIDAD	
Código acción correctiva	AC-003
Fecha detección	1/10/2025
Área / Proceso	Bahía de mantenimiento general
Fuente de detección	Hoja de verificación 5S
Descripción de la no conformidad	Presencia de residuos de aceite y filtros usados fuera de contenedores designados.

2. CORRECCIÓN INMEDIATA	
Acción inmediata aplicada	Recolección de residuos y disposición en contenedores autorizados.
Responsable	Técnico asignado a la bahía
Fecha	17/10/2025

3. ANÁLISIS DE CAUSA RAÍZ	
Método utilizado	5 Porqués
Causa raíz identificada	No se encontraba claramente definido el procedimiento de disposición de residuos al cierre de la OT.

4. ACCIÓN CORRECTIVA	
Acción correctiva definida	Actualizar el procedimiento de cierre de OT incorporando la disposición obligatoria de residuos.
Responsable	Jefe de taller
Fecha compromiso	24/10/2025

5. IMPLEMENTACIÓN Y SEGUIMIENTO	
Fecha de ejecución	23/10/2025
Evidencia generada	Procedimiento actualizado y comunicado al personal técnico.
Responsable ejecución	Jefe de taller

6. VERIFICACIÓN DE EFICACIA	
Criterio de verificación	Revisión posterior de hojas 5S sin reincidencia de residuos fuera de contenedores.
Resultado	Eficaz
Fecha verificación	30/10/2025

7. CIERRE DE LA ACCIÓN	
Estado	Cerrada
Fecha cierre	30/10/2025
Responsable cierre	Coordinador de calidad

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Article

The Effect of Service Quality on Customer Satisfaction in an Automotive After-Sales Service

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Abstract: Assessment of service quality has been widely utilized in after-sales service, especially in the automotive industry. The purpose of the study was to determine factors affecting customer satisfaction in an automotive after-sales service at Toyota Dasmarinas-Cavite Philippines by utilizing the SERVQUAL approach. Several SERVQUAL dimensions such as tangibles, reliability, responsiveness, assurance, and empathy were analyzed simultaneously to the customer satisfaction. Structural equation modeling (SEM) indicated that among the five SERVQUAL dimensions, reliability and empathy were found to have significant relationships to the satisfaction of customers at Toyota Dasmarinas-Cavite Philippines. Interestingly, tangibles, responsiveness, and assurance were found to have no significant relationships to satisfaction. The servicing dealer must deliver a high quality of service to meet customer expectations and achieve high customer satisfaction, which subsequently builds customer trust towards the company. With these, customer retention and loyalty can be attained by the company that can also increase the company's profit and competitive advantage.

Keywords: service quality; after-sales service; structural equation modeling; SERVQUAL; customer satisfaction; customer loyalty

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1. Introduction

Customer satisfaction is an individual perception or feelings towards the kind of service or product they received in relation to their expectation [1]. The idea is basically to satisfy customers for them to continue patronizing a business, for the business to increase their profit and to be sustainable in their line of industry [2]. Today's competitive market situation make industries prioritize customer satisfaction, which is widely known to lead to customer retention and loyalty. Through this, businesses can increase their profit and sustain their competitive advantage within their industry.

In the competitive service industry, customers play an important role in determining the service quality that they received [2]. This service quality or widely known as SERVQUAL is considered as an important factor in interpreting customer satisfaction [3]. It has been already used by different service industries like in the mobile banking, health management, telecommunication, online education, hoteling, and tourism [3]. There are several measures that can explore the SERVQUAL in service industry and one of the most utilized is after-sales service.

After-sales service is commonly used to define services carried out to the consumer of a product during its life cycle after it has been purchased [4]. It is said that after-sales services are not only vital as a requirement on a product or by law, but also a great contributor for a

business to enhance their competitiveness [5]. Examples of these after-sales services are mostly the repairs and maintenance of a product in automotive companies.

Automotive companies' way of delivering after-sales services is through its retailer or dealers. Car producers such as Toyota, Volkswagen, BMW and many others utilize their retailers to deliver services such as vehicle periodic maintenance and other repair services [5]. Over the years, these retailer services have been thriving industries in developing countries such as the Philippines.

The Philippines ranked 9th among the countries with the highest passenger cars sold within the Asia-Pacific region. With approximately 273.4 thousand vehicles in 2019, Toyota was the leading auto-motive company in the Philippines, selling about 161.4 thousand cars in the same year [6]. Toyota Motor Philippines, or TMP, as one of the well-known car companies in the Philippines, uses the approach of using its retailer or dealer to deliver the after-sales services for Toyota vehicle products all over the Philippine network. One of these dealers is the Toyota Dasmarinas-Cavite.

Toyota Dasmarinas-Cavite or TDM is located at Dasmarinas, City in Cavite, Philippines. It is the first Toyota dealer in Cavite. The business is focused on the sales and periodic maintenance of all Toyota vehicles. It started on 24 October 2003 and was the very first addition to the Toyota Manila Bay Corporation (TMBC) [7,8]. Toyota Dasmarinas-Cavite also offers after-sales services to all Toyota customers and only aims to exceed the customer expectation and deliver high customer satisfaction.

In enhancing the customer satisfaction, SERVQUAL has been widely utilized in an after-sales service worldwide. In Malaysia, Farooq et al. [3] explored the customer satisfaction in Malaysia Airlines by utilizing the SERVQUAL approach. In Ghana, Baidoo et al. [9] also conducted a study that assessed customer satisfaction in automotive repair garages in Cape Coast metropolis. Finally, In India, Baber [10] also utilized SERVQUAL to explore the gap between the level of expectation in service quality, service perception, and its influence on customer satisfaction of Toyota customers.

Despite the availability of numerous SERVQUAL studies worldwide, there was no local study in the Philippines particularly related to the automotive after-sales service. In fact, the application of SERVQUAL is very important particularly for enhancing the automotive after-sales service such as Toyota Dasmarinas-Cavite, Philippines. By meeting customer expectation and achieving high customer satisfaction, customer retention and loyalty will be certainly possible for Toyota Dasmarinas-Cavite. With these, customer retention and loyalty can be attained by the company, which can also increase the company's profit and competitive advantage.

The purpose of the study was to determine factors affecting customer satisfaction in an automotive after-sales service at Toyota Dasmarinas-Cavite by utilizing the SERVQUAL approach. Several SERVQUAL dimensions such as tangibles, reliability, responsiveness, assurance, and empathy were analyzed simultaneously to the customer satisfaction. This study is the first study that analysed automotive after-sales service in the Philippines. The results could be theoretical foundations for enhancing the customer satisfaction in the automotive industry worldwide.

2. Materials and Methods

2.1. Theoretical Framework

Figure 1 represents the theoretical framework showing customer's perception on service quality in terms of the five dimensions. These dimensions consist of tangibles, reliability, responsiveness, assurance, and empathy. It was assessed with the use of SERVQUAL questionnaires to determine its relationship on customer satisfaction at Toyota Dasmarinas-Cavite Service Department.

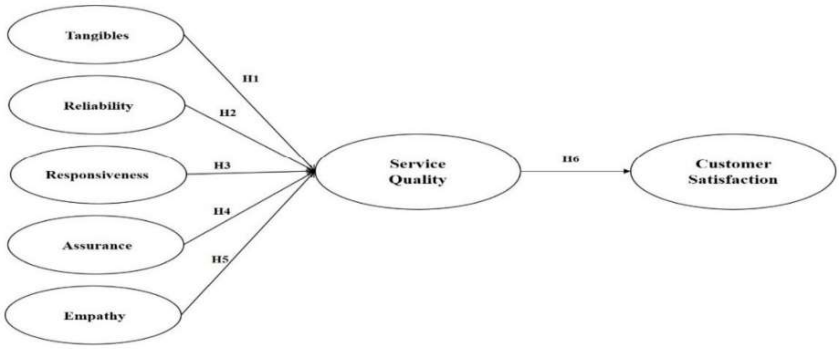


Figure 1. Theoretical Framework.

The tangibles dimension is a form of physical means used by organizations to create and do work. Supporting equipment and the appearance of employees used to serve consumers can create an impression that is easily remembered by consumers. In addition, pleasant conditions are also felt by consumers when making transactions against services produced by the company. Thus, the tangible dimension is part of the increasing condition of employees to act on time in accordance with the wishes of consumers. The better the tangibles provided by the organization, the better the service provided to consumers will be [11]. Thus, we hypothesized the following:

Hypothesis 1 (H1). *Tangibles had a significant direct effect on customer satisfaction.*

The reliability dimension is the ability and commitment possessed by employees to provide services in accordance with the agreement. The decision taken is the desire to adjust performance to customer expectations, which means the timeliness and the same service to all customers [11]. In an automotive service industry, getting a service from a reliable service provider extends the life of the car and prevents its sudden breakdown [7]. Thus, we hypothesized the following:

Hypothesis 2 (H2). *Reliability had a significant direct effect on customer satisfaction.*

Responsibility is the behavior of employees in the organization to act in time and convey information in accordance with consumer needs. The ability to respond to what is owned by employees will be positively assessed by consumers so that it can create capabilities when serving consumers. The motivation of employees to solve problems faced by customers when using the services has a positive effect on customer satisfaction [11]. Thus, we hypothesized the following:

Hypothesis 3 (H3). *Responsiveness had a significant direct effect on customer satisfaction.*

Assurance is one of the core dimensions of service quality that impacts customer satisfaction [12]. Khan et al. [12] stated that the process of acquired knowledge being showcased by staff in executing their term of preferences during service delivery can be highly assuring to customers. This gives customers the confidence that the service delivery representative will perform his/her duty professionally and ethically, encouraging the likelihood of word-of-mouth activity, especially in financial institutions [12]. Thus, we hypothesized the following:

Hypothesis 4 (H4). *Assurance had a significant direct effect on customer satisfaction.*

Faarooq et al. [3] provided evidence for the fact that better quality of personnel services will significantly improve customer satisfaction level. Without empathy, customers will remain dissatisfied with service quality; therefore, empathy greatly impacts customer satisfaction [12]. Thus, we hypothesized the following:

Hypothesis 5 (H5). *Empathy had a significant direct effect on customer satisfaction.*

Service quality is one of the main determining factors of customer satisfaction. Customers are the key evaluator that plays an important role in measuring the quality of service or product [13]. To remain competitive, retain their existing customers, and attract new ones, accommodation providers generally improve their service quality and, consequently, their customer satisfaction as a key strategy [2]. The study of Baidoo, F. and Odum-Awuakye, G. A [6] showed that wide quality service gaps exist between the expectation of the customer and the mechanics operating the garage. Communication gaps, tools and equipment, lack of service standard and working procedures, and the quality of service was the quality service gaps that have influenced customer satisfaction levels [6]. They recommended that dealership centers endeavor to work in partnership with these wayside garages, offer training support and help them to come out with service standards and work procedures [6]. Thus, we hypothesized the following:

Hypothesis 6 (H6). *Overall service quality had a significant direct effect on customer satisfaction.*

2.2. Participants

A total of 256 customers from Toyota Dasmarinas-Cavite were voluntary participants in the study. They were the individuals who are regularly having their vehicle serviced or those who have past experience of having their vehicle serviced at Toyota Dasmarinas-Cavite. Table 1 shows the descriptive statistics of all the respondents.

Table 1. Descriptive Statistics of Respondents (N = 256).

Characteristics	Category	Frequency (N)	Percentage (%)
Gender	Male	157	61.3%
	Female	98	38.3%
	Prefer Not to Say	1	0.4%
Age	18–30 years old	85	33.2%
	31–45 years old	122	47.7%
	46–60 years old	47	18.3%
	60 years old and above	2	0.8%
Estimated Monthly Income	P15,000 and below	39	15.2%
	P15,001—P50,000	160	62.5%
	P50,001—P100,000	52	20.3%
	P100,001 and above	5	2%
Number of Years Owning a Toyota Vehicle	0–5 years	166	64.8%
	6–10 years	78	30.5%
	11–15 years	9	3.5%
	16–20 years	2	0.8%
	21 years and above	1	0.4%

2.3. Questionnaire

A SERVQUAL-type questionnaire was utilized in this study. It is a tool used to measure service quality using both the gap concept and service quality dimensions [13]. The SERVQUAL comprised of the five service quality dimensions, which were the tangibles, reliability, responsiveness, assurance, and empathy [14–17]. Appendix A shows the sample survey questionnaire used in this study.

2.4. Analytical Tools

Structural equation modeling (SEM) was utilized to derive the relationships between SERVQUAL dimensions and customer satisfaction. It is an advanced statistical approach designed to describe causal relationships between the latent variables construct [18–20]. It is also widely utilized in SERVQUAL-type of study [21,22].

Figure 1 shows the study's structural equation modeling (SEM) framework. A total of 50 customer assessment items were used under service quality with 10 items each per service quality dimensions, which are the tangibles, reliability, responsiveness, assurance, and empathy. In addition, a total of 10 items were used to assess customers based on customer satisfaction and future intention. These were the items customers answered to determine the effects of service quality on customer satisfaction in automotive after-sales service.

3. Result

Figure 2 represents the initial model of the current study. Based on Table 2, three paths were found not to be significant: tangibles-customer satisfaction, responsiveness-customer satisfaction, and assurance-customer satisfaction. Thus, a revised model was derived by eliminating these three paths.

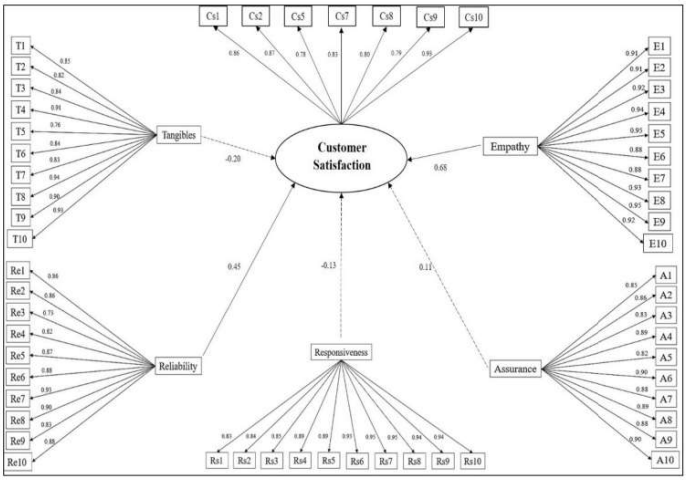


Figure 2. SEM Initial Results.

Figure 3 represents the final model of factors affecting customer satisfaction at Toyota Dasmarinas-Cavite service operation. Furthermore, an evaluation of each construct validity and composite reliability was also conducted; this was done to ensure that each set of indicators in relation to its construct accurately represents the investigated variables. In Table 3, three measures were used to test the reliability and validity of each construct. Cronbach's α and composite reliability (CR) measures the internal consistency of the construct and average variance extracted (AVE) measures the construct validity. All values surpass the recommended value (Cronbach's $\alpha > 0.7$, CR > 0.7, and AVE > 0.5), implying that each construct is indeed valid and reliable. This shows that among the five SERVQUAL factors, reliability and empathy were found to have a significant relationship to the satisfaction of customers at Toyota Dasmarinas-Cavite.

Table 2. Relationship Between the Five Factors.

No	Variables	Direct Effect	*p*-Value	Indirect Effect	*p*-Value	Total Effect	*p*-Value
1	T → CS	−0.20	0.058	-	-	−0.20	0.058
2	Re → CS	0.45	0.006	-	-	0.45	0.006
3	Rs → CS	−0.13	0.375	-	-	−0.13	0.375
4	A → CS	0.11	0.251	-	-	0.11	0.251
5	E → CS	0.68	0.000	-	-	0.68	0.000

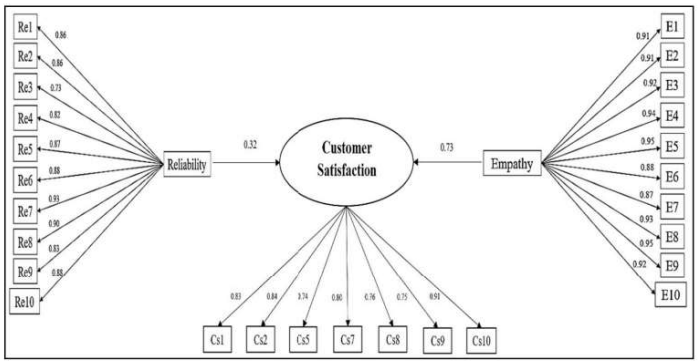


Figure 3. The Final SEM.

Table 3. Construct Reliability and Validity.

Factor	Cronbach's α	Average Variance Extracted (AVE)	Composite Reliability (CR)
Reliability	0.963	0.702	0.959
Empathy	0.982	0.829	0.980

Table 4 shows the relationship between the two hypotheses in this study. From this table, two hypotheses were shown to be significant, which was an indication of a relatively acceptable model construct. Reliability and empathy's *p*-value indicates a highly significant relationship between the two variables.

Table 4. Relationship Between the Two Hypothesis.

No	Variables	Direct Effect	*p*-Value	Indirect Effect	*p*-Value	Total Effect	*p*-Value
1	Re → CS	0.32	0.001	-	-	0.32	0.001
2	E → CS	0.73	0.000	-	-	0.73	0.000

As presented in Table 5, the GFI and AGFI values were 0.897 and 0.862, respectively, indicating that the model passed the minimum cut-off of the model fit [19]. In addition, the RMSEA value was 0.039, indicating that it was lower than the suggested cut-off of 0.07. IFI, TLI, and CFI values were greater than the suggested cut-off of 0.90 [20], indicating that the hypothesized construct of the specified model reflected the observed data very well [23,24].

Table 5. Goodness of Fit and Parameter Estimates.

Goodness of Fit Measures of the SEM	Parameter Estimates	Minimum Cut-Off	Recommended by
Goodness of Fit Index (GFI)	0.897	>0.80	[19]
Adjusted Goodness of Fit Index (AGFI)	0.862	>0.80	[19]
Root Mean Square Error of Approximation (RMSEA)	0.039	<0.07	[20]
Incremental Fit Index (IFI)	0.952	>0.90	[20]
Tucker Lewis Index (TLI)	0.953	>0.90	[20]
Comparative Fit Index (CFI)	0.951	>0.90	[20]

4. Discussion

In general, the study shows that two out of five factors were found to have a significant effect on customer satisfaction. Based on Figure 3, which represents the final SEM in the current study, empathy was found to have the most significant effect on satisfaction (β: 0.73). Several indicators are such as (1) service staffs understand customer needs (λ: 0.91), (2) service staffs give individual attention to the customer (λ: 0.91), (3) service staffs apologize when committing mistakes (λ: 0.92), (4) service staffs apologize when the customer requests were not done (λ: 0.94), (5) service staffs assist all customers in a caring manner (λ: 0.95), (6) convenient schedule for customers (λ: 0.88), (7) informing if there will be changes in promised time (λ: 0.87), (8) service staff's willingness to help (λ: 0.93), (9) service staff's courtesy (λ: 0.95), and (10) dealer is competent in correcting customer concerns (λ: 0.92). These results only show that customers appreciate it when they feel that they are important as a customer. They become even more satisfied if they are given prompt action and attention whenever they are availing of Toyota's service. Customers also appreciate when the service personnel apologized ahead of time if some requests cannot be done due to some reason, and if there will be any changes from the initial promised time to prevent customer disappointment. A similar study also provides evidence for empathy's significant influence on overall customer satisfaction. It was also stated that personal empathy positively contributes to service quality like in the airline industry [3].

Reliability was also found to have a significant effect on satisfaction (β: 0.22). Several indicators are such as (1) ease of arranging appointment schedule (λ: 0.86), (2) prioritization on appointment customers (λ: 0.86), (3) accommodation of walk-in customers (λ: 0.73), (4) promised time on service completion (λ: 0.82), (5) fairness on cost estimate prior to servicing (λ: 0.87), (6) vehicle cleanliness (λ: 0.88), (7) recommendations provided for customer's vehicle (λ: 0.93), (8) addressing customer vehicle concerns and requests (λ: 0.90), (9) addressing customer vehicle concerns and requests (λ: 0.83), and (10) all the discussed services were done accurately (λ: 0.88). These results indicate that most customers were satisfied with the service when the promised commitment time, estimated cost, vehicle concerns, and customer requests were achieved and done accurately. To add, vehicle cleanliness also represents the quality of service especially during vehicle turnover that makes the customers even more satisfied and makes not only the service personnel but also the servicing dealer more reliable. These findings were similar to Baber (2018) who mentioned that not every customer has good automobile knowledge, which is why they value reliable service, which has an impact on satisfaction [7]. In addition, service from a reliable service provider prolongs the vehicle's life and prevents possible breakdown.

Surprisingly, tangibles, responsiveness, and assurance were found to have no significant effects on customer satisfaction. Tangibles (β: −0.20) several indicators in this study were (1) accessibility to service entrance (λ: 0.85), (2) accessibility to the service reception area (λ: 0.82), (3) visual signs and messages for customers provided by the dealer (λ: 0.84), (4) service staff's appearance (λ: 0.91), (5) amenities (λ: 0.76), (6) state of the art equipment in-service workshop (λ: 0.84), (7) Courtesy items installed to vehicles (λ: 0.83), (8) overall service reception appearance (λ: 0.94), (9) overall service workshop appearance (λ: 0.90), and (10) overall facility appearance (λ: 0.93). This only indicates that customers have fewer

expectations when it comes to overall personnel and facility appearance. They are more focused on the quality of service delivered on their vehicle and how service personnel assists and communicate with them. A previous study revealed that tangibility does not take a significant role in providing service quality as customers do not expect to have tangibility in the after-sales service [7].

Responsiveness (β: −0.13) which was also found not significant to satisfaction includes indicators such as (1) assistance provided by guards or other staffs upon entry (λ: 0.83), (2) assistance by receptionist staff at the reception area (λ: 0.84), (3) waiting time before assisted by the Service Advisor (λ: 0.85), (4) assistance by the Service Advisor (λ: 0.89), (5) service staffs respond to all customer inquiries (λ: 0.89), (6) service advisor's clarity of explanation of service (λ: 0.93), (7) clarity of explanation to service billing or charges (λ: 0.95), (8) service staffs promptly serve all customers (λ: 0.95), (9) service staffs courteousness (λ: 0.94), and (10) Overall service staff's responsiveness to customers (λ: 0.94). This also shows that customers have fewer expectations when it comes to the overall responsiveness of service personnel.

Assurance was also found to have no significant effect on customer satisfaction (β: 0.11) but a high p-value of 0.251 (Table 2). Indicators under this factor were (1) maintenance reminder for customer's upcoming service (λ: 0.85), (2) confirmation and a reminder on customer's appointment schedule (λ: 0.86), (3) vehicle check listing or inventory system upon entry (λ: 0.83), (4) informing customers when their vehicle is being serviced (λ: 0.89), (5) allowing customers to watch their vehicle being service (λ: 0.82), (6) Service Advisor's constant update on the vehicle status (λ: 0.90), (7) providing warranty on parts and service repairs (λ: 0.88), (8) returning of used parts to customers (λ: 0.89), (9) all customer concerns and requests were done (λ: 0.88), and (10) all services and requests done were explained and shown upon vehicle pick-up (λ: 0.90). These revealed that customers have less expectation on service personnel's constant communication, honesty, and transparency such as returning all valuable items to the customers, informing if the vehicle is already being serviced, and allowing them to watch to show them that all the discussed inspections are properly done. In addition, explaining all the services done to the customer and giving them a work guarantee assures them of the kind of service they received from the servicing dealer but they do not see it as a contributing factor to the overall good service quality that they expect on their vehicle.

5. Conclusions

Service quality plays an important role in customer satisfaction, particularly in automotive after-sales service. The study aimed to explore the effects of service quality dimensions on customer satisfaction at Toyota Dasmarinas-Cavite. The findings revealed that there is a significant relationship between customer satisfaction and the two dimensions reliability and empathy, while tangibility, responsiveness, and assurance seemed to have less of an effect on customers.

Today, where most people rely on their vehicle as their day-to-day service, they need to make sure that their vehicle is always safe and in good running condition, which is why they still prefer having their car serviced at an authorized service center such as at Toyota Dasmarinas-Cavite [25,26]. In return, the servicing dealer must deliver a high quality of service to meet customer expectations and achieve high customer satisfaction that can later build customer trust towards the company. With these, customer retention and loyalty can be attained by the company that can also increase the company's profit and competitive advantage.

6. Recommendations

6.1. Practical Implications

This study has several practical implications for Toyota Dasmarinas-Cavite, its employees, and the management. The findings of this study suggest that Toyota Dasmarinas-Cavite must focus more on factors such as reliability and empathy in delivering high

quality of service since these are the factors most of the customers consider that affect their satisfaction.

The company must continue to provide employee pieces of training, particularly on service technicians to enhance their skills that will help the company to deliver fast and reliable service to all its customer's vehicles. This can be done by participating in all the training conducted by Toyota Dasmarinas-Cavite (TDM) or can be by Toyota Motor Philippines (TMP). The dealer can schedule a quarterly training properly coordinated with the training facilitators at the TMP. The dealer can also perform a job rotation at the service workshop which can also be done quarterly for the technicians to enhance their skills and knowledge on other tasks. In this case, reliable service can be attained and will lead to customer assurance on their vehicle's good running condition and performance.

The company must also continue to conduct customer care or customer handling related training especially for the service marketing personnel who handles customer directly for them to better understand the customer needs and expectations. This can be done at least once a year. The training can also serve as an annual refresher to the employees who already had this kind of training. With these, service personnel can identify and understand the customers better; what they want and how they feel. In this case, a suitable approach can be adapted towards the customer that can make them feel more comfortable and even more satisfied not only with the service they received but also with the heartfelt treatment by the service personnel.

Lastly, the management must always continue to improve the quality of service by doing "kaizen" activities, and even turning customer feedbacks and concerns into positive input to improve the overall service quality.

6.2. Limitations and Future Research

There are some limitations needed to be considered in this study. This study only utilized the traditional five factors of the SERVQUAL tool, namely tangibles, reliability, responsiveness, assurance, and empathy. There are still other factors and tools that can consider using in this type of study thus limiting the findings of this study. Future researchers can explore these factors using the latest improved tools and models that are applicable in this type of study. The study also focuses only on one after-sales service dealer. Future studies can overcome such limitations by exploring other servicing dealers and industries.

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Appendix A

Table A1. Sample Survey Questionnaire.

I. Customer Profile					
Name (Optional): _____					
Gender: _____					
Age: __ 18–30 years old __ 46–60 years old __ 31–45 years old __ 61 years old and above					
Estimated Monthly Income: __ P15,000 and below __ P50,001–P100,000 __ P15,001–P50,000 __ P100,001 and above					
Number of years owning a Toyota vehicle: _____					
II. Customer Assessment based on Service Quality Answer the following statements by checking the column that corresponds to your answer. **Rating Scale:** 5—Very Satisfied 4—Somewhat Satisfied 3—Neither Satisfied or Dissatisfied 2—Somewhat Dissatisfied 1—Very Dissatisfied					
Tangibles	**5**	**4**	**3**	**2**	**1**
1. Acessibility to service entrance.					
2. Acessibility to service reception area.					
3. Visual signs and messages for customers provided by the dealer.					
4. Service staffs appearance.					
5. Amenities (TV, WiFi, furnitures, and refreshments).					
6. State of the art equipments in service workshop.					
7. Courtesy items installed to vehicles (floor mats; steering, shifter and handbrake covers).					
8. Overall service reception appearance (service counters and waiting area).					
9. Overall service workshop appearance (equipments, tools, and working bays).					
10. Overall facility appearance (accessibility, cleanliness, ambience, etc.).					
Reliability	**5**	**4**	**3**	**2**	**1**
1. Ease of arranging appointment schedule.					
2. Prioritization on appointment customers.					
3. Accomodation on walk-in customers.					
4. Promised time on service completion.					
5. Fairness on cost estimate prior to servicing.					
6. Vehicle cleanliness (interior and exterior).					
7. Recommendations provided for customer's vehicle (prior to and after service).					
8. Addressing customer vehicle concerns and requests.					
9. Service staff returns personal belongings and other valuable items.					
10. All the discussed services were done accurately.					
Responsiveness	**5**	**4**	**3**	**2**	**1**
1. Assistance provided by guards or other staffs upon entry.					
2. Assistance by receptionist staff at the reception area.					
3. Waiting time before assisted by the Service Advisor.					
4. Assistance by the Service Advisor.					
5. Service staffs responds to all customer inquiries.					
6. Service advisor's clarity of explanation of service (prior to and after service).					
7. Clarity of explanation to service billing or charges.					
8. Service staffs promptly serve all customers.					
9. Service staffs courteousness.					
10. Overall service staffs responsiveness to customers.					

Assurance	5	4	3	2	1
1. Maintenance reminder for customer's upcoming service.					
2. Confirmation and reminder on customer's appointment schedule.					
3. Vehicle checklisting or inventory system upon entry (interior and exterior condition; valuable items left).					
4. Informing customers when their vehicle is being service.					
5. Allowing customers to watch their vehicle being service.					
6. Service Advisor's constant update on the vehicle status.					
7. Providing warranty on parts and service repairs.					
8. Returning of used parts to customers.					
9. All customer concerns and requests were done.					
10. All services and requests done were explained and shown upon vehicle pick-up.					
Empathy	**5**	**4**	**3**	**2**	**1**
1. Service staffs understand customer needs.					
2. Service staffs gives individual attention to customer.					
3. Service staffs apologize when committing mistakes.					
4. Service staffs apologize when customer requests were not done.					
5. Service staffs assist all customers in a caring manner.					
6. Convenient schedule for customers.					
7. Informing if there will be changes in promised time.					
8. Service staffs willingness to help.					
9. Service staffs courtesy.					
10. Dealer is competent in correcting customer concerns.					
III. **Customer Assessment based on Customer Satisfaction and Future Intention** Answer the following statements by checking the column that corresponds to your answer. **Rating Scale:** 5—Very Likely 4—Somewhat Likely 3—Neutral 2—Somewhat Unlikely 1—Very Unlikely					
Customer Satisfaction and Future Intention	**5**	**4**	**3**	**2**	**1**
1. Recommending TDM's service to a friend or peer.					
2. Re-availment of TDM's service.					
3. Switching to another Toyota Service left.					
4. Switching to non-Toyota or outside car service left.					
5. Recommending the service marketing staff/Service Advisor to a friend or peer.					
6. Switching to another service marketing staff/Service Advisor.					
7. Continue patronizing TDM's services even if your vehicle is already out of warranty.					
8. Continue patronizing TDM's services despite of price increases.					
9. Continue patronizing TDM's services despite of minor unwanted experience.					
10. Overall satisfaction with TDM's Service performance.					

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To Hell, with Shakespeare

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Abstract

In the teaching of Shakespearean plays to ESL students, deciphering Shakespeare's language has often been cited as the main obstacle to comprehending his work. This paper reports on how the researcher tapped on the diverse religious beliefs of the students and used Taoist, Muslim, and Hindu concepts of the afterlife as a prelude to teach and read the Porter's scene. As a result of the creative methodology used in the class, the ESL students were able to discuss and comprehend Shakespeare's treatment of Hell and grasp the concept of black comedy in the play.

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Keywords: Hell, humor, comic relief, background knowledge/schema, the aesthetic experience

1.Introduction

Shakespeare's language has often been cited as the main obstacle to comprehending his work; whilst this may hold true to a large extent, in the teaching of Shakespeare in the English as a Second Language (ESL) classroom, there are other 'aspects'/'areas' in Shakespeare's plays that are equally demanding for the ESL reader such as the concept of Hell and black humor. Humor is not only relative but it is also time and culture-bound; in the case of the Malaysian classroom, getting students from different ethnic and religious backgrounds to comprehend the black humor in the Porter's scene in *Macbeth* is no laughing matter. Two principal reasons for the lack of appreciation for the humor in the scene is that (i) the ESL reader here does not have a shared assumption of Shakespeare's treatment of Hell in the play (ii) due to their religious backgrounds, for many Malaysian students, Hell is a serious place to atone for one's sins thus to view Hell with humor is incomprehensible.

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Therefore, the central question is: how do we assist students who are from diverse racial and religious backgrounds connect with the Porter's scene as a comic relief?

The Malaysian classroom is as ethnically and religiously diverse as its society. The different religious festivals celebrated in a year bear testimony to the diverse religious beliefs practiced in the country: Islam, Christianity, Buddhism, Taoism, Hinduism, Sikhism, Bahai, not to mention other smaller groups of faiths. This paper reports on how the researcher tapped on the diverse religious beliefs of the students and used Taoist, Muslim, and Hindu concepts of the afterlife as a prelude to teach and read the Porter's scene. Following the pre-reading discussions of the afterlife in the different faiths, the students were induced to critically reflect on how Shakespeare's treatment of Hell in the Porter's scene qualified it as a comic relief in the context of the surrounding tragedy taking place by the second act of the play. To consolidate the pedagogical methodology, communicative, language-based activities such as interviews with the Porter and the other gatekeepers of Hell were carried out to make the characters real, transcend time and become meaningful to the students. This paper illustrates how diversity in the Malaysian classroom can be used creatively to develop the ESL students' comprehension and aesthetic appreciation of the text.

2. Review of Literature

Why do we teach Shakespeare? According to Berkowitz (1984), Shakespeare is a Major figure, central to any study of literature in English and anyone who is going to go into the world as a college graduate should know him. For Frey (1984), Shakespeare is continually reinvigorating and reinvigorated. To the question 'What do you hope to accomplish in teaching Shakespeare?', McDonald (1995) reports answers from teachers as classic and refreshing as the Bard: 'I teach because I like to..', 'teaching Shakespeare feeds the intellect, spirit, imagination – mine and the students…', 'because an author by any other name wouldn't smell as sweet…', 'his works present us with endless interesting questions, issues, dilemmas, conflicts that never go out of date…just like him!'. Adams (1995) holds firmly the view that all students should have the opportunity to read complex literature, in her experience of teaching Shakespeare in lower track classes, poor readers are not necessarily poor thinkers nor are they uninterested in the themes dealt with in Shakespearean plays. Into the millennium and the interest in Shakespeare continues: in his discussion on the myriad forms of pop-culture Shakespeare, Lanier (2002) informs us that even in contemporary versions of the Bard and his oeuvre, his name retains immense prestige; for Pujante & Hoenselaars (2003), even if English is not a global language, Shakespeare would still be a global author as evidenced by the numerous national literatures and different media in Europe that draw from his works; for Garber (2009), Shakespeare and modern culture is synonymous – long before the modern world questioned anti-Semitism, racism, youth rebellion, Shakespeare had raised these issues in his *Merchant of Venice, Othello, Romeo and Juliet* respectively thus the Bard is, as Garber argues, part of youth and popular culture.

How do we teach Shakespeare? In her article on the teaching of Shakespeare, O'Brien (1995) points out that most people meet Shakespeare in school and, there is a long tale of teachers involved in the collective struggle to find the best way to each Shakespeare. Patridge (1974) reminds teachers that a play is a play and advises against just studying the language because there are other obvious things, for example, the actors, the mise en scene, the costumes and not forgetting the silences that can be as powerful as any speech that students need to discover and respond to. In the nineties the most popular Shakespearean pedagogy was to get students and text together through performance. There are two volumes of *Shakespeare Set Free* by teachers at The Folger Shakespeare Library which offer practical and innovative means to read Shakespeare meaningfully; Taylor (2002) advises methodological eclecticism while Worster (2002) recommends performance with pedagogy. There is also a wealth of electronic support for the teaching of Shakespeare such as *Shakespeare on Disk, Shakespeare on CD-Rom, Much Ado about Shakespeare, Wordcruncher* and other Shakespeare-related softwares that this generation of digital native students may respond to in a way they may not respond to the printed word. For teachers of Shakespeare, *SHAKSPER* is an electronic seminar for those interested to talk about, teach, or study Shakespeare. Clearly, the list on how to teach Shakespeare is not exhaustive but given that text in the ESL context is often constructed on direct literal meanings and grammatical constructions and the cultural context within which Shakespeare's plays are written are foreign to the ESL reader, to what extent are the ESL students able to achieve bicultural status in the Shakespeare class?

The third question is, can we teach humor? According to Lewis (1989), humor appreciation is subjective and contextual, rooted in individual affective and intellectual responses. Accordingly, how well a joke is understood is determined in part by our immediate situation and in part by our values. Lewis further explains that in most cases, humor appreciation is based on a two-stage process of first perceiving an incongruity and then 'resolving' it. The perception of an incongruity (or what strikes us as a violation of our sense of reality) is subjective because it relies on the state of the perceiver's knowledge, expectations, values and norms. In the same vein, Raskin (1985) describes three subdivisions of the real/unreal dichotomy that are central to the interpretation of jokes: the actual versus the non-actual, the normal versus the abnormal, the possible versus the impossible. The process of comprehending and appreciating a joke involves first identifying the incongruity (the question: Can this happen/Is this possible?) and then resolving it (seeing it in a way whereby it may seem possible/less unreal than first supposed). What makes humor subjective is that ideas of the real/the possible/the actual/the normal are subject to individual and cultural definitions. Unlike slapstick humor which is often universal, according to George Meredith's true test of comedy, humor should "awaken thoughtful laughter" which means that the laughter should contribute to a deeper meaning of the work. In the Shakespeare class, obviously the aim is for the students to experience this "thoughtful laughter" as a way in for an aesthetic experience with the text. Generally, the humor in the porter scene functions as slapstick comedy due to the grotesque appearance and drunken stupor of the gatekeeper but there is a deeper significance for his appearance in the play: the porter and his work is a metaphor for Macbeth and his deeds, but taking into consideration that humor is based on a common world view, to what extent is this thoughtful laughter accessible to the ESL readers from diverse backgrounds?

3. Theoretical Orientations

All literary studies, in the ESL and non-ESL context, should stress the literary-aesthetic experience. The question is, how do we develop this experience with a Shakespearean text in a multiracial ESL classroom with students from different ethnic and religious backgrounds?

3.1 The Aesthetic Experience

In 1986, Rosenblatt characterized the literary experience as a transaction between the reader and the text. According to Rosenblatt (1988), reading is a two-way process where the reader's experience is operated on by the text while the text is simultaneously constructed according to the reader's understanding and assumptions. This Transactional Theory of the Literary Work bears important implications for the teaching of literature in the ESL classroom. Firstly, in reading and interpreting literature, it is more appropriate to take an *aesthetic* as opposed to an *efferent* stance. In the former, readers explore the world of self and the worlds of the writer; in the latter, the reader analyses a text for information. In the efferent, we want students to give a clear answer about the text's meaning; in the aesthetic, we want them to explore a range of possible meanings (Purves 1993). When the focus of the learner's attention is on the more personal, lived-through evocation of the literary work, the response to what is read is more aesthetic. Secondly, in the transaction between the reader and the text, readers create their own secondary world which is brought about by the merging of the reader's past experiences and the experiences gathered by the text. Hence, the *reader's background knowledge* comes into play in a more decisive dimension.

3.2 Background Knowledge/Schemata

Rather than passively receiving knowledge, students need to become actively engaged in making meaning in the literature class. However, in order to acquire meaning in their readings, students need to possess background knowledge to facilitate their understanding of the texts read. Bartlett (1932) theorizes that when readers read, they tend to interpret their texts according to their own background knowledge. A reader's background knowledge is previously acquired knowledge structures which are called schemata (Carell & Eisterhold 1983). Basically, there are two types of schema: content and formal schemata. Content schemata is the background knowledge a reader brings to a text while formal schemata is background knowledge of the rhetorical structures of different type sof texts (Carell 1987). According to Rumelhart et al. (1977), the text does not in itself carry meaning but rather depends on the individual's pre-existing knowledge structures and his/her interaction with the text to determine one's level of understanding it. Thus, background familiarity is a most important factor of good comprehension because comprehension becomes easier if the text corresponds to the student's *prior knowledge* of language,

rhetorical conventions and the world. Since background knowledge plays a significant role in text comprehension, relevant knowledge should be tapped and shared (Pearson & Fielding 1992). During pre-reading discussions, students often share information that is relevant to the topic but which they were not aware of possessing until they need the information to make connections. It is at this stage that teachers can tap into the student's life experiences and beliefs to help them connect and understand what they read. In multicultural societies, students often have differing prior experiences and beliefs and hence do not share the same assumptions with each other or with the text. In this case, the challenge here is to induce students to draw upon their differing beliefs and prior experiences to make comparisons and critically reflect on what is in the text and in the process, help students to transcend the text.

4. The Study

Thirty-seven Matriculation students between the ages of 17- 20 years in a local institution of higher learning who chose to read Drama In English as an elective took part in the study. The drama course was a prerequisite follow-up to another elective 'Play Production', which was to be offered in the succeeding semester. The prescribed Shakespeare play for the semester was Macbeth and the students were in the 5th week of their semester and had just completed their readings of Act 1 and the first two scenes of Act 2. Act 2 Scene 3 is the Porter's scene. Due to the different religious backgrounds of the students and her experience of teaching Shakespeare, the teacher hypothesized that the students would not find the scene humorous because they viewed the afterlife and especially Hell differently. In view of this, the researcher decided to approach Hell from the student's perspectives and then work their way into the Porter's scene.

5. Methodology

The research methodology employed in this study consists of four main activities culminating in a fifth consolidation activity as its aim is engage students in activities that will assist the students to transact with the text and experience a more personal, lived-through evocation of the text/the porter scene. The research design is referred to as the monomethod monostrand design in which only the qualitative or quantitative is used across all stages; in this particular case it is all qualitative. The research strand consists of three stages: the conceptualization stage, the experiential stage, the inferential stage (Teddie & Tashakkori, 2009).

The premise for the study is: Due to the different religious backgrounds of the ESL students in the Malaysian classroom, the class does not find the porter scene humorous because they view the afterlife, especially Hell differently. The research question to be addressed is: Taking into consideration that humor is based on a common worldview between the writer and the reader, to what extent is this thoughtful laughter made accessible via the designed activities which drew upon the ESL students' diverse background knowledge and experience?

5.1. Activating background knowledge

5.1.1 Activity 1

The objective of this exercise is to induce students to reflect on the concept of Hell according to their faiths and in the process raise awareness of the similarities and differences of Hell between the religions.

The students divided themselves into five main groups: the Muslim group (M), the Buddhist/Taoist group (BT), the Hindu group (H), the Christian group (G) and the Atheist group (A) as there were ten Muslims, thirteen Buddhist/Taoists, seven Christians, five Hindus and two Atheists. Each group had to

i) brainstorm on the concept of the afterlife
ii) give at least three words/phrases associated with Hell in their religion or thinking (the Atheist group)
iii) describe Hell according to their faiths (or thinking)

Each group then presents to the class what Hell is according to their religious/philosophical orientation.

5.1.2 Activity 2

The objective of this exercise is to make students realize that some ethnic groups believe that the mortal relatives on Earth are obliged to 'help' their dead relatives in their journey to the other world thus they may need to hold prayers in which food and gifts are offered; likewise some Christian groups believe that prayers can help atone the sins of the deceased. This activity also foreshadows the next two activities in which students will narrow down their focus and discussions to the gatekeepers of Hell in the Chinese afterlife and in Macbeth.

- *1 pair red candles*
- *A pair of joss sticks for each person's present*
- *Kim Chua ('gold' paper) – to be folded, burned, and sent to her*
- *3 types of fruits*
- *3 types of dishes*
- *1 bowl rice*
- *3 small cups of tea*

After reading the above, the students were to discuss these questions:

i) What is the 'other world'? What constitutes the 'other world'?
ii) Which religious group do you think practice this?
iii) Have you ever witnessed these 'prayers for the dead' scene? Where/When?
iv) What, do you think, is the 'gold' paper for?
v) How is this treatment of the afterlife different from the other religious group?

5.1.3 Activity 3

This exercise is to narrow down the lesson and the students' focus to the functions and characteristics of gatekeepers of Hell in the different religions and ultimately prepare students to discuss the porter in the Porter's scene.

For this task, students were given information cards each containing a picture and the name of the gatekeepers of Hell in Islam (Maalik), in Christianity (Satan), in Hinduism (Yamaraja), and on Buddhist-Taoist Hell Bank notes, Yuen Wong alias Yanluo Wang, the gatekeeper of the Buddhist-Taoist underworld . Students are to refer to the information cards and discuss the roles and the characteristics of these gatekeepers of Hell e.g. What are their duties? How do they appear to you - Fierce? Evil? Sadist? Do you expect these gatekeepers to be humorous?

5.1.4 Activity 4

Students read Act 2 Scene 3, the Porter's Scene and:

i) Discuss what the scene is about
ii) Compare the duties of the Porter with the other gatekeepers of Hell in Islam, Christianity, Hinduism, Buddhist-Taoism (cf. Activity 3)
iii) Discuss, in their opinion, why Shakespeare included the Porter's scene in Macbeth
iv) Decide whether the Porter's scene is comic - what is humorous and what is not, and whether the scene serves the purpose of comic relief for the tragedy

5.2 Enhancing the aesthetic experience

To consolidate the teaching-learning experience, students prepare interview questions for the all gatekeepers of Hell (Maalik, Satan, Yamaraja, Yanluo) and the Porter. Students then pair up as interviewer and interviewee, taking turns to be either one and conduct the interviews. The pair of students who managed to portray the Porter most accurately and also draw the most laughter in the interview with the Porter received the commendation for having transcended the text.

6 .Results and discussion

The results of the 'intervention' - the five activities given by the researcher in the study - is reported here according to the activities carried out in the methodology. As mentioned earlier, the analysis is qualitative as the focus is on how, judging by the responses, the students interacted with the text. Nevertheless, the activities were planned to yield responses according to the three stages of the monomethod research design:

i) The Conceptualization stage
ii) The Experiential stage
iii) The Inferential stage

6.1 The Conceptualization stage

The first activity, Brainstorming on the afterlife/the concept of Hell, was successful in getting the students to reflect on the afterlife, the existence of heaven and hell, as well plead ignorance of whether there is an afterlife, heaven or hell. The second activity, Journey to the other world, added further conceptualization of the afterlife and of dealing with the dead. These activities helped set the stage for further discussions and thinking of the afterlife thus students were able to conceptualize what the afterlife is likely to be.

Table 1.The afterlife and the concept of hell

Groups	The afterlife	Hell
Muslim	Syurga (Heaven) and Neraka (Hell)	Neraka -a place where evil doers go to, steaming and tormenting or freezing, to suffer Hell is a terrible place, must avoid
Buddhist/Taoist	Buddhist In the afterlife you are reborn. Rebirth is according to levels, the good is reborn into a higher being, the bad/evil is reborn into worse states.	Naraka – the lowest realm of Hell, punishment, no escape
	Taoist The afterlife is a journey. Where to? Don't know.	A place to cleanse your sins, many chambers to punish according to your sins
Christians	Either you go to heaven or hell. Your soul meets the Lord. A state of non-existent.	When you are not worthy of the Lord, hot, evil, tragic.
Hindus	Depends on your karma – either you go to heaven or hell when you die.	The lowest spiritual plane called naraka, not permanent, a place to be punished
Atheists	When you die, it's all over. No heaven or hell.	Don't know.

From the brainstorming session, it is clear that most religions believe in the existence of hell; the difference is some religions such as Muslims and Christians believe that hell is a point of no return while the Taoists and Hindus consider hell as a temporary place where a person's sins can be atoned.

Table 2 .Journey to the Other World'

Questions	Responses
i. What is the 'other world'?	The dead (world). The afterlife. Up or down there! Paradise.
What constitutes the 'other world'?	God, heaven, the devil, hell, don't know.
ii. Which religious group practises this (ritual)?	The Buddhist. The Chinese. The Taoist.
iii. Have you ever witnessed these prayers? Where/When?	Yes, a t funerals. Sometimes by the roadside? During Chinese religious festivals.
iv. What, do you think, is the 'gold' paper for?	Don't know; not sure; for moneylah!
v. how is this treatment of the afterlife different from the other religious groups?	More prayers/longer time for prayers. They believe that the spirits come down to eat the food/fruits. There is contact between the dead and the alive – scary!

It can be seen from Table 2 that being a multiracial country, most of the students have been exposed to some form of Chinese prayers but unless you are Chinese, most of the students do not know what these prayers are for. Thus, for most of the non-Chinese students, this exercise is informative.

6.2 The Experiential stage

Activities iii and iv, Discussing the roles and characteristics of the gatekeepers of Hell and Reading the Porter's scene, were complementary as the students at this stage were making connections between the duties of the gatekeepers of hell in other religions and experiencing the different treatment of the porter's role in the Porter's scene.

Table 3. The gatekeepers of Hell

Questions	Responses
i. Maalik	Really? Never heard of him. I thought Satan rules Hell?
ii. Satan	Oh, the evil one. This fellow is big time bad! Scary. Not one you want to meet!
iii. Yamaraja	
iv. Yanluo Wang	I didn't know there's one in Hinduism too. Why is he in blue? I thought Yami is the one guarding hell?
How do they appear/look to you?	This guy doesn't look like a gatekeeper of hell, he's like a businessman! I don't believe it – there's money in hell too?
	All fierce and evil except the Wang guy. Nolah, definitely not funny. Hell is not a jokelah so how can it be funny?

As expected, all the gatekeepers of Hell are expected to be fearsome and evil. Also, the students do not expect hell or their gatekeepers to be viewed with humor – to them, hell is serious business.

Table 4. Porter's Scene

Questions	Responses
i. Describe what the scene is about.	The fat man…the porter is guarding the gates of Hell. Some people have arrived and the porter is admitting them in, he insults them but lets them in.
ii. Compare the duties of the porter and the other gatekeepers of hell	Although the porter is admitting people (sinners) into hell, somehow the afterlife is not so scary in this scene. Is the porter real?
iii. Why do you think Shakespeare included this scene in Macbeth?	For a break? Don't know, maybe to laugh?
iv. Is the scene comic/hunorous? Does the scene provide comic relief?	If you compare the porter with the other gatekeepers, he looks funny and sounds funny. Is that comic relief?

With reference to Table 4, what makes the porter funny is more his appearance. Thus, we can say that at this point, the appreciation of humor is low level (not 'thoughtful laughter').

6.3 The Inferential stage

So far, the four activities have assisted the students to activate their schema to discuss and prepare them for the context of the porter's scene. The last activity is the inferential stage because it was not until the students engaged in the role play of interviewing and being interviewed as the Porter did they actually experience (not just read) the laughter and humor of the scene. The students were able to laugh at the scene as they have transcended the text: the appreciation of humor takes place because the ESL students were able to find incongruity in the porter as a gatekeeper of hell (that this gatekeeper is not the normal serious, evil-faced gatekeeper of hell that one sees in religious beliefs) and resolve this mismatch of expectations (it is possible to have such a gatekeeper of hell because it is meant to be humorous/to provide comic relief).

7. Conclusion

This paper has shown that in the teaching of Shakespeare to ESL students, the language of the Bard is not the only obstacle to appreciating his play(s) and that humor, especially black humor, is one of the most challenging experience to acquire in the class. The methodology advocated in the study clearly reinforces the pedagogical need for the practitioner to draw upon the student's background knowledge and experiences to help them transact with the text (Lee, 2008). The paper also exemplified how diversity in the ESL classroom can be reaped creatively when the students are not taught but led to discover for themselves the meaning of the text via meaning-making activities. To conclude, learner diversity can be an asset in the ESL classroom if it is used creatively.

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Towards a health observatory conceptual model based on the semantic web

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Abstract

Introduction. Health Observatories have gained global popularity and have been established worldwide since the 1970s. With the advent of the Semantic Web, machines can process, reuse, integrate and understand the meaning (semantics) of the information and knowledge on the World Wide Web to perform complex tasks. Objective. To propose a health observatory conceptual model based on Semantic Web in order to assist in the design, development and implementation processes of a Health Observatory. Methods. The proposed model was based on a conceptual analysis that include Semantic Web technologies narrative review, multi-layer software architecture and an integrative review of Health Observatories. Results. The proposed Health Observatory conceptual model consists of a chain of several related components based on information technology multi-layer architecture, Semantic Web technologies, Health Observatories stakeholders and key concepts. Conclusion. The proposed model can provide opportunities for the development and implementation of new observatories or for the adequacy of existing Health Observatories.

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Keywords: Health observatory; semantic web; conceptual model

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1. Introduction

Health Observatories (HOs) are defined as policy-oriented centres that perform continuous and systematic observations and analyses of health issues relevant to a particular population and a geographic region [1][2][3].

The idea of a HO has gained global popularity since the 1970s because of the rapid changes in the health sector, the growing importance of public health and the need for reliable and up-to-date information for monitoring and evaluating the impact of health programs and policies [4][5].

Typically, a HO has a web portal in order to disseminate and communicate its results in different formats and to generate knowledge and health intelligence in several areas, such as cancer, infectious diseases, mental health and urban health through dynamic and interactive web pages [1][2][3][5].

On the World Wide Web (WWW), the retrieval of information from a large collection of texts is a laborious and time-consuming task for humans and difficult and error-prone for machines [6]. Thus, the concept of Semantic Web (SW) emerged, defined as a network that not only links hypertext documents among themselves, but also recognizes the meaning of these documents and, through a machine processing mechanism, infers new knowledge [6].

Therefore, the objective of this article is to propose a HO conceptual model based on SW in order to assist in the design, development and implementation processes of a HO.

Firstly, we will present a theoretical background on SW and HOs. Secondly, the methods for the elaboration of the conceptual model will be described. Thirdly, we will describe the conceptual model and its mains components as well as discuss the obtained results. Finally, it is presented the conclusion of this paper.

2. Background

In this section, theoretical elements of SW and HO will be presented as the basis of the conceptual model.

2.1 Semantic web

The World Wide Web Consortium (W3C) has been leading initiatives to improve the integration, standardization and exchange of information as well as the semantic understanding of WWW information by machines [7]. One such initiative is the Semantic Web (SW), defined as an extension of the WWW that not only links hypertext documents among themselves, but is also able to recognize the meaning (semantics) of the information contained in these documents and, through inference mechanisms and ontologies, assist in the knowledge management [7].

The SW can be implemented through a combination of technologies, languages and standards recommended by W3C, such as: Resource Description Framework (RDF), a standard language for representing data, metadata and information about resources in the WWW [8]; Resource Description Framework Attribute (RDFa), which provides a set of mark-up attributes to augment the visual information on the WWW with machine-readable hints [9]; Web Ontology Language (OWL), a standard language that can be used to explicitly represent the meaning of terms in vocabularies and the relationships between those terms (ontologies) [10]; and SPARQL Protocol and RDF Query Language (SPARQL), that can be used to perform queries across diverse repositories, in which the data is stored natively as RDF or viewed as RDF via middleware [11]. Furthermore, the Linked Data (LD) approach proposes a set of recommendations and practices that enable applications to expose, query, share and integrate data from different sources through SW technologies as well as to draw inferences using ontologies [7].

2.2 Health Observatory

In general, a Health Observatory (HO) is operationally defined as a policy-oriented centre that performs continuous and systematic observations and analyses of health issues relevant to a particular population and a geographic region in support of evidence-based health policies, decision-making, planning, and actions in health and health systems [1][2][3]. Additionally, a HO is a platform which uses an integrated a set of methods, processes, tools and individuals working together to collect, analyse, report and share data and information and to generate evidence and knowledge to be disseminated to health policymakers, planners and managers of a health system as well as political and health authorities [1][2][12].

The main functions of a HO are related to: provision of a virtual repository for health data and information from different sources; identification of gaps in health information; generation of synthesized, updated and contextualized

health reports; provision of services for data and information analysis, interpretation and dissemination; primary commitment to work with partners to support sustainability; and support or recommend evidence-based actions, practices and policies in order to improve health [1][2][3][12][13].

Typically, a HO has functional components and operational resources. The functional components are: inputs, such as data sources and data management; processes, that include production of indicators, knowledge and health intelligence; and outcomes, which are the communication of produced results [1][2][12]. The operational resources, in turn, include: governance; analytical staff; information technology staff; and information and communication technologies [1][2][12].

Recently, some studies have been analysing the use of SW technologies in HOs. In general, they are middlewares for complex data from diverse sources on the WWW. Furthermore, they provide access to visualization and analytical environments capable of collecting, sharing and querying structured and standardized data sets, such as LD, as well as integrating knowledge through ontology management in order to facilitate cross-collaboration analysis for health issues [4][14][15].

3. Methods

Firstly, an integrative review was conducted to investigate the definition, functions, tools and services of a HO. The inclusion criteria were: studies that describe the definition or functions or tools or services of a HO; and studies in English, Spanish or Portuguese. The exclusion criteria were: lack of information (e.g. full text not found); and studies whose focus were not health. The query string 'health observatory' was used and 3456 studies were found on Scopus, 56 on Web of Science, 303 on PubMed, 58 on IEEE digital library, 9 on LILACS and 59 on Worldcat. In addition, 5 WHO and PAHO guidelines and manuals related to HOs were found through handsearching. After the removal of repeated studies and title, abstract and full text analysis, 59 documents, including full articles, editorials, thesis, book chapters and WHO and PAHO manuals were included. Through the findings of this review, it was possible to identify the main definitions of a HO and its key functions, tools and services, which were adopted as the basis of the 'stakeholders' and 'key concepts' components of the conceptual model.

Secondly, a narrative review was conducted in order to explore SW main concepts and technologies. Furthermore, W3C documents for the SW standards were investigated to complement this review [8][9][10][11]. The justification for choosing SW is due to the fact that it is recommended by the W3C and it can, through ontologies and data/information exchange between semantic applications, enhance and assist in knowledge management, which is one of the key concepts of a HO [1][2][12].

Finally, the multi-layer software architecture comprehends different components that are organized in layers in order to provide dedicated functionality and separation of concerns in layers [16]. This architecture along with the findings of the narrative review (SW main concepts and technologies) were adopted as the basis of the 'information technology architecture' component in the conceptual model.

4. Results and discussion

The proposed HO conceptual model consists of a chain of several related components based on information technology multi-layer architecture, SW technologies, stakeholders as well as key concepts (Fig. 1).

The 'stakeholder' component represents the stakeholders of a HO and their roles. It is composed by: information technology (IT) staff, responsible for IT activities; analytical staff, responsible for data-related and analytical tasks; end users, such as health professionals, policy makers, planners, managers, political and health authorities, and researchers; governance staff, responsible for coordinating HO internal staffs, guaranteeing sustainability and establishing partnerships; and SW applications, which communicate with the 'IT architecture' component through LD. In addition, the governance staff needs to work periodically and frequently with end users in order to validate whether the HO functionalities and operations are coherent and responsive to their needs [1][2].

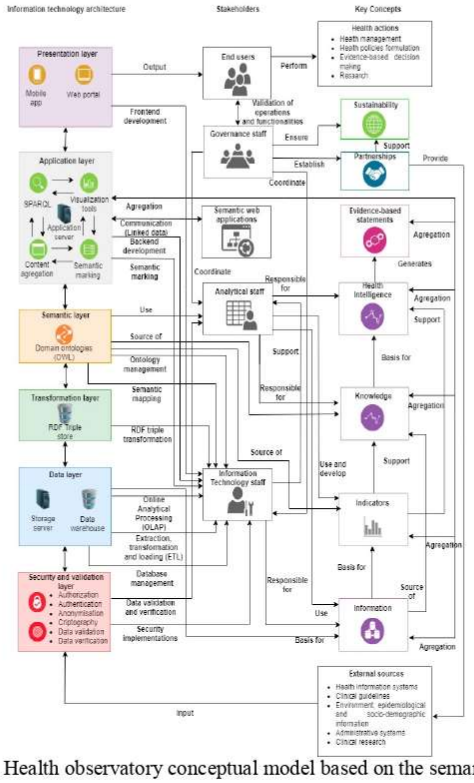


Fig. 1. Health observatory conceptual model based on the semantic web.

The ‘information technology architecture’ component is based on the multi-layer software architecture and SW technologies. The main idea of this component is to represent, in different layers, the information technology artefacts and processes needed for data/information security, management, integration, analysis, dissemination and how the SW technologies can be linked into this structure. It has the following layers:

- Security and validation layer: the IT staff is responsible for ensuring data security from different external sources through authorization, authentication, anonymisation and cryptography mechanisms, while the analytical staff is responsible for performing data validation and verification. Concerns about data security is an essential and sensitive part of a HO in order to preserve the confidentiality and privacy of patients, health professionals and institutions [17]. Furthermore, when the set of data incorporated in a HO is treated and validated, it can be appropriately used in evidence-based decision making and in the development of health policies and guidelines [1];
- Data layer: after the first layer, an Extraction, Transformation and Loading (ETL) process is applied to integrate the datasets from external sources and, subsequently, are uploaded into a data warehouse. Additionally, an Online Analytical Processing (OLAP) is used to generate information, process sets of indicators and provide support to data analysis. The importance of adopting a data warehouse is related to its capability of managing large amounts of data in an easily, accessible, consistent and adaptive way [1][2][18]. Within the OLAP engine, it is possible to create and manage aggregations through precalculations, indexing strategies and other optimizations [18];

- Transformation layer: transforms the stored data from data layer into RDF triples. The set of RDF triples can be stored into RDF triple store, a database which is structured and optimized for storage and retrieval of triples [19]. The process of RDF transformation involves extracting the OLAP results from data layer, transform them into a triple format and notation and load the resulting triples into the RDF triple store;
- Semantic layer: contains a set of ontologies represented in OWL. The resulting RDF triples from the transformation layer can be mapped into a set of ontologies using OWL. Additionally, developed ontologies can be added into the HO set of ontologies, requiring an ontology management [7][9][15]. Hence, in order to assist in the integration of knowledge derived from a variety of ontologies and to provide a common ontological architecture, a standard top-level ontology, such as the Basic Formal Ontology (BFO), is necessary [15][20];
- Application layer: includes the business logic of the HO. The set of ontologies from Semantic layer, whose content is stored in RDF, can be queried through SPARQL, enabling data, information, indicators and knowledge aggregation across diverse SW applications, RDF repositories and related ontologies in OWL [19]. The content semantic marking is possible through the RDFa, allowing other SW applications to process and understand the content that is made available [9]. In addition, visualization tools aim to prepare the results of the SPARQL queries and the knowledge produced by the analytical staff for the presentation layer;
- Presentation layer: it is an accessibility layer to allow end users to access the results from application layer in a structured manner through a web portal or a mobile app. All user interfaces styles and dynamics need to be implemented by IT staff (frontend development). This layer depends on the proper functioning of all others layers in order to support the generation and visualization of HO main outputs, based on SW technologies, such as: summaries of the health situation and trends; analytical reports; indicators, dynamic tables, charts, interactive maps and geographic variations; and evidence-based, technical and methodological recommendations, comments and guidelines [1][2][3][5].

The 'key concepts' component represents the main concepts and functionalities for the HO operation. Firstly, external sources provide the input for the 'IT architecture', in which health information systems, administrative systems, environment, epidemiological and socio-demographic information offer the healthcare primary datasets, through direct database import or Application Programming Interfaces (APIs) [21]. Moreover, clinical researches, such as randomized controlled trials and systematic reviews, are required for generation of knowledge, health intelligence and evidence-based statements [1]. Secondly, after the data layer operations, the information is produced from ETL and OLAP processes. Subsequently, the knowledge can be generated though analysis by the analytical staff based on these produced information along with indicators and SW ontologies. The next step is to translate knowledge into health intelligence, which is produced when the knowledge is analysed by specialized and experienced members of the analytical staff from different perspectives and is compared with clinical research and guidelines. Then, the health intelligence can be structured to generate evidence-based statements [1]. Thirdly, end users use the output from the web portal or the mobile app to perform health actions, such as health management, health policies formulation, evidence-based decision making and research [1][2][3][12]. Finally, the governance staff needs to maintain and expand a network of partnerships, which is necessary to guarantee access to external sources, learn from other established HOs and ensure the HOs sustainability [22].

The proposed HO conceptual model aims to assist in design, development and implementation processes of an HO. Therefore, it is expected that the model can be replicable and valuable, as well as flexible enough to be used in different health domains to encourage creativity and novel use [17]. The use of SW technologies can enhance the HO in terms of data standardization, knowledge management and interoperability with other SW applications. However, in order to be sustainable and successful, a HO need to: have an integrated, specialized and committed staff (IT, analytical and governance); have the involvement and feedback from local community and key stakeholders; be responsive to national, regional, and local information priorities; take into consideration that the development process of the HO is a labour-intensive process that takes time and planning; have a careful strategic project monitoring and periodic evaluation; and consider that the outputs of the HO depend on the availability and the development level of external sources [1][2][5][12][22].

5. Conclusion

The proposed HO can provide opportunities for the development and implementation of new observatories or for the adequacy of existing HOs. Consequently, these opportunities may considerably contribute to the health policies formulation, health management, evidence-based decision making and health research, thus, improving, preserving and promoting health and quality of life of the population.

The next steps involve a practical application of this model in a specific health domain, which requires exploring and analysing the specific context in which the HO will be developed, through the identification of end users problems and needs, relevant external sources to be the HO inputs, as well as partnerships, financial and human resources in order to ensure the HO sustainability.

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A generic framework to support the implementation of six sigma approach in SMEs

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Abstract: Six sigma is a well-assessed methodology for optimizing the performance of the enterprise through the reduction of the variability of their process outputs. Six sigma implementation consists of the development of the DMAIC phases to improve existent processes. Each phase of this methodology adopts statistical as well as qualitative tools to fix variability sources and assess the process to a six sigma level of quality. However, there is a lack of an implementation model on how to guide effectively the implementation of the methodology DMAIC. This is particularly true for SMEs that not have enough human resources for supporting the needed knowledge. To answer to this limitation of six sigma, the objective of this paper is to present a framework to support the implementation of six sigma approach in SMEs. This framework is formalized by a meta-model, which is based on different studies on six sigma, its phases and its tools. This framework aims to propose a solution to validate the passage between the DMAIC phases defining the requirements to be satisfied during each phase.

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Keywords: Six sigma, DMAIC, SMEs, Framework, Meta-model, Formalization.

1. INTRODUCTION

In the economic context of globalization and the strong competition, the performance of the company is a major challenge, especially in Small and Medium Enterprises (SMEs). These SMEs play a pivotal role in the industrial economy all over the globe. Moreover, they need to upgrade their performance to achieve economic, social and environmental improvement (Cherrafi et al. 2016).

Six Sigma is one method for improving performances that focuses on reducing the number of defects in products, processes and services. It was successfully introduced in many major groups such as General Electric and Motorola, but many obstacles were identified in its implementation in SMEs (Fouweather *et al*., 2006). In fact, SMEs lack the requisite resources such as skills and human resources and funding to implement six sigma (Alhuraish *et al*., 2017; Antony *et al*., 2005; Cherrafi *et al*., 2016; Jessica Hwang *et al*., 2006).

Six sigma training can be of great benefit as it gives opportunities for any company to become more efficient and competitive. However, the cost of this training is often too high for SMEs (Fouweather *et al*., 2006). The basic principle of six sigma according to (Antony *et al*., 2003) is to take an organization to an improved level of sigma capability through the rigorous application of statistical tools and techniques; hence, the heart of six sigma is the use of statistical tools to control variability.

There are two types of key factors in the success of six sigma: methodological factors and human factors. The use of a methodology for the selection of Six Sigma projects has to take into account Critical to Customer (CTC), company strategy and financial profitability objectives.

The application of six sigma for the improvement of an existent process consists in the development of five phases called DMAIC (Define, Measure, Analyze, Improve and Control). Each phase is developed through statistic and qualitative tools to satisfy determined objective during each phase. The whole DMAIC process is typically implemented by a team specialized in the methods and tools of six sigma phases. Six Sigma team members are trained and certified according to a belt structure. The belt structure is formed by four levels and each one of them has its own competencies and responsibilities (Hoerl, 2002; BSI/ ISO 13053-1, 2011): Master Black Belt, Black Belt, Green Belt and Yellow Belt.

There is a growing concern that six sigma and other process improvement programs fail because they do not consider the human side of implementation. Previous research (e.g., Chakravorty *et al*., 2008) has shown that effective management of human aspects is critical for a successful six sigma implementation. (Zimmerman *et al*., 2005) point out that companies need to pay attention to the human side of six sigma implementation.

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In particular, for helping human implementing six sigma in SMEs, a model on how to guide effectively the implementation of these programs is a critical issue. One reason is that SMEs do not have enough human resource supporting the needed knowledge's. To answer to this limitation, the objective of this paper is to present a framework for supporting the implementation of six sigma approach in SMEs.

The paper is organized as follows. In section 2, we present the state-of-the-art associated to the problem addressed in this paper. In section 3, we present our contribution based on the formalization of a framework to support the implementation of six sigma approach in SMEs. In the last section, some conclusions and limitations of our study are proposed, and some opportunities for future research are given.

2. STATE OF THE ART

Concerning the continuous improvement of companies, there are increasing needs to pursue new ways of thinking as a source of competitive advantage. More research in this area is necessary to contribute to the science and practice of implementation of six sigma to create value. (Cherrafi *et al.*, 2016) has presented many major gaps in six sigma implementation. Some of them are the need to develop an integrated model applicable to many industries and functions and the need to focus more on the context of SMEs to assist them to implement successfully six sigma. (Andel, 2007) claims that six sigma programs should be implemented with a clear objective of improving competitive positioning or value from the customer's point of view. All activities related to six sigma implementation should be related to this objective.

(Chakravorty *et al*., 2004) indicated that a detailed plan need to be developed to orchestrate activities related to the implementation. The plan should include the sequence of execution activities ranging from setting up lower level improvement in teams, training schedules, and a detailed plan to make all the necessary changes related to the implementation. Also, (Foster, 2007) claimed that if programs are not *skillfully implemented, the benefits of Six Sigma may be marginal*.

To answer to this lack, (Chakravorty, 2009; Franza *et al.*, 2009) show that many of the implementations of six sigma fail because a rigorous research is lacking on how to effectively guide this implementation. They used a successful six sigma program in a network technology company through a six-steps implementation model to guide effectively the implementation of a six sigma project. This implementation model allows taking into account most of the factors of success during the implementation of a six sigma project. This work proposed a general model without monitoring how and when it is possible to move from a step to another step. In fact, this work only explained the different activities in each step.

(Shahada *et al*., 2012) has also develop a Lean six sigma framework according to the six sigma systemic process improvement methodology. It is based on the five phases of six sigma methodology (DMAIC). Each phase contains several steps based on "Lean" and six sigma tools in order to improve the system. The authors tried to explain the activities in each phase only, but there is no formalization of the implementation of six sigma, and no explication how to move from one phase to the other.

(Tenera, 2014) proposed a sequential decomposition of each DMAIC phase into several steps whom output is supported by specific tools and methods chosen according to the processes. The author tried to explain only the output and the input of each phase of a DMAIC.

In the field of telecom operations, (Fahmy, 2017) proposes an integrated framework in the objective to have the Six Sigma project becoming more structured and more measurable. This framework integrates the Cross Industry Standard Process for Data Mining (CRISP-DM) – as one of the most widely adopted framework for developing data mining solutions – with the phases of Six Sigma (DMAIC) project – as one of the most used methodologies. The objective is to improve the six sigma projects by introducing data mining techniques into their phases to achieve a breakthrough quality improvement.

In the healthcare domain, (Ratnaningtyas *et al*., 2013) tried to create an information Quality Improvement Model for Hospital Information System based on six sigma Analysis: (1) Defining parameters for each DMAIC steps, and (2) Tools and technique selection for each DMAIC steps. In the same domain, (Lin *et al*., 2014) formalized the application of six sigma through a simulation based on a lean six sigma approach to improve the operations in healthcare industry. The DMAIC phases are adopted as a thread of entire problem solving, and simulation is embedded into the improve phase. In addition, only the different activities in each phase were explained without showing the transition between the phases.

In financial service organizations, (Chakraborty *et al.*, 2011) proposed a framework that defines the elements which should be considered when implementing six sigma in a financial service company. This framework enables organizations to introduce the elements of six sigma in a more comprehensive way in the organism. In addition, this framework does not explain how to move from a step towards the other.

In order to help SMEs to realize their continuous improvement process, (Nunes, 2015) proposed a framework to help choosing and applying the tools and methods used by six sigma but also by Ergonomics paradigms. The proposed framework associates the six sigma procedures used in each phase of the DMAIC cycle with ergonomic tools and methodologies introducing an additional ergonomic perspective. This framework is useful both to experts in continuous improvement and to SMEs managers, which may have the awareness but usually, lack the means to develop the required steps to implement six sigma.

In many others domains, some works tried, also to introduce a framework to implement six sigma: (Krotov et al., 2017) in manufacturing of nutritional product, (Duan et al., 2016) in aerospace domain and (Costa et al., 2017) in the domain of tire production. However, their contribution show only the different activities and methods used in each phase without showing the transition between the phases.

As a conclusion to this state-of-the-art, it is clear that most of this work propose some solutions to help SMEs for applying the different activities and tools from six sigma but without defining the prerequisites for going from one phase to another phase in the DMAIC methodology. However, this question is crucial as it needs a lot of skills for evaluating if a phase has reach the milestones for going to the next phase. Typically, black belts have these skills but SMEs have not the means for training black belts. To response to this lack of a framework applicable to many industries and functions and the need to focus more on the context of SMEs to assist them to successfully implement six sigma, we propose a generic framework to support the implementation of six-sigma approach in SMEs.

3. A FRAMEWORK TO FORMALISE THE IMPLEMENTATION OF SIX SIGMA

Developing an implementation model and guide for six sigma is a subject recurrent in the literature as shown in the previous section. It is an important subject to be developed because of the typical lack of skills within the SMEs for applying six sigma methodology. Therefore, proposing a framework can be very useful for six sigma project in order to achieve positive and best results and to develop the culture of performance and continually hunting down waste. The proposed six sigma framework is based on different studies on six sigma, its phases and its tools. This framework is formalized through a meta-model based on the different concepts necessary to represent what is six sigma. This meta-model is the starting point for the definition of the wanted requirements and was declined in an objective and requirements diagram for each phase. This can help the user for managing the six sigma project. Requirements definition must place its basis on all the elements composing the engineering system that is Six Sigma methodology.

These are not only the tools and their outputs, but also the actors owning the knowledge useful to develop a six sigma project and the objective to achieve during each phase. In order to take into consideration all these elements, it is very useful to develop a six sigma meta-model to conceptualize all the cited elements and the links between them. The framework is the structure of six sigma elements and how these interact between them in order to reach the wanted results and satisfy the phase requirements. This meta-model can be used as a base for future automatic tools or methodology acting on six sigma.

3.1 MEGA environment

For the construction of the meta-model, the associated instantiated diagrams, and offer a future automatic methodology acting on six sigma, we need a tool that meet our needs. Many tools can be used to implement our meta-model. We arbitrarily decide to use MEGA (http://www.mega.com/). Mega offers rich tools to develop many different types of diagrams: UML, BPMN etc. Moreover, MEGA contains a template of six sigma project in which each phase has been developed in different steps (but not deeply described) and a six sigma method that adds to the phases some deliverables. With this paper, we will be able to enrich the tools offered by MEGA. In particular, we used MEGA tools for the definitions of the meta-model and the objective and requirement diagrams.

3.2 Six Sigma meta-model

The proposed meta-model formalizes six sigma concepts (using classes and associations) as in (Fig. 1) and give the conditions that must be reached from moving from one phase to another. This meta-model puts in evidence how each phase of a six sigma project is designed in order to achieve objectives measured and quantified by specific indicators. To achieve the objectives of each phase, we need to implement phase tools in a process that is the sequence of tools application and data collection. Therefore, this process is linked to the tools used in each phase. Each tool is described with its inputs and outputs; some outputs can be used as input for other tools. Once an output has been developed, we need to analyse it to achieve some concrete information. Therefore, we defined the class “knowledge”. This class identifies the knowledge, owned by a belt level in the six sigma classification, useful for studying the output obtained from a tool and leading to the development of a deliverable. Deliverables are documents, information produced that are fundamental to satisfy one or several requirements. Once the requirements have been achieved, the objectives of the phase can be considered as reached and the following phase can be started.

3.3 Requirement definition

The requirements are the point of connection between tools implementation and objective satisfaction (and consequently phase completing). The requirements, here described, have been defined from the study of tasks and objectives of each tool that could be used on the considered phase. Particular attention has been paid in order to cover each phase needs and objectives. The following requirements for each phase have been defined (Table 1).

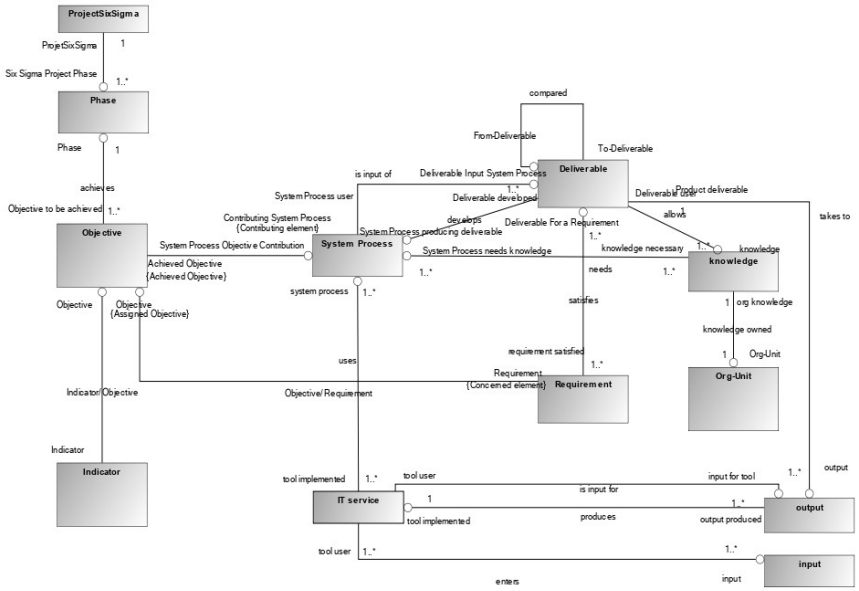


Fig. 1. Proposed Six Sigma meta-model

3.4 Objective and requirement diagrams

Once we have defined the meta-model and the requirements, it was possible to build, an objective and requirement diagram associated to each phase. Objective and requirement diagrams have been built in MEGA environment and for each phase of six sigma method. In order to build the diagrams, we had to add some objects in the objective and requirement diagram existing in MEGA. These classes are: input, output, phase and deliverable. Hereafter it was possible to instantiate the meta-model building the following diagrams. The objective and requirement diagrams have been added in the method six sigma section of MEGA. To each one of the phases, an objective and requirement diagram, structured as in (Fig. 2), has been associated. The diagram has been built with the same classes and associations already described in the meta-model. An example of instantiation for the phase control is shown in (Fig. 3).

The aim of these diagrams is to help project leaders to implement six sigma in their enterprises. The instantiation of the meta-model for each phase allows the project leader to have the knowledge necessary to six sigma implementation. The diagrams add information about the tools developed during each phase, indicating needed inputs and expected outputs for each one of these tools. Moreover, they describe the links between tools' output and the objective of each phase.

Table 1. DMAIC phases requirements

PHASE	REQUIREMENTS
DEFINE	Point out what is the waited financial result Identify the CTQ Identify the schedule, team and goals of the project Identify the different levels of belts Map the structure of the system to improve
MEASURE	Give the current Z level and the measure of improvement of the process for each CTQ Identify a mean for measuring Z for each CTQ Qualify measurement tools Design and plan a data collection mode
ANALYSE	Identify root causes of non-quality Quantify the impact of each cause factor on CTQs
IMPROVE	Define a list of possible improvement Select the improvement to be implemented - Evaluate the impact of each improvement - Discriminate the proposed improvement Design the implementation of the selected improvement Implement the selected improvement
CONTROL	Validate that the objectives have been achieved Maintain the effects of improvement Deliver the project review

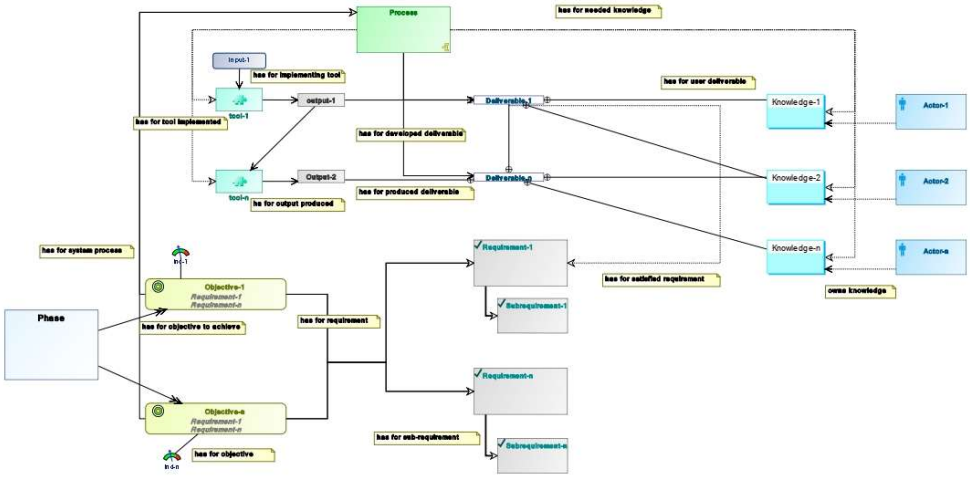


Fig. 2. Objective and requirement diagram pattern

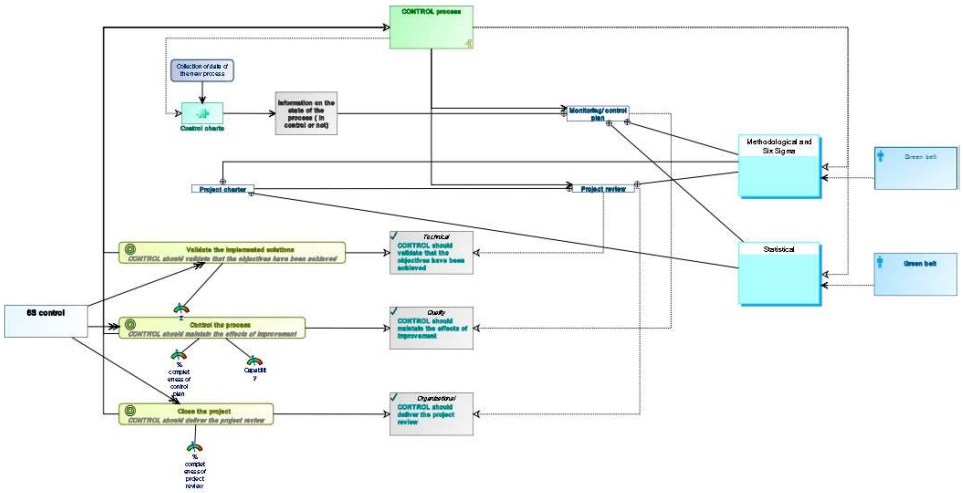


Fig. 3. CONTROL phase Objective and requirement diagram

Links are represented by the couple deliverable-requirement. In fact, all the produced deliverables, as the results of an output and a kind of knowledge, must be available to satisfy the requirements defined in the paragraph 3.3 in order to validate a phase. In order to verify if the requirements and the linked objective have been satisfied, some measurable indicators are proposed that will return the degree of completeness of the phase objectives. Therefore, diagrams provide a precise structure of the phases, linking the tools implemented to the satisfaction of precise requirements, supporting the user in well developing the phases and managing the project.

4. CONCLUSION

In this paper, the objective is to help the people in the SMEs, to implement six sigma project in their enterprises and reduce the cost of six sigma implementation. For this, we have

proposed a six sigma framework describing the fundamental elements of the six sigma methodology and the relationships between them. A list of requirements for the verification of the results obtained at the end of each phase is provided. Objective and requirements diagrams have been designed starting from the meta-model to provide a guide to a six sigma users to achieve requirements satisfaction.

For the future perspectives, it will be useful to well define the indicators linked to each phase in the objective and requirements diagrams. In fact, here we give a first definition of them but it will be very important to implement them with an automatic computing tool returning their value.

To validate the feasibility of our proposition, it will be necessary, in a near future, to put our meta-model as the core of an expert system helping small and medium enterprises to support their six sigma projects development saving the high costs linked to six sigma experts evaluating the results obtained during each phase.

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ANEXO DE REFERENCIA 5

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REVISIÓN

Design and Implementation of an ISO 9001:2015 Quality Management System in Various Organizational Sectors

Diseño y Aplicación de un Sistema de Gestión de Calidad ISO 9001:2015 en Diversos Sectores Organizacionales

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ABSTRACT

Introduction: the research focused on the design and implementation of a Quality Management System (QMS) under the ISO 9001:2015 standard, considering its relevance in a highly competitive organizational environment. It started from the recognition of quality as a strategic axis and set as its main objective the analysis and adaptation of a management model appropriate to the characteristics of a specific organization.
Development: a literature review was conducted of relevant studies that applied this standard in sectors such as transportation, legal services, aircraft maintenance, food distribution, and roadside assistance. Cases such as those of López, Solano , and Vargas demonstrated how the standard made it possible to standardize processes, increase efficiency, and improve customer satisfaction. Tools such as process maps, checklists, and risk analysis were also applied to develop proposals for continuous improvement.
Conclusions: it was concluded that the ISO 9001:2015 standard is an effective tool for strengthening organizational processes and ensuring the quality of products and services. The key to success lay in management commitment, ongoing training, and the use of appropriate methodologies. In addition, it was evident that the standard offers greater flexibility compared to other quality models such as EFQM and Deming, making it particularly applicable to different types of organizations.

Keywords: ISO 9001:2015; Quality Management; Continuous Improvement; Organizational processes; International Standards.

RESUMEN

Introducción: la investigación se orientó al diseño e implementación de un Sistema de Gestión de la Calidad (SGC) bajo la norma ISO 9001:2015, considerando su relevancia en un entorno organizacional altamente competitivo. Se partió del reconocimiento de la calidad como eje estratégico y se planteó como objetivo principal el análisis y adaptación de un modelo de gestión adecuado a las características de una organización específica.
Desarrollo: se realizó una revisión bibliográfica de estudios relevantes que aplicaron dicha norma en sectores como transporte, servicios jurídicos, mantenimiento aeronáutico, distribución de alimentos y asistencia vial. Casos como los de López, Solano y Vargas demostraron cómo la norma permitió estandarizar procesos, aumentar la eficiencia y mejorar la satisfacción del cliente. Asimismo, se aplicaron herramientas como mapas de procesos, listas de verificación y análisis de riesgos para desarrollar propuestas de mejora continua.
Conclusiones: se concluyó que la norma ISO 9001:2015 constituye una herramienta eficaz para fortalecer los procesos organizacionales y asegurar la calidad de productos y servicios. La clave del éxito radicó en el

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compromiso gerencial, la capacitación constante y el uso de metodologías apropiadas. Además, se evidenció que la norma ofrece mayor flexibilidad frente a otros modelos de calidad como EFQM y Deming, lo que la hace especialmente aplicable a diferentes tipos de organizaciones.

Palabras clave: ISO 9001:2015; Gestión de Calidad; Mejora Continua; Procesos Organizacionales; Estándares Internacionales.

INTRODUCCIÓN

En el contexto organizacional actual, la calidad ha dejado de ser un valor agregado para convertirse en un requisito esencial para la sostenibilidad y competitividad de cualquier institución, empresa o servicio. El acelerado dinamismo del mercado, la globalización de los procesos productivos y el incremento de las exigencias de los clientes han llevado a las organizaciones a implementar sistemas que garanticen la mejora continua, la estandarización de los procesos y el cumplimiento de normas internacionales. En este sentido, la Norma ISO 9001:2015 se ha consolidado como una herramienta fundamental para la gestión eficaz de la calidad, al establecer directrices claras que permiten alinear los objetivos estratégicos con las expectativas de los clientes.

La presente investigación se fundamenta en el diseño e implementación de un Sistema de Gestión de la Calidad (SGC) basado en la norma ISO 9001:2015, enfocado en fortalecer los procesos claves de una organización determinada. Para ello, se tomó como base una revisión exhaustiva de antecedentes nacionales e internacionales, los cuales aportaron información valiosa sobre metodologías aplicadas, resultados alcanzados y elementos críticos en el desarrollo de sistemas de gestión de la calidad. Trabajos como los de López[1], Solano[2] y varios estudios evidencian la pertinencia de esta norma en sectores tan diversos como el transporte, el derecho, el mantenimiento aeronáutico, la distribución de alimentos y los servicios de asistencia vial. Estos estudios, desde diferentes enfoques y metodologías, demuestran que la ISO 9001:2015 no solo mejora la calidad del servicio o producto, sino también la eficiencia operativa, la satisfacción del cliente y la competitividad organizacional.

En este contexto, se plantea como objetivo general el análisis y aplicación de un modelo de gestión de la calidad adaptado a las necesidades y particularidades de la organización objeto de estudio. La investigación se sustenta en un enfoque cualitativo, bajo una modalidad de proyecto factible, y contempla el uso de herramientas de diagnóstico como diagramas de flujo, mapas de procesos y listas de verificación, a fin de proponer mejoras orientadas a la estandarización y control de los procesos.

Este trabajo cobra relevancia en tanto responde a la necesidad de establecer mecanismos que aseguren la calidad como un principio organizacional transversal, y aporta una base documental y metodológica para futuras investigaciones sobre la implementación de sistemas de gestión de la calidad en diversos contextos organizacionales.

DESARROLLO

Antecedentes de la Investigación

En esta etapa de la investigación fue necesario hacer una revisión de los trabajos a fines, a objeto de tomarlos como referencia y orientar adecuadamente a la presente investigación, tomándose como aporte dos internacionales y tres nacionales que sirvieron de gran importancia acerca de lo objetivos asociados al tema en desarrollo, asimismo proporcionando en detalle de cómo se abordaron dichos problemas previamente los cuáles fueron las soluciones puestas en práctica y de esta manera explicando todas las ideas y conceptos necesarios para poder comprender a fondo el tema de estudio.[3,4,5,6]

En resumen, los presentes antecedentes que a continuación se citan son de gran importancia, ya que nos brinda un horizonte claro y preciso de cómo hacer las cosas y mejorarla en beneficios tanto como para el investigador como para los lectores y que servirá como futura referencia a las próximas investigaciones en sistema de gestión de la calidad.[7,8]

López[1] expone en su tesis en maestría titulada: Diseño de un sistema de gestión de calidad basado en la norma ISO 9001:2015 en la gestión de transporte de Transterre SAC - Surco 2020, para optar al título de la Escuela de Posgrado, Maestría en Gerencia de Operaciones y Logística, de la Universidad César Vallejo, Sede Lima Norte, cuyo objetivo principal fue del diseño, aplicación, activación y funcionamiento de un sistema de gestión de calidad bajo una normativa ISO 9001: 2015, brindando entregas constantes de productos y servicios de calidad, cumpliendo con los requisitos aplicables, de igual modo se enfoca en negocios y de esta manera direcciona la calidad como un factor relevante para que las empresas perduren con éxito asegurando un efectivo desarrollo del sistema de gestión de la calidad.

El tipo de investigación adoptó la modalidad de un modelo cualitativo, no experimental transeccional y

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descriptivo con una modalidad de investigación de proyecto factible y diseño de campo, el universo de estudio estuvo formado por 20 trabajadores y su oficina principal se encuentra ubicada en el Distrito de Santiago de Surco es una empresa dedicada a la tercerización del servicio de transporte de carga pesada y mercancías bajo el sistema multimodal.

Por todo lo expresado anteriormente, es un antecedente bibliográfico de gran envergadura para el desarrollo del presente trabajo de investigación, toda vez que permite determinar y sustentar la variable estudiada sobre la base del sistema de gestión de calidad basado en la norma ISO 9001:2015. El aporte a la información proporciono bases teóricas importantes en la implementación del sistema de gestión de calidad, dando firmeza en la base para la realización de información necesaria para el cumplimiento de la norma internacional ISO 9001:2015.

Solano[2] en su investigación correspondiente a la maestría titulada: Creación de un Sistema de Gestión de Calidad en base a la Norma ISO 9001:2015, para una firma de Abogados en la República Dominicana. Caso de estudio: Dra. Kennia Solano & Asociados SRL. Para obtener el grado en Magister en Auditoria Integral y Control de Gestión en la Universidad APEC Decanato de Postgrado - Republica Dominicana, tuvo como objetivo diseñar procesos de valor basados en un Sistema de Gestión de la Calidad para lograr la eficacia y la eficiencia de esa oficina de abogados para controlar el desempeño de la organización, el cual permitirá a la empresa ejercer un mayor control en los procesos para aumentar su eficacia de estos.

En este trabajo de investigación, se propuso la creación de un sistema de gestión de calidad en base a la norma ISO 9001:2015, a partir de un levantamiento y análisis de las políticas y procedimientos realizados por la Oficina de Abogados Dra. Kennia Solano & Asociados. Esta creación permitió la aplicación teórica de lo que son los programas de trabajo, mapas de procesos, los diagramas de flujos, entre otros. A raíz de esta investigación, se pudo identificar deficiencias en las capacitaciones del personal, incumplimiento de funciones por falta de supervisión y disminuciones de ingresos de la empresa por debilidades en el servicio hacia los clientes.

El tipo de investigación se trata de una microempresa del sector jurídico, adoptando un modelo cualitativo, no experimental, descriptivo, proyecto factible y diseño de campo, con una población formado por 12 empleados que colaboran directamente con sus actividades económicas principales, comprendidas en servicios legales de elaboración de contratos, legalizaciones, gestiones de títulos de inmuebles, desalojos y gestión de cobros, el alcance del Sistema de Gestión de Calidad aplica para llevar a cabo los procesos que se consideran clave para que la firma sea constante en la correcta operación de sus funciones con respecto a las diferentes responsabilidades que comprenden dichas prácticas.

Esta investigación guarda relación con el presente trabajo ya que se propuso la creación de un sistema de gestión de calidad basado en la norma ISO 9001:2015, a partir de un levantamiento y análisis de las políticas y procedimientos, permitiendo la aplicación teórica de lo que son los programas de trabajo, mapas de procesos, los diagramas de flujos, entre otros. A raíz de esta investigación, se pudo identificar deficiencias en las capacitaciones del personal, incumplimiento de funciones por falta de supervisión y disminuciones de ingresos de la empresa por debilidades en el servicio hacia los clientes.

Se concluyó que, al realizar el levantamiento de la información se obtiene que del proceso de valor: gestiones de títulos de inmuebles, desalojos y cobros incluyendo prácticas que le lleven a organizar mejoramiento de sus funciones, de manera que las operaciones sean realizadas con mayor agilidad y obtengan mejores resultados. Y como aporte a esta investigación fue la comprensión del problema y al marco metodológico, donde se hace un recuento sobre las limitaciones y delimitaciones de la investigación, el tipo de metodología utilizado y el enfoque o alcance esperado con su desarrollo. Además, se destacan los resultados de la investigación de campo, expresada a través de tablas de frecuencia, gráficos y un breve y conciso análisis sobre los mismos.

Un estudio desarrolló un trabajo de grado de maestría en sistema de la calidad de la universidad Católica Andrés Bello, cuyo objetivo general estuvo orientado al Sistema de Gestión de la Calidad Basado en ISO 9001:2015 Aplicable al Proceso de Mantenimiento Aeronáutico en Aerolíneas Venezolanas.[9,10,11] Tal objetivo contribuyó a establecer los lineamientos y requisitos sujetos a la norma que permitirán mejorar los procesos y subprocesos que se realicen en la consecución de las labores de mantenimiento aeronáutico y que englobe todos los requisitos de calidad exigidos en la nueva norma ISO 9001:2015, adaptando tanto los requerimientos de la regulación como los estipulados en la normativa internacional, para así, proporcionar atributos necesarios a los sistemas de gestión de la calidad de las aerolíneas en la consecución de las labores de mantenimiento aeronáutico.[12,13]

Para tal fin, se plantea una investigación de campo tipo cualitativa y descriptiva, se procederá a la revisión de diferentes sistemas de gestión de la calidad mediante un modelo de instrumento de recolección de datos en este caso la encuesta, que contribuya a la toma muestras para el análisis de las posibles falencias en los procesos presentes, la entrevista se le hará a Gerentes, Jefes de Departamentos y personas que estén involucradas en el proceso de tal forma que se pueda entender todo el panorama presente y poder diseñar y proponer un Sistema de Gestión de la Calidad que sea aplicable a diversas organizaciones y que les proporciones bondades que la ayuden tanto a mejorar su funcionamiento y les sirva de apoyo al momento de que estas quieran optar por una posible certificación internacional.[14,15,16]

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Proceso de mantenimiento aeronáutico en aerolíneas venezolanas. Han evidenciado la importancia de mejorar continuamente sus procesos operativos y administrativo con el propósito de medir la calidad del servicio basándose en variables como son los costos y tarifas, servicios en vuelo, abordaje / descarga del avión / equipaje, tripulación de vuelo, aeronaves, registro y reservaciones, con el propósito de crear nichos que los distingan de otras Aerolíneas generando una ventaja competitiva sobre ellos.[17,18]

El aporte que brindó este trabajo fue de suma importancia ya que oriento sobre la identificación de política y objetivo de calidad, organigrama y funciones basado en el levantamiento de la información mediante diagrama de flujo y el mapa de procesos, con la correspondiente identificación de: los procesos claves, de apoyo, estratégicos realizados por la empresa Cardon Rent Car C.A.[19,20,21,22,23]

Un estudio el cual elaboró una tesis de maestría para optar al título de magister en sistemas de la calidad de la universidad Católica Andrés Bello, denominada: Diseño del sistema de gestión de la calidad para los procesos logísticos de las empresas distribuidoras de quesos pasteurizados. Su objetivo fue analizar comercializar y obtener ganancia de ello, siendo un sector sumamente competitivo, la relación costo beneficio juega un papel decisivo para la sobrevivencia económica, entre sus operaciones neurálgicas se encuentran los mantenimientos de stock de inventarios y la distribución del producto al cliente.[24,25,26,27,28]

El proyecto de investigación se desarrolló bajo la metodología de técnicas y procedimientos que se emplean para formular y resolver problemas, de investigación como una estrategia asertiva para lograr procesos con mejora continua y satisfacción del cliente, de esto nace la necesidad de diseñar un Sistema de Gestión de la Calidad para los procesos logísticos de las empresas distribuidoras de quesos pasteurizados en la región Capital de Venezuela.[29,30,31]

El presente estudio está enmarcado dentro de la investigación, modalidad proyecto factible, inscribiéndose en un diseño de investigación no experimental, nivel descriptivo y tipo documental ya que se basó en la revisión y análisis de documentos para extraer datos claves que alimentaron el diseño propuesto. En este sentido, se realizó un diagnóstico en materia de calidad a las distribuidoras delimitadas con una población de 18 distribuidoras ,las cuales realizan los procesos logísticos de quesos pasteurizados, seleccionando tres como muestra a criterio del investigador, se identificó cual sistema de gestión de la calidad se adapta a las necesidades del sector, aplicando una serie de herramientas cualitativas y cuantitativas para el levantamiento y análisis de la información, de los procesos, de los puntos de control, y la relación de costo/beneficio en la aplicación del diseño.[32,33,34]

Como resultado de la investigación se obtuvo, el conocimiento de la presente investigación aporta un juicio más profundo a cerca de la variable estudiada en la tesis en curso, debido a que se hace necesario posterior a la obtención de sus resultados formular alternativas o estrategias que impulsen el cumplimiento y la puesta en práctica del sistema de gestión de la calidad. Este trabajo sirvió de apoyo a la hora de seleccionar las herramientas a utilizar para el análisis de la situación de los procesos actuales en aras de mejorar los mismos y aumentar la productividad.

Machado[3] desarrolló un trabajo de grado de maestría en sistema de la calidad de la universidad Católica Andrés Bello, cuyo objetivo general estuvo orientado a la Formulación de un Sistema de Gestión de la Calidad en Empresas de Servicios que Ofrecen Asistencia Vial Basado enla Norma ISO 9001 2015. Tal objetivo contribuyó a establecer los lineamientos y requisitos sujetos a la norma que permitirán mejorar los procesos identificados para la elaboración de productos de calidad. El presente trabajo de investigación consiste en formular un Sistema de Gestión de la Calidad, en empresas de servicios que ofrecen asistencia vial basada en la Norma ISO 9001:2015. Esta propuesta obedece a que un Sistema de Gestión de la Calidad garantiza el hecho o por lo menos en un alto porcentaje de que las características del servicio cumplan con los requisitos del cliente y satisfaga sus necesidades y expectativas, garantizando el porcentaje de ventas necesarios para la sustentabilidad de la empresa.

Para obtener el objetivo general y los objetivos específicos, el estudio se enmarca en una investigación no experimental, apoyado en una investigación del tipo documental y de campo, nivel descriptivo. La población está constituida por las empresas prestadoras de servicios de asistencia vial en la ciudad de Caracas y la muestra es de tipo dirigida o intencional no probabilística. Las técnicas de recolección de datos que se utilizarán para la investigación serán la observación directa, revisiones documentales y entrevistas. Los resultados de esta investigación representan un impacto positivo para el sector, ya que ante este entorno económico y determinante, convertirse competitivos, forma parte de las estrategias personales y organizacionales para afrontar los distintos escenarios de turbulencias económicas y de negocios en el país.

Para desarrollar el trabajo de grado, primeramente se analizó la situación actual donde se evaluaron los distintos parámetros de la norma a través de la lista de chequeo arrojando resultados confiables, con un grado de incumplimiento de 75,77 % mediante la evaluación de 214 ítems, así mismo se identificaron los procesos y subprocesos, para lo cual se efectuó un levantamiento de la información correspondiente al mapa de procesos como propuesta el cual comprende la identificación de: los procesos claves, de apoyo, estratégicos realizados por la empresas de servicios que ofrecen asistencia vial. Cabe destacar que se propuso estrategias para mejorar la calidad mediante la medición de la satisfacción del cliente, así como el mejoramiento continuo al que está sujeto.[35,36,37,38]

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Posteriormente se procedió a conceptualizar la estructura documental basada en un modelo piramidal jerarquizado, identificando los distintos documentos distribuidos en niveles como lo son: Primer nivel: misión, visión, políticas y objetivos de la calidad. Segundo nivel: manual de gestión de la calidad. Tercer nivel: Manuales por departamentos y procedimientos asociados. Cuarto nivel: Instrucciones de trabajo. Quinto nivel: Formularios y registros, para luego documentar los procesos operacionales de la empresa de servicios que ofrecen asistencia vial, para luego establecer un plan de implantación. Este trabajo sirvió de apoyo en el proceso de investigación, al proporcionar un modelo de lista de chequeo que sería aplicada para el análisis de la situación actual de la empresa Cardon Rent. Car C.A.

Bases Teóricas

Los fundamentos teóricos asociados a los ejes principales que se desarrollarán, favorecen al diseño de un sistema de gestión de la calidad ISO 9001:2015, que permita controlar y mejorar los aspectos más sensibles de la organización relacionados con la calidad. Los ejes o bien teóricas principales que respaldan esta investigación se sintetizan a continuación:

Gestión de la Calidad

Autores como Castillo et al.[14] Definen la gestión de la calidad como "la función general de la gestión que determina e implanta la política de calidad, que incluye la planeación estratégica, asignación de recursos y acciones relacionadas con la calidad". De esta manera, se puede decir que la estructura de los Sistemas de Gestión debe ser tal que sea factible realizar una coordinación y un control ordenado y permanente sobre la totalidad de las actividades que se realizan. Debe estructurarse y adaptarse al tipo y características de cada organización, tomando en consideración particularmente los elementos que sean apropiados para su estructuración y siguiendo las etapas del sistema de gestión de la calidad. A continuación, se muestra la evolución de la calidad (tabla 1).

Tabla 1. Evolución de la Gestión de Calidad

Etapa	Concepto	Objetivo
Etapa artesanal	Hacer las cosas bien independientemente del costo esfuerzo necesario para ello.	Satisfacer al cliente. Satisfacer al artesano por el trabajo bien hecho. Crear un producto único.
Revolución industrial	Hacer muchas cosas no importa no importando que sean de calidad (se identifica producción con calidad).	Satisfacer una gran demanda de bienes. Obtener beneficios.
Segunda guerra mundial	Asegurar la eficacia del armamento sin importar el costo, con la mayor y más rápida producción (eficacia es igual a calidad).	Garantizar la disponibilidad de un armamento eficaz en la cantidad y el momento preciso.
Post guerra (Japón)	Hacer las cosas bien a la primera.	Minimizar costos mediante la calidad. Satisfacer al cliente. Ser competitivo.
Post guerra resto del mundo	Producir, cuanto más mejor.	Satisfacer la gran demanda de bienes causada por la guerra.
Control de calidad	Técnica de inspección en producción para evitar la salida de bienes defectuosos.	Satisfacer las necesidades técnicas del producto.
Aseguramiento de la calidad	Sistemas y procedimientos de la organización para evitar que se produzcan bienes defectuosos.	Satisfacer al cliente. Prevenir errores. Reducir costos. Ser competitivo.
Calidad total	Gestión de la administración empresarial centrada en la permanente satisfacción de las expectativas del cliente.	Satisfacer tanto al cliente externo como interno. Ser altamente competitivo. Mejora continua.

Sistema de Gestión de la Calidad

Para, Simat[4] "Asevera que un sistema de gestión de la calidad es una forma de trabajar, mediante el cual una organización asegura la satisfacción de las necesidades de sus clientes. Para lo cual planifica, mantiene y

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mejora continuamente el desempeño de sus procesos, bajo un esquema de eficiencia y eficacia que le permite lograr ventajas competitivas".

En general se puede definir el sistema de gestión de la calidad como el aspecto de la gestión general de la empresa que determinara y aplica la política de calidad, con el objetivo de orientar las actividades de la empresa para obtener y mantener el nivel de calidad del producto o el servicio, de acuerdo con las necesidades del cliente. En palabras sencillas: "decir lo que se hace, hacer lo que se dice, archivar lo que se hizo, comprobar los resultados y actuar sobre las diferencias que se encuentren en ellos".

Como finalidad de un sistema de gestión de la calidad se busca dirigir y controlar una organización con respecto a la calidad, por lo tanto, está integrado en las operaciones de la empresa u organización y sirve para asegurar su buen funcionamiento y control en todo momento; proporciona además herramientas para la implantación de acciones de prevención de defectos o problemas (procedimiento de acciones preventivas), así como de corrección de los mismos. Incluye también los recursos, humanos y materiales, y las responsabilidades de los primeros, todo ello organizado adecuadamente para cumplir con sus objetivos funcionales.

Por lo tanto, un sistema de gestión de la calidad anima a las organizaciones a analizar los requisitos del cliente, definir los procesos que contribuyen al logro de productos aceptables para el cliente y a mantener estos procesos bajo control. Un sistema de gestión de la calidad puede proporcionar el marco de referencia para la mejora continua con objeto de incrementar la probabilidad de aumentar la satisfacción del cliente y de otras partes interesadas.

Procesos de Mejora Continua

Según el autor Fleitman[5] señala "el mejorar es una necesidad de cualquier persona o empresa que quiera ser competitiva con la premisa de que siempre se pueden hacer mejor las cosas. La mejora continua es una cultura, una forma de ser de las personas y de las empresas en donde mejorar es el nombre del juego". Lo ante expuesto por el autor y de manera resumida, para que una empresa consiga ser competitiva no basta con implantar mejoras aisladas o accidentales, sino que necesita hacerse de manera constante y estratégica. En esto está el secreto de la continuidad y mejora del proceso. El mismo autor refiere que los procesos de mejora continua, la búsqueda de la calidad y la excelencia no son fines en sí mismos, sino que son medios que permiten a las empresas tener cada día una posición más exitosa.

La mejora continua se debe establecer como política y se tienen que establecer las estrategias para implantarla. A continuación, se muestra el modelo del ciclo deming de mejora continua.



Figura 1. Modelo del Ciclo Deming

Planear

Es establecer los objetivos y procesos necesarios para conseguir resultados de acuerdo con los requisitos del cliente y las políticas de la organización las cuales son:

- Identificar servicios.
- Identificar clientes.
- Identificar requerimientos de los clientes (5.1).
- Trasladar los requerimientos del cliente a especificaciones (6.3).
- Identificar los pasos claves del proceso (diagrama de flujo) (7.1).
- Identificar y seleccionar los parámetros de medición (9.1).
- Determinar la capacidad del proceso (9.1).
- Identificar con quien compararse (benchmarking) (5.1 de ISO 9004).

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Hacer

- Implementación de los procesos.
- Identificar oportunidades de mejora (10).
- Desarrollo del plan piloto.
- Implementar las mejoras.

Verificar

- Realizar el seguimiento y medir los procesos y los productos contra las políticas, los objetivos y los requisitos del producto e informar sobre los resultados.
- Evaluar la efectividad (9.1.2).

Actuar

- Tomar acciones para mejorar continuamente el desarrollo de los procesos.
- Institucionalizar la mejora o volver al paso de hacer (9.3).
- Se aplica en acciones correctivas, preventivas y planes de mejoramiento como consecuencia de unos informes de auditorías, adicionalmente se aplica la metodología para análisis y solución de problemas a aquellos subprocesos que necesitan un mejoramiento continuo para luego incorporarlos en los subprocesos y convertirlos nuevamente como parte del día a día.

Modelos de Gestión de la Calidad

Los modelos están diseñados para la evaluación del grado de desarrollo para las empresas tanto pequeñas como grandes cuyos objetivos es la implementación de la gestión de la calidad de manera que el modelo sea un referente permanente y un instrumento eficaz en la mejora de proceso de toda empresa de mejorar sus productos o servicios que ofrece. En este sentido encontramos lo más relevantes modelos para el análisis y puesta en marcha para solución de los problemas que se presentan en las empresas, las cuales se mencionan: el modelo Deming, el modelo EFQM. El modelo Malcom Baldrige y la Certificación ISO 9001. A continuación, se resumen cada uno de ellos:

Modelo Deming

Este modelo fue creado por Shewhart y perfeccionado por Deming, desarrollado el 14 de octubre de 1900, en Sioux City, Iowa. El Dr. Deming despreciado en Estados Unidos, es posiblemente mejor conocido por sus logros en Japón, donde desde 1950 se dedicó a enseñar a ingenieros y altos ejecutivos sus conceptos y metodología en gerencia de calidad. "Estas enseñanzas cambiarían radicalmente la economía japonesa". En este sentido el autor, explica que el modelo Deming, se basa en un enfoque de conducción de la empresa orientada hacia los procesos, alcanzando grandes logros en calidad y confiabilidad del producto o servicio.

Modelo EFQM

Este modelo fue creado en 1992 por la fundación europea para la Gestión de la Calidad (EFQM), y su principal función es "potenciar la posición de las compañías europeas en los mercados mundiales",[6] con el fin de acelerar la aceptación de la calidad como una ventaja competitiva y el desarrollo de actividades ligadas al mejoramiento continuo, creada especialmente también para reconocer los países europeos del este. El modelo consiste en la evaluación de los siguientes nueves (9) criterios: liderazgo, política y estrategia, orientación hacia los empleados, recursos y relaciones, procesos, productos y servicios, satisfacción del cliente, satisfacción de los empleados, responsabilidad social y orientación a los resultados. Lo que caracteriza este modelo es la separación entre los criterios relacionados a los resultados y a los relacionados a los agentes promotores, por lo que de esta manera se evalúan los resultados del negocio, paralelo a la evaluación de la forma en que la empresa actúa hoy para ser exitosa mañana.

Modelo Malcom Baldrige

Este modelo apareció en estados unidos en el año 1987, promoviendo tres importantes características como, premiar la calidad a fin de incrementar la competitividad, entender los requisitos para la excelencia en calidad y compartir información y beneficios derivados de las estrategias efectivas de calidad empleadas por las empresas. En el mismo orden de idea, el premio otorgado por el cumplimiento de este modelo, "no es otorgado para un producto o servicio específico, sino que es otorgado a aquellas compañías que tienen una gerencia de clase mundial para gestionar a sus empleados y procesos".[7] De esta manera, este modelo está basado en siete (7) criterios a ser evaluados para optar a un premio anual, entre los cuales tenemos: liderazgo, planificación estratégica, orientación al cliente, medición, análisis y mejora de gerencia, orientación al personal, orientación a las operaciones y resultados.

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Modelo Norma Internacional Certificación ISO 9001

Esta misma norma internacional ISO 9001, dice que promueve la adopción de un enfoque a procesos al desarrollar, implementar y mejorar la eficacia de un sistema de gestión de la calidad, para aumentar la satisfacción del cliente mediante el cumplimiento de los requisitos del cliente. Además, esta norma incorpora el ciclo planificar, hacer, verificar y actuar (PHVA), y el pensamiento basado en riesgos y oportunidades, centrándose en todos los elementos de administración de calidad con los que una empresa debe contar para tener un sistema efectivo que le permita administrar y mejorar la calidad de sus productos o servicios. Los beneficios potenciales para una empresa de implementar un sistema de gestión de la calidad basado en esta norma internacional son:

- La capacidad para proporcionar regularmente productos y servicios que satisfagan los requisitos del cliente y los legales y reglamentarios aplicables.
- Facilitar oportunidades de aumentar la satisfacción del cliente.
- Abordar los riesgos y oportunidades asociadas con su contexto y objetivos.
- La capacidad de demostrar la conformidad con requisitos del sistema de gestión de la calidad especificados.

El cumplimiento permanente de los requisitos y la consideración constante de las necesidades y expectativas representa un desafío para las empresas en un entorno cada vez más dinámico y complejo. Para lograr estos objetivos, las empresas podrían considerar necesario adoptar diversas formas de mejora además de la corrección y la mejora continua, tales como el cambio abrupto, la innovación y la reorganización.

Comparación de los Modelos de Gestión Aplicables, Deming, EFQM, Malcom Baldrige y la Certificación ISO 9001

Estos modelos son de gran importancia para la empresa en tener en cuenta a la hora de orientarse y tener claro su horizonte hacia dónde enfocarnos y tener un modelo adaptado a las necesidades de la empresa, en estos tiempos tan competitivos surge la idea y el interés de satisfacer las necesidades del cliente y que estas necesidades se cumplan en el tiempo, rindiendo un gran desempeño a los procesos en la mejora continua, tomando en cuenta la competencia de otras empresas, que sirvan de referencia en la comparación de estos modelos de gestión como lo son: el modelo Deming, el modelo EFQM, el modelo Malcom Baldrige y la norma internacional de calidad ISO 9001:2015. Y como resultado de esta comparación se recomendará el modelo de certificación ISO 9001 para la empresa Cardon Rent. Car C.A, ya que promueve la adopción de un enfoque a procesos al desarrollar, implementar y mejorar la eficacia de un sistema de gestión de la calidad con el propósito de aumentar la satisfacción de los clientes mediante el cumplimiento de los requisitos de este. A continuación, se muestra en el tabla 2, la comparativa del origen y estructura de los diferentes modelos de gestión a comparar en este estudio y aplicable para la empresa y alcanzar los objetivos planteados.

Tabla 2. Comparación del Desarrollo de los Modelos de Gestión

	Premio Deming	Premio EFQM	Premio Baldrige	Certificación ISO 9001
Año de Creación	1951	1992	1987	1987
Estructura Básica	Premio a Largo Plazo	Concurso Anual	Concurso Anual	Certificación
Aplicabilidad Geográfica Principal	Japón	Europa	Estados Unidos	Todo el Mundo
Ganadores	Pocos	Muy Pocos	Pocos	Muchos

En relación al cuadro antes mencionado es posible apreciar la diferencia en madurez debido a los años de uso, siendo el premio Deming el más antiguo con el año de nacimiento en 1951, los modelos comparados tienen una estructura básica similar de concursos anuales, siendo el premio Deming con una estructura a largo plazo y el modelo de gestión ISO 9001, con certificaciones los que se diferencian según en el estudio es que la certificaciones internacional ISO 9001, la ubica en el modelo con mayor aplicabilidad en todo el mundo. Los ganadores de cada certificación difieren en cantidad según el modelo de gestión, en el caso del premio Deming y del Baldrige los ganadores son unos pocos, sobre el premio EFQM son muy pocos, pero en el caso de las certificaciones ISO 9001 son muchos.

En conclusión a los cuatros diferentes modelos se tomó la norma internacional ISO 9001, porque es un modelo más orientado y aplicado a los procesos, riesgos y oportunidades siendo esta la más adecuada a la empresa en estudio, porque gira en torno a la satisfacción del cliente, ya que hoy en día el mundo es muy cambiante y exigente ya que esta norma ISO 9001, se centra en todos los elementos de administración de calidad con los

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que una empresa debe contar para tener un sistema efectivo que le permita administrar y mejorar la calidad de sus servicios con el objetivo de superar sus expectativas. En fin, todos estos modelos tienen categoría global ya que sus conceptos son universales.

Principios Básicos de los Sistemas de Gestión Basados en ISO 9000

Según la Norma ISO 9001:2015, para conducir y operar una organización en forma exitosa se requiere que ésta se dirija y controle en forma sistemática y transparente. La gestión de una organización comprende la gestión de la calidad entre otras disciplinas de gestión. Se han identificado siete principios de gestión de la calidad que pueden ser utilizados por la alta dirección con el fin de conducir a la organización hacia una mejora en el desempeño.

La Norma ISO 9001:2015, establece que un principio de gestión de la calidad es una regla o creencia profunda y fundamental, para dirigir y hacer funcionar una organización, enfocada a una mejora continua de la ejecución a largo plazo y centrándose en los clientes, por lo tanto, se fundamentan en siete principios, los cuales son:

1. Enfoque al cliente: las organizaciones dependen de sus clientes y por lo tanto deberían comprender las necesidades actuales y futuras de los clientes, satisfacer los requisitos de los clientes y esforzarse en exceder sus expectativas. Para esto deben realizarse las actividades siguientes:
2. Liderazgo: los líderes establecen la unidad de propósito y la orientación de la organización. Ellos deberían crear y mantener un ambiente interno, en el cual el personal pueda llegar a involucrarse totalmente en el logro de los objetivos de la organización.
3. Compromiso de las personas: el personal, a todos los niveles, es la esencia de una organización y su total compromiso posibilita que sus habilidades sean usadas para el beneficio de la organización.
4. Enfoque basado en procesos: implica la definición y gestión sistemática de los procesos y sus interacciones, con el fin de alcanzar los resultados previstos de acuerdo con la política de la calidad y la dirección estratégica de la organización. La gestión de los procesos y el sistema en su conjunto puede alcanzarse utilizando el ciclo phva.
5. Mejora: identificar, entender y gestionar los procesos interrelacionados como un sistema, contribuye a la eficacia y eficiencia de una organización en el logro de sus objetivos.
6. Toma de decisiones basada en la evidencia: la mejora continua del desempeño global de la organización debería ser un objetivo permanente.
7. Gestión de las relaciones: las decisiones eficaces se basan en el análisis de los datos y la información.

Estos siete principios de gestión de la calidad constituyen la base de las normas de sistemas de gestión de la calidad.

Ventajas del Sistema de Gestión

"Enumera algunas de las ventajas que se obtienen de la definición, desarrollo e implantación de un sistema de gestión de la calidad entre las que se mencionan:

Desde el Punto de Vista Externo

- Potencia la imagen de la empresa frente a los clientes actuales y potenciales al mejorar de forma continua su nivel de satisfacción. Ello aumenta la confianza en las relaciones cliente y proveedor siendo fuente de generación de nuevos conceptos de ingresos.
- Asegura la calidad en las relaciones comerciales.
- Facilita la salida de los productos y servicios al exterior al asegurarse las empresas receptoras del cumplimiento de los requisitos de calidad, posibilitando la penetración en nuevos mercados o la ampliación de los existentes en el exterior.

Desde el Punto de Vista Interno

- Mejora en la calidad de los productos y servicios derivada de procesos más eficientes para diferentes funciones de la organización.
- Introduce la visión de la calidad en las organizaciones, fomentando la mejora continua de las estructuras de funcionamiento interno y externo y exigiendo ciertos niveles de calidad en los sistemas de gestión, productos y servicios.
- Decrecen los costos (costos de no calidad) y crecen los ingresos (posibilidad de acudir a nuevos clientes, mayores pedidos de los actuales, etc).

International Organization for Standardization (ISO)

ISO (Organización Internacional de Normalización), es una federación mundial de organismos nacionales de normalización (organismos miembros de ISO). Este organismo fue creado en 1947, trabaja para lograr una forma

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común de conseguir el establecimiento del sistema de calidad, garantizando la satisfacción de las necesidades y expectativas de los consumidores. El trabajo de preparación de las normas internacionales normalmente se realiza a través de los comités técnicos de ISO.

Las normas ISO 9000, es el término utilizado para indicar una familia de normas relativas a sistemas de gestión de la calidad. Las normas ISO 9000, se han elaborado para asistir a las organizaciones, de todo tipo y tamaño, en la implementación y la operación de sistemas de gestión de la calidad eficaces. Las normas ISO 9000 están basadas en las normas nacionales inglesas del sistema de calidad, es decir, la serie BS 5750 desarrollada por el instituto británico de normas en 1979.

Evolución de las Normas ISO 9001

La norma ISO 9001 nace en el año 1987, y desde ese año ha estado sufriendo revisiones que han dado lugar a diversas actualizaciones de la norma. La última revisión corresponde a la versión 2015, que ha sido culminada con la publicación del estándar el día 23 de septiembre de dicho año. Siendo la precursora de todas las que vinieron después en 1987, 1994, 2000 y 2008. A continuación, se muestran desde los inicios hasta la actualidad. (tabla 3).

Tabla 3. Evolución de las Normas ISO 9001

	Año 2015
Requisitos	ISO 9001:2015 Esta revisión se puso en marcha para adaptar la norma a la realidad actual de las organizaciones. Se trata de un cambio muy importante y delicado debido a que ISO 9001 supone el 80 % de la totalidad de certificaciones mundiales.
	Año 2008
	ISO 9001:2008 No hubo grandes cambios a resaltar
	Año 2000
	ISO 9001:2000 Incorporó cambios en la efectividad del sistema de gestión de la calidad y un mejor desempeño de las organizaciones. Algunos expertos decían que esta versión pasó del concepto "conformance" a "performance", es decir de conformidad a desempeño.
	Año 1994
	Año 1986/87
	ISO 9001:1987 Modelo para el aseguramiento de la calidad en el desarrollo, diseño, servicio, producción e instalación. ISO 9002:1987 Modelo para el aseguramiento de la calidad en la producción, servicio e instalación. ISO 9003:1987 Modelo para el aseguramiento de la calidad en inspecciones y pruebas. Estas normas contenían determinados requisitos que aseguraban la calidad allí donde se aplicasen.

Estructura de la Norma ISO 9001:2015

El 23 de septiembre de 2015, se publicó la nueva versión 2015. La revisión de la norma surgió por la necesidad de adaptarse a los tiempos actuales en los que se ven envueltas las organizaciones. La misma presenta cambios en su estructura.

La estructura de los capítulos pretende proporcionar una presentación coherente de los requisitos, más que un modelo para documentar los políticas, objetivos y procesos de una organización. Para la ISO 9001:2015, en su página número 26, la estructura de la norma ISO 9001:2015 es la siguiente:

1. Objeto y campo de aplicación: se refuerza la necesidad de cumplir los requisitos legales y reglamentarios asociados al producto. Asimismo, se diferencia el término "producto" de "servicio".
2. Referencias normativas: menciona las normas para consulta, pero se enfatiza en la realización de la ISO 9001 con la ISO 9000, que se trata de fundamentos y vocabulario.
3. Términos y definiciones: sirve de consulta, además, posee actualización permanente, se eliminan términos obsoletos.
4. Contexto de la organización: este punto habla sobre la necesidad de comprender a la organización y su contexto, asimismo las necesidades y expectativas de las partes interesadas y determinar el ámbito de aplicación del sistema de gestión de calidad. Este punto tiene la siguiente estructura:

Comprensión de la organización y de su contexto

Comprensión de las necesidades y expectativas de las partes interesadas. Determinación del alcance del

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sistema de gestión de calidad.

Sistema de gestión de la calidad y sus procesos.

5. Liderazgo: el capítulo destaca el rol de liderazgo a la par de la gestión. Se reitera la asignación de responsabilidades y roles dentro de la organización. Asimismo, de enfatiza en la participación de la alta dirección dentro del sistema de gestión. El punto tiene la siguiente estructura:
   - Liderazgo y compromiso.
   - Política.
   - Roles, responsabilidades y autoridades en la organización.

6. Planificación: el capítulo destaca el carácter preventivo de la norma, enfatizando el abordaje de los riesgos y oportunidades que se presentan en la organización. Asimismo, incluye la planificación de los objetivos y cómo lograrlos. La cláusula tiene la siguiente estructura:
   - Acciones para abordar riesgos y oportunidades.
   - Objetivos de calidad y planificación para lograrlos.
   - Planificación de los cambios.

7. Soporte: el capítulo señala los aspectos necesarios para el soporte del sistema de gestión, y así cumplir con los objetivos y metas de la organización. Recursos, Competencia, Toma de conciencia, Comunicación, Información documentada.

8. Operación: capítulo para la planificación y control de todos los procesos, tanto internos como externos la cual cuenta con la siguiente estructura:
   - Planificación y control operacional.
   - Requisitos para los productos y servicios.
   - Diseño y desarrollo de los productos y servicios.
   - Control de los procesos, productos y servicios suministrados externamente.
   - Producción y prestación del servicio.
   - Liberación de los productos y servicios.
   - Control de las salidas no conformes.

9. Evaluación del desempeño: se destaca el seguimiento de la eficacia y desempeño del sistema de gestión, a través de mediciones, análisis, evaluaciones, así como auditorias y revisión por la dirección la cual cuenta con la siguiente estructura:
   - Seguimiento, medición, análisis y evaluación.
   - Auditoría Interna.
   - Revisión por la dirección.

10. Mejora: capítulo que recalca la importancia de evaluar y realizar acciones de mejora en todos los componentes del sistema de gestión, como resultado se muestra en la siguiente estructura:
   - Generalidades.
   - No conformidad y acción correctiva.
   - Mejora Continua.

En resumen, esta estructura de la norma ISO 9001:2015, es fundamental en la operación de toda empresa y puede ser asociada en un principio con los procesos productivos. Es por eso que las empresas han adoptado medidas para la implantación de todos sus procesos y estar al vanguardia de la innovación y resaltar entre las primeras en cumplir cada una de sus cláusulas y ganar la confianza de todos sus clientes, en contar con esta extraordinaria certificación, generando así ventajas en ser reconocidas a nivel mundial, estableciendo los requisitos necesarios que toda organización debe cumplir para su posterior certificación y aumento de la satisfacción de sus clientes.

CONCLUSIONES

A partir del análisis realizado, se concluye que la implementación de un Sistema de Gestión de la Calidad (SGC) basado en la norma ISO 9001:2015 constituye una herramienta estratégica indispensable para las organizaciones que desean mantenerse competitivas, sostenibles y orientadas a la mejora continua. La norma, al centrarse en procesos, en la satisfacción del cliente y en la gestión del riesgo, permite alinear la operación diaria con los objetivos estratégicos, lo cual fortalece el desempeño organizacional y garantiza la conformidad con estándares internacionales.

Los antecedentes revisados, tanto nacionales como internacionales, evidencian que diferentes sectores productivos y de servicios han logrado significativos avances al adoptar esta norma. Investigaciones muestran

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que la estructura y enfoque de la ISO 9001:2015 se adapta a organizaciones de diversas naturalezas, tales como transporte, asistencia legal, mantenimiento aeronáutico, distribución de alimentos y asistencia vial. En todos los casos, la norma ISO fue clave para optimizar procesos, documentar procedimientos críticos, establecer controles de calidad más eficaces y elevar los niveles de satisfacción de los clientes.

Asimismo, se confirma que el éxito en la aplicación de un SGC depende no solo del conocimiento técnico de la norma, sino también del compromiso de la alta dirección, la capacitación del personal y el uso de herramientas metodológicas adecuadas como mapas de procesos, listas de verificación, auditorías internas y sistemas de medición del desempeño. Estos elementos, integrados bajo un enfoque preventivo y correctivo, permiten identificar oportunidades de mejora, gestionar los riesgos y reducir las no conformidades.

Desde una perspectiva teórica, modelos como los de Deming, EFQM y Malcom Baldrige sirvieron como marco comparativo para destacar las ventajas de la ISO 9001 en cuanto a aplicabilidad, estructura, alcance global y orientación a resultados. La revisión de estos enfoques reafirma que, aunque todos promueven la excelencia, es la ISO 9001:2015 la que ofrece una mayor flexibilidad y adaptabilidad para ser implementada en diversos entornos organizacionales, lo que la convierte en una opción sólida para las empresas que buscan certificarse y crecer.

En síntesis, la investigación confirma la importancia del diseño e implementación de sistemas de gestión de calidad sólidos, sostenibles y alineados con estándares internacionales. Además, proporciona bases metodológicas y conceptuales valiosas para futuras investigaciones que busquen fortalecer la cultura de calidad en organizaciones de cualquier tipo.

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Los autores declaran que no existe conflicto de intereses.

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ISO 9001:2015 Adoption: A Multi-Country Empirical Research

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Abstract:

Purpose: This paper aims at identifying obstacles, benefits, leading practices and lessons learned in the transition/certification of the revised standard for quality management systems ISO 9001:2015 for organizations in various sectors, countries and spanning a range of sizes.

Design/methodology/approach: Based on literature review and inputs from experts in management systems certification, a quantitative survey was launched in Portugal, Romania, Switzerland, and Turkey in April 2018, addressed at quality and organizational managers and CEOs from ISO 9001:2015-certified organizations by certification bodies partners of the leading International Quality Network (IQNet). The answers were collected anonymously through an automated online database, until the end of April 2018. The overall response rate was 3.1%, encompassing 222 organizations already certified according to ISO 9001:2015.

Findings: The surveyed organizations reported significant benefits from ISO 9001:2015 implementation. Only 3.9% of the respondents considered the 3-year transition period (from September 15, 2015, to September 15, 2018) as too short. The respondents' organizations attended ISO 9001:2015 training and seminars, and collected information from websites, newsletters, books and interpretation guides and directly from certification bodies. Some (29.8%) relied on their own internal resources for the transition processes, while external consultants supported 22.7%. The respondents considered the adoption of risk-based thinking the major difficulty to be overcome, but simultaneously as the major benefit to be realized. The alignment with other management systems, the increased top management commitment, the identification of risks and opportunities and the knowledge management were also reported as significant benefits.

The initial timing when organizations started working on the transition process and the activities carried out seem to differ between countries, while the adjustments performed to the existing management systems seem to differ by sector and size of the organization. The benefits attained by the organizations vary according to the perception regarding the information resources made available and organizations should be aware of the advantages of early planning. The organizations that rated the benefits of ISO 9001:2015 adoption higher considered the information resources as adequate and started working with ISO 9001:2015 at an earlier stage, while those that rated the benefits lower stated that the information resources were made available too late. The organizations that successfully managed the ISO 9001:2015 transition/certification process were the ones that attended ISO 9001:2015 training courses and seminars and got useful information from their certification body.

This research highlights the relevance of the geographical context, of the organization size and the sector for successful adoption of ISO 9001:2015. The identification and promotion of resources that led to the highest benefits are worth pursuing. The replication of this study can add a time perspective and the assessment if these perceptions are expected to materialize into tangible results such as cost benefits and higher customer satisfaction.

Research limitations/implications: Due to the novelty of ISO 9001:2015, these results should be subjected to additional validation and longitudinal analyses. Although measures have been taken to minimize possible bias errors from both non-respondents', and respondents' subjectivity, these limitations of the survey methodology should be acknowledged.

Practical implications: The findings of this research provide standardization and certification bodies and quality management systems practitioners with leading practices in the implementation of ISO 9001:2015 and guidance for an efficient and effective transition/adoption.

Originality/value: This investigation contributes to the ISO 9001:2015 body of knowledge by mapping the transition/certification processes with a multi-country perspective. The results empirically validate the potential value of transitioning or adopting ISO 9001:2015 and give insights on the implementation methodologies, leading practices to follow, difficulties to overcome and benefits to realize, to maximize the success of ISO 9001:2015 adoption.

Keywords: ISO 9001:2015, quality management systems, certification, benefits, difficulties, methodologies

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1. Introduction

Quality management is an economic issue; however, the drivers, as well as research perspectives, go far beyond. Literature reviews addressing ISO 9001 benefits (Tarí, Molina-Azorín & Heras, 2012) and bibliometric studies on the intellectual structure of research in ISO 9000 (Hussain, Eskildsen & Edgeman, 2018), converge on the conclusion that multidisciplinary fields, such as engineering, management sciences, social sciences, and behavioral sciences, contribute to the extensive existing research addressing quality management systems certification. Karapetrovic, Casadesús and Heras-Saizarbitoria (2010) acknowledged more than 30 empirical studies researching the impacts of ISO 9000 standards, while, more recently, Fonseca, Domingues, Machado and Calderón (2017) identified 101 scientific articles published between 2012 and April 2017 on this topic. According to Jain and Ahuja (2012), the ISO 9000 investigations focus on management issues, implementation, customer orientation, barriers, and advantage of certification. Considering the breadth and width of the scope of research on ISO 9000, analyzing the impact of a revision of the standard requires a multidimensional approach. Therefore, this study included organizations of different sizes, sectors and geographical location.

A standard should be a means to an end and, ultimately, prove to be beneficial. Based on a bibliometric study on the benefits of Management Systems Certification that analyzed 259 articles, from 699 authors, published in 132 scientific journals, from 1998 to April 2017, Fonseca, Domingues, Machado and Calderón (2017) concluded that a Quality Management System (QMS) certification generates benefits for the certified organizations, confirming previous research from other authors, e.g., Casadesús and Giménez (2000), Psomas and Fotopoulos (2009), Boiral (2012) and Tarí et al. (2012). These benefits can have both an internal and external scope, such as improved product quality and process performance, cost reductions, and higher quality awareness, leading to enhanced customer

satisfaction and a stronger competitive position. However, there is some variation on the results achieved with QMS certification related to the organizational motivations (internal and external) and to the way the standard is interpreted and implemented (Fonseca, 2015b). Recent research has also been addressing the implementation of ISO 9001 in countries and regions not studied before (Bounabri, Oumri, Saad, Zerrouk & Ibnlfassi, 2018). So, although there is ample evidence for the benefits of complying with ISO 9001, there are clear indications that the success of implementation is dependent on context factors not specified in the standard.

The perception of quality changes over time. With significant transformations driven by globalization, the move towards a more service-oriented economy, increasingly complex supply chains and the digital age, ISO had to ensure that the ISO 9001 quality management systems-requirements, international standard remained updated and adjusted to the current business environments. This led to the revision of ISO 9001:2015 published in September 2015, with the aim of ensuring the flexibility to respond to the rapid changes and the complexity of business dynamics, while ensuring that organizations that comply consistently with its requirements can deliver products and services that satisfy customers' needs and expectations and address the relevant statutory and regulatory requirements (Fonseca, 2015a). In short, ISO 9001 was revised to satisfy the requirements of supporting organizations with a QMS standard that reflects recent developments of business in general.

ISO released the ISO 9000 International Standards series in 1987. Since then, approximately 1,059 thousand organizations have implemented and certified their quality management systems (QMS) according to ISO 9001 requirements (ISO, 2018), assured by an audit and certified by an independent external certification body (CB). As of December 31, 2017, about 42% of the total ISO 9001 certificates have been issued according to the ISO 9001:2015 edition, while about 58% were issued according to the ISO 9001:2008 edition (ISO, 2018). With this large number of lagging organizations and the need to shift to the latest edition of ISO 9001, guidance for a successful transition for practitioners is urgently required.

The revision of ISO 9001 affects all organizations willing to comply with this standard. Organizations that have been certified according to ISO 9001:2008 need to transition their existing QMS to the new edition by a successful transition audit to get re-certified before the end of the transition period, which ended September 15, 2018. After that date, ISO 9001:2008 (ISO, 2008) certificates will lose validity, even if the lifecycle of regular certifications may not have been concluded. Moreover, the International Accreditation Forum (IAF) passed a resolution stating that from March 15, 2018, CBs must conduct all ISO 9001 audits by the ISO 9001:2015 edition (IAF, 2017). The ISO Survey 2017 (ISO, 2018) indicated that as of December 31, 2017, only 42% of the ISO 9001-certified organizations had successfully transitioned to ISO 9001:2015, with countries such as Japan boasting a transition rate of more than 65%, while other countries like Italy reported a transition rate of only 24%. With the validity of ISO 9001:2008 certifications ending soon, there is a strong need to investigate the ISO 9001:2015 transition process, namely the methodologies, the difficulties, the benefits, leading practices, and the overall lessons learned with these processes. As recognition of the need for action, this research can offer valuable insights for organizations that aim to implement and certify their QMS by ISO 9001:2015. To this avail, we present a first comprehensive study on the transition/certification process from ISO 9001:2008 to the revised ISO 9001:2015 from several countries and sectors, spanning a spectrum of sizes of organizations.

The next sections are organized as follows. Section 2 provides a brief literature review of ISO 9001:2015 implementation. Section 3 introduces the research methodology. The findings of the study are presented in Section 4. The last section 5 gives a systematic discussion of the results and the theoretical and practical implications as well as limitations and future research directions.

2. Literature Review

The first edition of the family of ISO 9000 standards for quality management systems (QMS) was published in 1987. During the introduction phase of ISO standardization, the main objectives of organizations seeking ISO 9001 series certification were to implement a documented quality system to facilitate the access to diversifying and more demanding global markets (Yahya & Goh, 2001; Rodríguez-Escobar, Gonzalez-Benito & Martínez-Lorente, 2006). Over time, the motivation evolved to improve process performance, streamline the overall documentation system, enhance customer satisfaction, improve business results and ensure company survival (Poksinska, Eklund,

Jörn & Jens, 2006; Han & Chen, 2007; Singh, 2008; Clougherty & Grajek, 2008; Cagnazzo, Taticchi & Fuiano, 2010; Prajogo, 2011; Santos, Costa & Leal, 2014; Chatzoglou, Chatzoudes & Kipraios, 2015; Zimon, 2016). In summary, the motivations to seek an ISO 9001 series certification are typically both internal and external; however, the priorities (both in scope and depth) vary between different types of organizations (Sharma, 2005; Martínez-Costa, Martínez-Lorente & Choi, 2008; Georgiev & Georgiev, 2015), which can influence the way the ISO quality management system is implemented and the subsequent success of the implemented system (Casadesús & Giménez, 2000; Martínez-Costa & Martínez-Lorente, 2007).

The adoption and certification of a QMS support an organization's mission. The main leverage points are to achieve quality through cohesiveness and standardization of its processes (Terlaak, 2007), and to aim for maximum customer satisfaction, global recognition, and improved performance (Heras-Saizarbitoria, Arana & Boiral, 2015). Corbett, Montes-Sancho and Kirsch (2005) tracked the financial performance of publicly traded ISO 9000-certified manufacturing firms in the United States from 1987 to 1997. They found that the decisions of firms to seek their first ISO 9000 certification were followed by significant abnormal improvements in financial performance. Lo, Yeung and Cheng (2009) found that economic and financial indicators improved one year after ISO 9000 implementation, based on a study of changes in 695 US-listed manufacturing firms prior and after ISO 9000 implementation. Data gathered by the Australian Bureau of Statistics (O'Neill, Sohal & Teng, 2016) through a longitudinal panel indicated that quality management approaches of those firms had positive impacts on their financial performance. In a study of 27 Japanese manufacturing firms, Phan, Abdallah and Matsui (2011), confirmed a positive relationship between quality management practices and competitive performance. Jain & Ahuja (2011), based on a study of published research addressing ISO 9000, posited that the investigations addressed mainly management and implementation issues, barriers, and the advantages of certification. Psomas and Fotopoulos (2009), based on another ISO 9000 meta-study, concluded that the findings suggest a positive impact of certification on the development of business excellence. More recently, Fonseca, Domingues, Machado et al. (2017) conducted a bibliometric study of scientific articles published between 1996 and April 2017 that also supports the view that QMS certification brings benefits for the certified organizations, which is in line with Boiral (2012) and Tarí et al. (2012). Overall, empirical research strongly supports the notion that the introduction of ISO 9000 yields tangible economic benefits for organizations.

ISO had reviewed its ISO 9001 standard in 2000 and in 2008. The next revision aimed to allow for an increased ISO 9001 flexibility while ensuring that organizations that meet its requirements can consistently provide products and services that satisfy their customers' needs and expectations and meet the relevant statutory and regulatory requirements. ISO reviewed the ISO 9001:2008 International Standard leading to the publication of ISO 9001:2015 on September 15, 2015 (Croft, 2012; Fonseca, 2015a).

The September 15 release of ISO 9001:2015 brought several significant changes compared to ISO 9001:2008 (Fonseca, 2015a):

- The adoption of a common high-level structure for all ISO Management System Standards (MSSs), with identical core text, terms, and definitions, to ensure compatibility and foster easier implementation and integrating of ISO MSS with the management systems of organizations.
- The ISO 9001:2008 concept of *management responsibility* has been replaced by *leadership* in ISO 9001:2015. The top management should lead and commit to the QMS and be strongly accountable for its effectiveness.
- There is a new ISO 9001:2015 requirement addressing the context of the organization, the internal and external issues that can impact the organizational strategic objectives and the planning of its QMS. Possible trends and changes in internal and external context and the relevant requirements of the relevant interested parties need to be monitored and reviewed and leading to the planning and implementation of QMS changes.
- Risk-based-thinking was included, replacing the so-called preventive actions in the 2008 edition of ISO 9001. The relevant risks and opportunities that may affect the QMS and its intended results must be identified and managed, both at the organizational and at the process level, emphasizing the systemic and systematic nature of prevention.

- ISO 9001:2015 brings a reinforced focus on the process approach and the intended QMS results, with less emphasis on prescriptive requirements and documentation.
- Since improvement can be achieved both in a continual and in a disruptive mode, the concept of *improvement* replaced *continual improvement* allowing for both sorts of improvements.
- The consideration of change management and knowledge management have been introduced (both at strategic and the operational level) and the objectives to be achieved with the changes must be defined, and its implications and impacts, either positive or negative, identified, and managed. Moreover, the required resources and organizational knowledge need to be available, and the QMS integrity checked and ensured.

Numerous authors contributed to the debate of previous ISO 9000 standards revisions (Vouzas & Gotzamani, 2005; van der Wiele, van Iwaarden, Brown, Steimle & Zink, 2009) and ISO 9001:2015 caught researchers' attention. However, due to its novelty, few investigations have addressed its implementation. This is unfortunate, as the ISO 9001:2015 aims at embedding quality management on several organizational levels and linking QMS more with the overall strategy and the prevailing mindset of an organization. An implementation, therefore, affects an organization systemically and should subsequently be treated with appropriate management care and attention.

Fonseca (2015a) studied and compared the Draft DISO 9001:2015 version with Total Quality Management approaches concluding it is a step towards that direction and can represent significant benefits for the organizations, such as less emphasis on documentation and new/reinforced approaches. Chen, Anchecta, Lee and Dahlgaard (2016), presented a stepwise ISO-TQM implementation approach based on ISO 9001:2015 and Marques, Meyrelles, Saraiva and Frazão-Guerreiro (2016) proposed a model for integrating Lean and or Six Sigma projects by systematically linking with the applicable clauses and sub-clauses of ISO 9001:2015. Anttila and Jussila (2017) analyzed the ISO 9001:2015 International Standard and gathered feedback during the first six months of its application. They concluded that there are improvements in the ISO 9001 edition of 2015, such as the new harmonized structure, the adoption of risk-based thinking and the reinforced business-centered focus on business processes; however, they claim it is ambiguous, and it has incomplete and imperfect text and requirements.

There are also several empirical investigations addressing the implementation of ISO 9001:2015. Based on a survey among 393 IRCA registered auditors worldwide, Fonseca and Domingues (2017) posit that ISO 9001:2015 is in line with modern business and quality management concepts and will be a useful tool for organizations that successfully adopt this international standard. Based on an empirical study with 1,175 German companies, Rybski, Jochem and Homma (2017) concluded that there is a lack of training and knowledge concerning the new requirements of ISO 9001:2015, particularly regarding the adoption of risk-based thinking. Research also suggests that ISO 9001:2015 will require new approaches and competencies for quality and organizational excellence managers (Fonseca, Domingues & Sá,, 2017) and auditors (Gluck et al., 2015). In a study with a sample of 28 CB experts and quality managers from European manufacturing SMEs, Chiarini (2017) identified the lack of competence regarding risk assessment as a significant challenge to ISO 9001:2015 implementation. Fonseca and Domingues (2018a), based on an empirical study of more than 300 Portuguese organizations, ISO 9001-certified or in the process of becoming certified, identified risk-based thinking, mapping of the organisational context, and stakeholder identification as the most relevant benefits reported for ISO 9001:2015. Additionally, they found evidence that ISO 9001:2015 enhances both internal and external organizational issues and generates benefits for all the researched dimensions. According to Hussain et al. (2018), based on a bibliometric analysis of ISO 9001 Elsevier Scopus Bibliometric database journal articles, published during 1987-2015 period, the findings are still inconclusive for issues like "the performance outcomes, challenges in acquiring, registering, and maintaining certification, lessons learned, and effectiveness of certification, internal and external challenges, and the trade-off between cost and benefits". These studies outline three main propositions: first, for some researchers, ISO 9001:2015 is in line with modern business and quality management concepts and will be a useful tool for organizations that successfully adopt this international standard and can be regarded as a step towards TQM; second, some authors acknowledge benefits through ISO 9001:2015 but also point to some shortcomings; third, there is a lack of awareness and training for the implementation of ISO 9001:2015 and some of its new requirements, e.g., risk-based approach.

Several researchers have highlighted the different challenges and practices of organizations in different regions of the world face while adopting ISO certification (Heras-Saizarbitoria & Boiral, 2013; Nair & Prajogo, 2009). There

are also observed differences in the driving forces for ISO 9001 certification between manufacturing and services (Pekovic, 2010), hinting that the results of ISO 9001 certification may depend on the sector of activity of the organization. Another significant domain of ISO-based research is whether organizations size (number of employees) and turnover, influences the results of ISO 9001 certification, due to different resources availability and flexibility and openness for changes (Fonseca & Domingues, 2018a).

This study aims to investigate if: 1) the methodology adopted by the organization concerning ISO 9001:2015 transition process; 2) the benefits achieved by successfully implementing ISO 9001:2015 requirements; 3) the difficulties the organization had to implement ISO 9001 successfully: 2015 requirements; and 4) the lessons learned with ISO 9001:2015 transition/certification requirements, differ according to the relevant variables reported in the literature:

- The country where the organization operates;
- The sector in which the organization operates;
- The size of the organization;
- The annual turnover of the organization.

In line with existing literature, this investigation aims to contribute to the ISO 9001:2015 body of knowledge by researching, within a multi-country perspective, the transition methodologies, difficulties, benefits, leading practices and the overall lessons learned with these processes for organizations in various sectors, countries and spanning a range of sizes. It is expected that these results, based on a considerable sample, can contribute to foster the successful implementation and certification of ISO 9001:2015, on a global scale.

3. Research Methodology

The research tool for this quantitative study was developed based on a literature review (e.g., Fonseca & Lima, 2015; Fonseca & Domingues, 2018a). It was pilot tested with the Swiss based IQNet – The International Certification Network, a network of leading certification bodies with worldwide coverage (IQNet, 2018) and the participating of CB IQNet partners experts from Portugal, Romania, Switzerland, and Turkey, leading to the approval of the final questionnaire. The construct reliability was tested and validated with Cronbach Alpha (greater than 0.7).

The survey was addressed to quality and organizational managers, and CEOs and the data was collected with an online questionnaire among ISO 9001:2015-certified organization from four CB partners of the leading IQNet network in Portugal, Romania, Switzerland, and Turkey. An e-mail was sent to the ISO 9001:2015-certified organizations in April 2018, and the answers were collected anonymously through an automated online database, until the end of April 2018.

The sample comprised a total of 7,260 organizations certified according to ISO 9001:2015. The overall response rate was 3.1%, encompassing 222 organizations already certified according to ISO 9001:2015. While this is a lower response rate than those of national surveys, the overall sample size was considered sufficient to be representative and yield valuable research insights due to is large dimension and diversity, incorporating organizations of different sizes, sectors and geographical location. The survey was designed to include several sections as presented in Annex A. IBM Social Sciences Statistical Package (SPSS) v.22 software was used to conduct the statistical tests and calculations (after ordinal to a numerical transformation of the Likert scale type of answers). The non-parametric Kruskal-Wallis one-way analysis of statistical variance test was used to determine whether some variables, measured on an ordinal scale, differed significantly from other variables (namely those related to the characterization of the company). The survey results were monitored during the survey period to check for possible non-respondent bias with a "wave analysis" (Armstrong & Overton, 1977). No significant differences were found between early and late respondents, and the analysis of the survey results suggests that it is representative since the distribution of the sample is consistent with the population, which minimizes possible bias errors.

The following research hypotheses were tested:

Dimension 1 – Methodology adopted by the organization concerning ISO 9001:2015 transition process

Research Statement: The selection of the methodology adopted by the organization concerning the ISO 9001:2015 transition process differs with the …

- Hypothesis 1 (H1) … country where the organization operates.
- Hypothesis 2 (H2) … sector in which the organization operates.
- Hypothesis 3 (H3) … size of the organization.
- Hypothesis 4 (H4) … turnover of the organization.

Dimension 2 – The benefits the organization achieved by successfully implementing ISO 9001:2015 requirements

Research Statement: The benefits the organization achieved by successfully implementing ISO 9001:2015 requirements differ with the …

- Hypothesis 5 (H5) … country in which the organization operates.
- Hypothesis 6 (H6) … sector in which the organization operates.
- Hypothesis 7 (H7) … size of the organization.
- Hypothesis 8 (H8) … turnover of the organization.
- Hypothesis 9 (H9) … methodology adopted by the organization concerning the ISO 9001:2015 transition process.

Dimension 3 – The difficulties the organization had to successfully implement ISO 9001:2015 requirements

Research Statement: The difficulties the organization had to successfully implement ISO 9001:2015 requirements differ according to the …

- Hypothesis 10 (H10) … country where the organization operates.
- Hypothesis 11 (H11) … sector in which the organization operates.
- Hypothesis 12 (H12) … size of the organization.
- Hypothesis 13 (H13) … turnover of the organization.
- Hypothesis 14 (H14) … methodology adopted by the organization concerning the ISO 9001:2015 transition process.

Dimension 4 – The lessons learned with ISO 9001:2015 transition/certification requirements

Research Statement: The lessons learned with ISO 9001:2015 transition/certification requirements differ with the …

- Hypothesis 15 (H15) … country where the organization operates.
- Hypothesis 16 (H16) … sector in which the organization operates.
- Hypothesis 17 (H17) … size of the organization.
- Hypothesis 18 (H18) … turnover of the organization.
- Hypothesis 19 (H19) … methodology adopted by the organization concerning the ISO 9001:2015 transition process.
- Hypothesis 20 (H20) … benefits the organization had to successfully implement ISO 9001:2015 requirements.
- Hypothesis 21 (H21) … difficulties the organization had to successfully implement ISO 9001:2015 requirements.

The Kolmogorov-Smirnov and the Shapiro-Wilk statistical tests were used to evaluate the normality of the distribution of the results collected and as an indication for which tests to use subsequently for the research questions. The statistical tests show that the results did not have a normal distribution (Sigma ≤ 0.05) and therefore, the Kruskal-Wallis statistical test was used to ascertain and validate the statistical hypotheses formulated. Variable 2.2 was divided into five different dimensions (Table 1).

To validate the research hypotheses H5 to H21, the following criteria were adopted per dimension of the survey:

- Hypothesis validated (✓): at least 2/3 of the items tested validated according to the Kruskal-Wallis test (p-value<0.05).
- Hypothesis partially validated: More than 1/3 and less than 2/3 of the items tested validated according to the Kruskal-Wallis test (p-value < 0.05).
- Hypothesis rejected (✗): Less than 1/3 of the items tested validated according to the Kruskal-Wallis test (p-value < 0.05).

Dimension	Description
1	Timing when organizations started working in the transition process
2	Perception of the 3-year transition process
3	Activities carried out
4	Perception of the information resources made available
5	Adjustments performed on the existing management system

Table 1. Dimensions of Variable 2.2

4. Findings

4.1. Profiles of Organizations/Respondents

The quantitative survey yielded data on the traits of 222 organizations already certified according to ISO 9001:2015. Specifically, the survey detailed the role of respondents, their geographical context, sector, size, international orientation, and financial volume as well as the time since the last ISO 9001 certification. The characteristics of the surveyed respondents and their respective organizations are presented in Table 2.

		n	%
Respondent's role	Quality and organizational excellence managers	141	65.3
	CEO/COO/CFO	26	12.0
	Other	49	22.7
Respondent's country (geographical context)	Portugal	50	23.1
	Switzerland	62	28.7
	Turkey	93	43.1
	Others	11	5.1
Typology: number of employees	Micro (less than 10)	11	5.1
	Small (11–50)	61	28.2
	Medium (51–250)	72	33.3
	Large	72	33.3
International market activity, in %	0%	68	31.5
	Between 1 and 25%	80	37.0
	More than 25%	68	31.5
Annual turnover in Million Euros	Less than 0.5 M	32	14.8
	Between 0.5 and 5 M	57	26.4
	Between 5 and 10 M	32	14.8
	Between 10 and 50 M	42	19.4
	More than 50 M	53	24.5
Number of years of ISO 9001 certification	Less than 3	42	19.4
	Between 3 and 6	18	8.3
	More than 6	156	72.2

		n	%
Sector	Industry	80	37.0
	Services and Commerce	56	25.9
	Health and Social	27	12.5
	Public Administration	16	7.4
	Others	37	17.1

Table 2. Characterization of respondents

4.2. ISO 9001:2015 Transition Process

The transition process was analyzed regarding timing and allowable time window for (re-)certification. Although almost half of the organizations (47.5%) started to work with ISO 9001:2015 as late as 2017, only 3.9% of the respondents considered the 3-year transition period (from September 15, 2015 to September 15, 2018) as too short.

The analysis of the transition process revealed several leading practices. Methodologically, 58.0% of the respondents' organizations attended ISO 9001:2015 trainings and seminars, with 29.8% relying solely on their own internal resources for the transition processes, while external consultants supported 22.7%. Another 44.2% of the organizations gathered information from websites, newsletters, books, and interpretation guides, and certification bodies (CB) as major sources of valuable inputs (35.4%). However, there was a split concerning the nature of the ISO 9001:2015 transition process information resources, with 25.4% considering it as adequate, but 20.4% stating it was too generic for guidance. Finally, 30.9% of the organizations made significant adjustments to their existing ISO 9001:2008 QMS, while 28.2% only made small ones. The percentages of respondents' answers concerning the adoption of ISO 9001:2015 transition process methodology is presented in Figure 1.

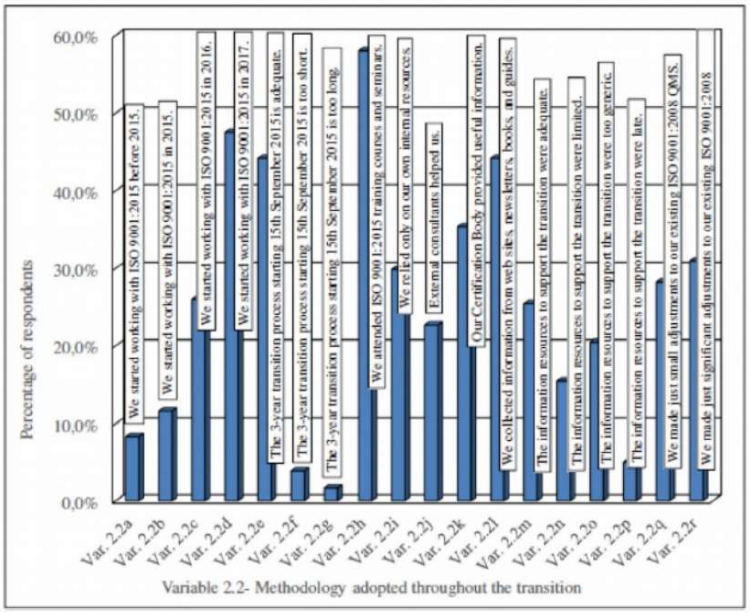


Figure 1. Methodology adopted by the organization concerning the ISO 9001:2015 transition process (% of respondents)

The data analysis yielded the most pertinent obstacles to the transition process. The adoption of risk-based thinking was reported as the major difficulty during the transition process (75.7%), followed by the determination of the organizational context (37.6%) and the identification of the relevant interested parties and their relevant requirements (36.5%). Figure 2 presents the average values after ordinal to numerical transformation (scale: 1 minimum to 5 maximum) of the difficulties faced by the organization in the implementation of ISO 9001:2015.

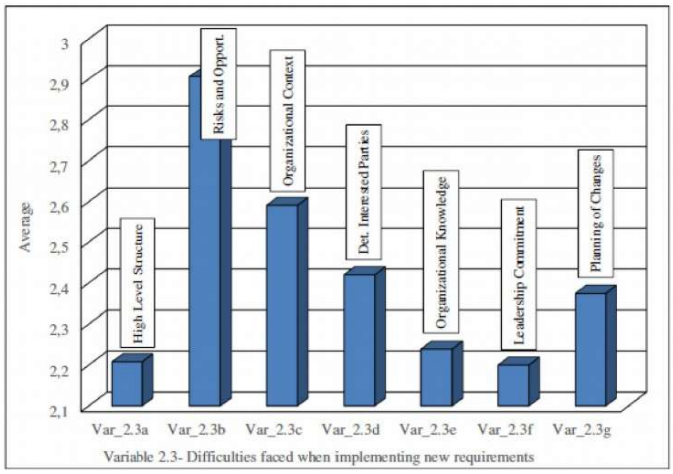


Figure 2. Average values of the difficulties faced by the organization when implementing the new ISO 9001:2015 requirements

4.3. Benefits Achieved by ISO 9001:2015 Implementation

The survey identified the most pertinent benefits of an implementation of ISO 9001:2015. With an average value of 4.17, the adoption of risk-based management was the major reported benefit achieved with an implementation of ISO 9001:2015, highlighting that the major obstacle also yields the most significant benefits. The alignment with other management systems (4.00), the increased top management commitment (3.90), the identification of risks and opportunities (3.93) and the knowledge management (3.83) were also mentioned as significant benefits of ISO 9001:2015. Conversely, it should be noted that cost reduction was evaluated as just 2.94 on a scale of 1 to 5, hinting at a possible caveat of more time needed to quantify and achieve this desired outcome. Additionally, there were high variations in some reported benefits, such as documentation requirements (standard deviation of 1.20), cost reduction (standard deviation of 1.18) and improved integration with other MSSs (standard deviation of 1.13), which might be explained by different approaches used for the ISO 9001:2015 transition/certification processes (minor to significant adjustments) and their QMS maturity. Figures 3 and 4 present the averages and standard deviations of the benefits attained by the organizations with the implementation of the new ISO 9001:2015 requirements.

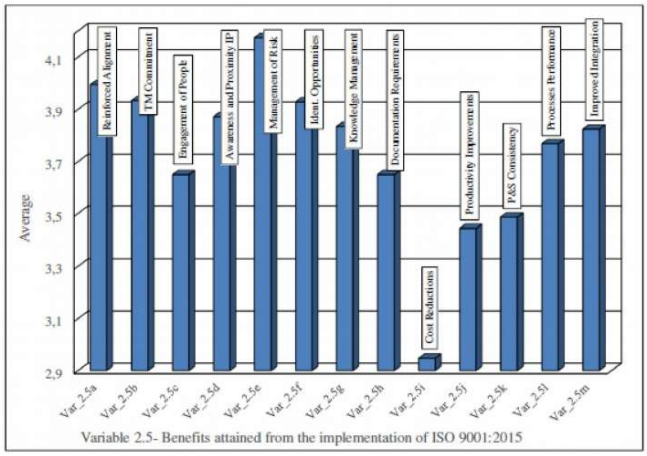


Figure 3. Average values of the benefits attained by the organization from the implementation of the new ISO 9001:2015 requirements

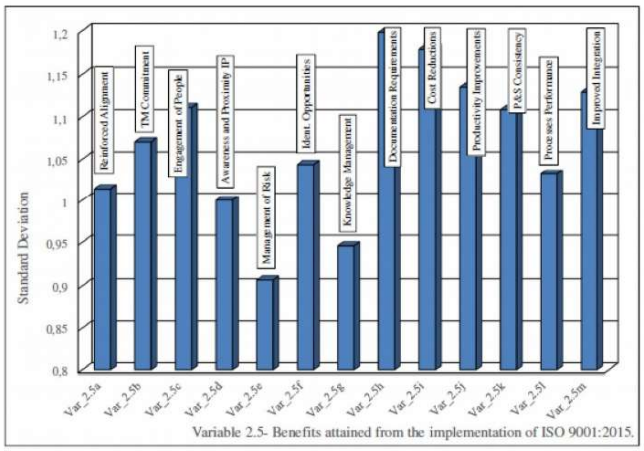


Figure 4. Standard deviations of the benefits attained by the organization fromthe implementation of the new ISO 9001:2015 requirements

4.4. Lessons Learned from the ISO 9001:2015 Transition and Certification

The lessons learned from the ISO 9001:2015 transition and certification by the respondents' organizations confirm that it was perceived as valuable to certify according to the ISO 9001:2015 edition (average 4.10) and consultants were helpful in that process (average 4.19). Some items showed a high variation among respondents, namely the support received from the certification body (standard deviation of 1.41), the value of training (standard deviation of 1.37) and the training effectiveness (standard deviation of 1.32). The detailed results of the lessons learned are presented in Figure 5 (averages) and Figure 6 (standard deviations).

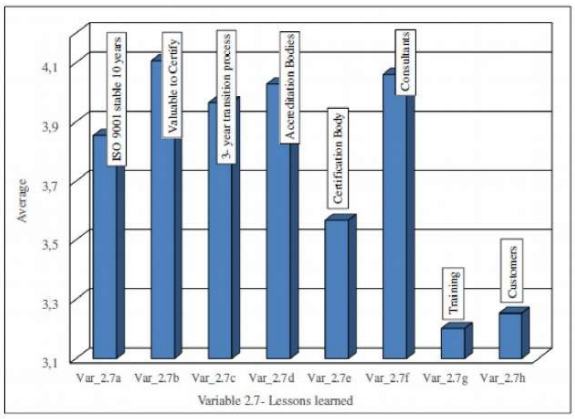


Figure 5. Average of the lessons learned with the implementation of the ISO 9001:2015 transition/certification requirements

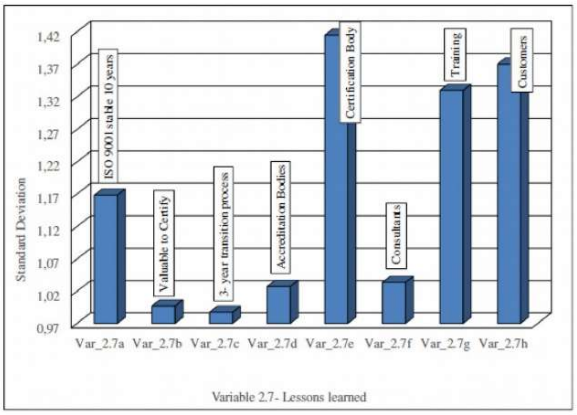


Figure 6. Standard deviation of the lessons learned with the implementation of the ISO 9001:2015 transition/certification requirements

To sum up, the new/reinforced ISO 9001:2015 approach reported as more beneficial was the "Adoption of risk-based thinking" (75.7%), followed by "Organizational knowledge" (39.8%), "Organizational context determination" (37.6%) and "Identification of the relevant interested parties and their relevant requirements" (36.5%). The overall results are presented in Figure 7.

There was a remarkable match with the significant difficulties previously reported (adoption of risk-based thinking, followed by the determination of the organizational context and the identification of the relevant interested parties and their relevant requirements), that highlight that requirements more challenging to implement were also those that yielded more benefits for the respondents' organizations. This conclusion is consistent with recent studies addressing the implementation of ISO 14001:2015 Environmental Management Systems (Fonseca & Domingues, 2018b).

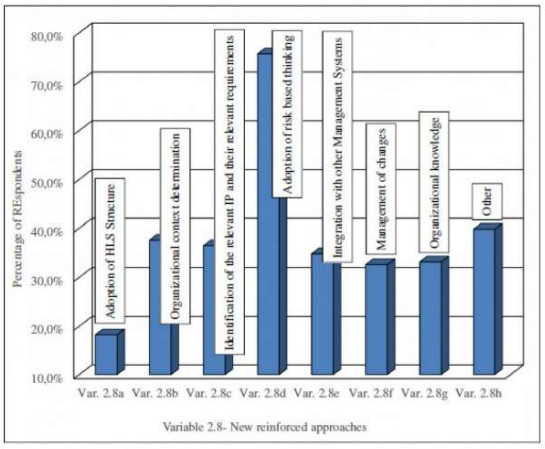


Figure 7. New/reinforced ISO 9001:2015 approaches considered more beneficial (% of respondents)

4.4. Results of the Hypotheses Testing

Table 3 presents the results of the Kruskal-Wallis statistical test (Asymptotic Sigma) regarding the methodologies adopted. The results suggest that the initial timing, when organizations started working on the transition process, differed by country; namely, Turkey and Portugal started working on the transition process significantly later than Switzerland and other countries. Additionally, based on the statistical tests, the activities carried out seemed to differ by country and size of the organization. The "Other" country category displayed a strategy deviating from other countries: organizations within this category seem to have relied heavily upon their own resources and the support of external consultants compared to organizations from Turkey, Portugal, and Switzerland. On the other hand, employees from organizations of "Other" countries seem not to have attended as many ISO 9001:2015 trainings and seminars. Concerning the dimension of the organization, results suggest that micro-companies (< 10 employees) favoured their internal resources compared to SMEs (between 11 and 250 employees) and large companies (> 250). On the other hand, SMEs and large companies seem to have collected a great deal of information by websites, newsletters, books, and interpretation guides.

The adjustments performed to the existing management systems seem to differ with the sector and size of the organization. Public administration and commerce and services made significant adjustments to the existing management systems, whereas health and social and other sectors introduced mainly slight adjustments. Regarding the industrial sector, the conclusions were not so straightforward. Regarding company dimension, it should be stated that micro-companies (< 10 employees) seem to have introduced solely slight adjustments compared to SMEs and large companies.

Concerning the validation of H9 (Table 4), some benefits attained by the organizations seem to differ with the perception of information resources made available (partially validated). Results suggest that organizations that rated the benefits "It promoted the engagement of the people throughout all organizational levels", "It raised awareness and proximity with relevant interested parties, their needs and expectations", "It improved awareness and allowed a more systematic approach to determine and manage risks", "Contributed to the Identification of opportunities", "It allowed for less prescriptive, and documentation requirements" and "We achieved cost reductions" higher also stated that information resources available were adequate (although limited and too generic) but did not find that these information resources were made available too late. Organizations that rated the benefit "It helped us to determine the knowledge needed, how to safeguard it and have access to it" lower also stated that

information resources available were adequate although made available too late. Based on the collected data, no other validation was possible.

Hypothesis	Started Working	Transition Process	Activities Carried Out	Information Resources	Adjustments
H1 Country	0.001 (✓)**	0.433 (×)	0.000 (×)***	0.009 (✓)	0.154 (×)
H2 Act. Sector	0.652 (×)	0.212 (×)	0.237 (û)	0.480 (×)	0.078 (×)*
H3 Size Org.	0.154 (×)	0.910 (×)	0.003 (✓)**	0.324 (×)	0.013 (✓)**
H4 Turnover	0.304 (×)	0.283 (×)	0.123 (×)	0.503 (×)	0.245 (×)

Hypothesis: validated (✓)* Statistical significant 0.1 level; ** Statistical significant at 0.05 level; *** Statistical significant at all levels; rejected (×)

Table 3. Asym. Sig. (Kruskal-Wallis test)

Variable	Dimension	No. of statistically significant benefits (Var. 2.5) (p < 0,1)	Test validation result
Var. 2.2	Dimension 1	1	×
	Dimension 2	1	×
	Dimension 3	0	×
	Dimension 4	7	Partially Validated
	Dimension 5	0	×

Hypothesis: validated (✓), partially validated, rejected (×)

Table 4. Hypothesis 9 validation

Concerning the validation of H14 (Table 5), some difficulties faced by organizations seem to differ with the initial timing when organizations started working on the transition process, the perception on information resources made available, and the adjustments made on the existing management system (partially validated). Generally, Organizations that rated the difficulties "Implementation of high-level structure", "Determination of risk and opportunities and the actions to address them", "Leadership commitment" and "Planning of changes" higher also made significant changes to the existing management system. Additionally, organizations that rated the difficulties "Implementation of high-level structure", "Determination of risk and opportunities and the actions to address them", "Organizational context determination – internal and external relevant issues" and "Determination of the relevant interested parties and their relevant requirements" higher also found information resources limited, too generic and made available too late. Organizations that rated the difficulties "Implementation of high-level structure", "Organizational context determination – internal and external relevant issues" and "Planning of changes" higher also started working with ISO 9001:2015 in 2016 and 2017. Based on the collected data, no other validation yielded significant results.

Concerning the validation of H14 (Table 6), the assessment of some lessons learned by the organizations throughout the transition process seems to differ with activities carried out (partially validated). The perceptions that the 3-year transition process was planned and managed in an effective way, that the certification body and consultants provided an effective support, and that the training was helpful differed with the activities carried out. Organizations that rated "The 3-year transition process was planned and managed in an effective way" and "Our Certification Body provided us with effective support" higher also attended ISO 9001:2015 training courses and seminars and stated that the certification bodies provided useful information. On the other hand, they did not have to collect as much information from websites, newsletters, books, and interpretation guides. Organizations that rated "Consultants provided us with effective support" and "Training was helpful" higher also stated that external

consultants were helpful, they did not rely so heavily on their internal resources and did not collect so much information from websites, newsletters, books, and interpretation guides. Based on the collected data and according to the criteria applied, no other validation was possible.

Variable	Dimension	No. of statistically significant difficulties (Var. 2.3) ($p < 0,1$)	Test validation result
Var. 2.2	Dimension 1	3	Partially
	Dimension 2	1	✗
	Dimension 3	1	✗
	Dimension 4	4	Partially
	Dimension 5	4	Partially

Hypothesis: validated (✓), partially validated, rejected (✗)

Table 5. Hypothesis 14 validation

Variable	Dimension	No. of statistically significant lessons learned (Var. 2.7) ($p<0.1$)	Test validation result
Var. 2.2	Dimension 1	1	✗
	Dimension 2	2	✗
	Dimension 3	4	Partially
	Dimension 4	2	✗
	Dimension 5	0	✗

Hypothesis: validated (✓), partially validated, rejected (✗)

Table 6. Hypothesis 19 validation

5. Discussion and Research Implications

The body of knowledge on ISO 9001 is continuously growing (Fonseca, Domingues, Machado et al., 2017); however, there is a clear research gap on the transition/certification process with the introduction of the revised ISO 9001:2015. This study presents the findings of a quantitative survey among 222 organizations and their experience with ISO 9001:2015. Major benefits, leading practices and lessons learned concerned mainly time allowed for transition, sources of information, and the adoption of risk-based thinking. The results indicate that there are some significant differences in the transition/certification process depending on the country and sector as well as the size of an organization.

There were some obvious differences in the transition/certification process between organizations from different countries. Many Swiss organizations started to work with ISO 9001:2015 earlier than organizations in other countries. Although almost half of the surveyed organizations (47.5%) started to work with ISO 9001:2015 as late as 2017, only 3.9% considered the 3-year transition period (from September 15, 2015, to September 15, 2018) as too short. This might help to explain and confirm some of the differences found in surveys conducted only on national levels and highlighted the importance of a timely introduction of changes to allow for organizational inertia in the transition to ISO 9001:2015.

The revision of ISO 9001:2015 requires adaptations in existing QMS. Methodologically, 58% of the respondents' organizations attended ISO 9001:2015 trainings and seminars, with 29.8% relying solely on their own internal resources for the transition processes, while external consultants supported 22.7%. Micro-companies relied more on their own internal resources compared to SMEs and large companies (that collected considerable information from websites, newsletters, books, and interpretation guides). Concerning the extent of the adjustments to the

QMS for an adoption of ISO 9001:2015, there was a balance between organizations that made significant adjustments to their existing ISO 9001:2008 QMS (30.9%) with those made only small ones (28.2%). The sectors of public administration and commerce and services made significant adjustments in contrasts to micro-companies (< 10 employees) that reported having introduced solely slight adjustments. Although most organizations reported a successful transition to ISO 9001:2015, more research is required to analyze if the adjustments made were improving or degrading the overall quality of the QMS of organizations and the specific role of external consultants as agents of change.

The revision of ISO 9001 triggered a need for information among organizations, on the content as well as on the changes necessary for a successful transition. Concerning the nature of information resources for the ISO 9001:2015 transition process, 25.4% considered it as adequate, but 20.4% stated it was too generic for guidance, with the company that rated the benefits of ISO 9001:2015 adoption higher also judged the information resources as adequate, while those that rated the benefits lower also stated they were made available too late. The respondents' organizations emphasized that it was valuable to certify according to the ISO 9001:2015 edition and trainings and consultants were helpful in that process. The organizations that successfully managed the ISO 9001:2015 transition/certification process were the ones that attended ISO 9001:2015 training courses and seminars and got useful information from their CB. This approach can, therefore, be identified as leading practice and guidance for organizations intending to get certified.

The revision of ISO 9001:2015 is aiming at providing significant benefits in the current business context. The adoption of risk-based thinking was the major reported benefit achieved by the implementation of ISO 9001:2015, followed by the alignment with other management systems, the increased top management commitment, the identification of risks and opportunities and the knowledge management. With cost reduction evaluated at about 3 on a scale of 5, there seems to be a delay to achieve this desired outcome. Consistent with the ISO 9001:2015 literature, the realization of the major benefits requires more time and effort. The benefits attained by the organizations seem to differ with the perception of information resources made available, so the identification and promotion of the resources that led to the highest benefits are worth pursuing. Significant adjustments and the (less) availability of resources led to a large number of difficulties in the transition from the 2008 to the 2015 version of ISO 9001. Organizations that adopt early planning reported more major benefits and fewer difficulties, which is a significant lesson learned and can be labeled as leading practice. In conclusion, there is a perception of benefits from implementing ISO 9001; however, providing enough time is essential for realizing these.

Any transition/certification process involves obstacles that need to be overcome. The adoption of risk-based thinking was reported as the major difficulty faced during the transition process, followed by the determination of the organizational context and the identification of the relevant interested parties and their relevant requirements. Organizations that made significant changes to their MSs reported the greatest difficulties and the same was true to the late ISO 9001:2015 adopters. Therefore, there seems to be a relationship between the scope and start of the change and the adoption of the significant mindset promoted by ISO 9001:2015.

In summary, the research results confirm the relevance of the addition of new and reinforced requirements, such as risk-based thinking in the ISO 9001:2015 edition, and the need to acquire proper competencies on that regard, as outlined by Fonseca and Domingues (2017), Rybski, Jochem and Homma (2017) and Chiarini (2017). Additionally, there is support for the view that ISO 9001:2015 enhances both internal and external organizational issues and will be a useful tool for organizations that successfully adopt this international standard, which is consistent with previous research from Fonseca and Domingues (2017, 2018a). However, this investigation also identifies some shortcomings and lack of awareness and training for the implementation of ISO 9001:2015, as reported by other researchers (Rybski, Jochem & Homma, 2017; Chiarini, 2017).

There are several theoretical and practical implications of this investigation. Concerning the methodological aspects, an early start of the transitioning process can be strongly advised. Since the initial timing when organizations started working on the transition process and the activities carried out differed by country, the geographical context should be considered when planning transition processes and for future research on ISO 9001:2015. Moreover, it might be justified to instruct certification bodies in lagging countries to urge organizations for a timely onset of the change with future revisions of ISO 9001. Organizing the change is closely related to the

activities carried out and the adjustments made to existing QMS, so this is another dimension to be considered. It can be derived that mandating external consultants is linked to the size of an organization. This further entails that it may be advisable to provide more information resources specifically geared for SME to facilitate the transition process. Moreover, national certification bodies should review their strategies to lower the threshold to be contacted by SME on information and issues of the transition/certification process.

The adjustments performed to the existing management systems seem to differ by sector. Similarly, the lessons learned by the organizations throughout the transition process seem to vary with the activities carried out, and activities should be carried out considering the context and sector, in which the organization operates as this will likely improve the efficiency of the transition process. Furthermore, future research should try and assess the quality of those adjustments, i.e., use longitudinal studies to monitor the maturity of organizations regarding the development of their QMS. The determinants of a "slight adjustment" and those of a "significant adjustment" should then be mapped, e.g., with case studies based on sector and maturity of the QMS. Thus, standardized roadmaps for the transition process of QMS could be designed and customized for organizations from different countries and sectors as well as along a scope of sizes.

This study is a first investigation to provide details on the transition/certification process of the revised ISO 9001:2015, encompassing several countries and sectors and a spectrum of diverse organizations. Although differences in perceived benefits, obstacles, leading practices, and lessons learned are significant, a replication of this study at a later stage and countries not considered in this research may contribute additional time and geographic perspectives to evaluate if these perceptions materialize into tangible results such as cost benefits and higher customer satisfaction.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Annex A: Survey

1. Socio-demographic characterization of respondents

We would like to begin with some background about you, your organization (the entity you work for) and its ISO 9001:2015 status. So, please select ...:

1.1. Country (select from list):

1.2. ... the activity sector of the organization (choose the one that better describes it):

1.3. ... the number of employees of your organization:

1.4. ... the percentage of activity in the international market:

1.5. ... the annual turnover (in US$) of your organization:

1.6. ... the number of sites of your organization:

1.7. Is your organization certified according the 2015 revision?

2. ISO 9001:2015- Certified Organizations

2.1. Please select the first year of ISO 9001 certification:

2.2. Please choose the options that best describe the methodology adopted by your organization concerning the ISO 9001:2015 transition process:

□ We started working with ISO 9001:2015 before 2015.

□ We started working with ISO 9001:2015 in 2015.

□ We started working with ISO 9001:2015 in 2016.

□ We started working with ISO 9001:2015 in 2017.

□ The 3-year transition process starting 15th September 2015 is adequate.

□ The 3-year transition process starting 15th September 2015 is too short.

□ The 3-year transition process starting 15th September 2015 is too long.

□ We attended ISO 9001:2015 training courses and seminars.

□ We relied only on our own internal resources.

□ External consultants helped us.

□ Our Certification Body provided useful information.

□ We collected information from web sites, newsletters, books, and interpretation guides.

□ The information resources to support the ISO 9001:2015 transition processes were adequate.

□ The information resources to support the ISO 9001:2015 transition processes were limited.

□ The information resources to support the ISO 9001:2015 transition.

□ processes were too generic for guidance.

□ The information resources to support the ISO 9001:2015 transition.

□ processes were made available too late.

□ We made just small adjustments to our existing ISO 9001:2008 Quality

□ Management System.

□ We made significant adjustments to our existing ISO 9001:2008 Quality Management System.

2.3. To which extent did your organization had difficulties to successfully implement the following ISO 9001:2015 requirements:

	Not at all	A little	A moderate amount	A lot	To a great extent	Don't know
High Level Structure	○	○	○	○	○	○
Determinination of risk and opportunities and the actions to address them	○	○	○	○	○	○
Organizational context determination- internal and external relevant issues	○	○	○	○	○	○
Determination of the relevant interested parties and their relevant requirements	○	○	○	○	○	○
Organizational knowledge	○	○	○	○	○	○
Leadership commitment	○	○	○	○	○	○
Planning of changes	○	○	○	○	○	○

2.4. Please point out any other significant difficulty (please specify):

2.5. Concerning the benefits that your organization achieved by successfully implementing ISO 9001:2015 requirements, or expects to achieve in the near future, to which extent do you agree with the following statements?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly Agree	Don't know
It reinforced the alignment with business strategy	○	○	○	○	○	○
It Increased Top Management commitment	○	○	○	○	○	○
It promoted the engagement of the people throughout all organizational levels	○	○	○	○	○	○
It raised awareness and proximity with relevant interested parties, their needs and expectations	○	○	○	○	○	○
It improved awareness and allowed a more systematic approach to determine and manage risks	○	○	○	○	○	○
Contributed to the Identification of opportunities	○	○	○	○	○	○
It helped us to determine the knowledge needed, how to safeguard it and have access to it	○	○	○	○	○	○

It allowed for less prescriptive and documentation requirements	○	○	○	○	○	○
We achieved cost reductions	○	○	○	○	○	○
We achieved productivity improvements	○	○	○	○	○	○
We deliver our products and services more consistently with customer needs	○	○	○	○	○	○
It Improved processes performance	○	○	○	○	○	○
There is an improved integration with other Management systems standards such as ISO 14001	○	○	○	○	○	○

2.6. Please point out any other significant benefit (please specify):

2.7- Concerning the lessons learned with ISO 9001:2015 transition/certification requirements, to which extent do you agree with the following statements?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly Agree	Don't know
ISO 9001:2015 will remain updated and stable for the next 10 years	○	○	○	○	○	○
It was valuable to transition/certify with ISO 9001:2015	○	○	○	○	○	○
The 3-year transition process was planned and managed in an effective way	○	○	○	○	○	○
Our Certification Body provided us with effective support	○	○	○	○	○	○
Consultants provided us with effective support	○	○	○	○	○	○
Training was helpful	○	○	○	○	○	○
Our organization involved its customers in the ISO 9001:2015 transition process	○	○	○	○	○	○
Our organization involved its services providers in the ISO 9001:2015 transition process	○	○	○	○	○	○

2.8. Which were the new/reinforced ISO 9001:2015 approaches that your organization considers more beneficial?

□ Adoption of HLS Structure
□ Organizational context determination
□ Identification of the relevant interested parties and their relevant requirements
□ Adoption of risk-based thinking
□ Integration with other Management Systems
□ Management of changes
□ Organizational knowledge
□ Other

3. Role of Respondent

□ CEO (Chief Executive Officer)/ General Manager
□ COO (Chief Operational Officer)/ Operations Manager
□ CFO (Chief Financial Officer)/Financial Manager
□ Quality and/or Organizational Excellence Manager
□ Manager
□ Expert / Specialist
□ Assistant
□ Other

Thank you very much!

Please press "Submit".

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Article

Implementing Key Performance Indicators and Designing Dashboard Solutions in an Automotive Components Company: A Case Study

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Abstract: In the context of highly competitive markets, organizations face dynamic challenges, requiring effective solutions to maintain and enhance their competitive standing. Performance measurement, supported by advanced information systems, is critical for organizational improvement. This study involves the implementation of key performance indicators (KPIs) within an automotive components company. Insights from employees across various departments were gathered for the development and deployment of 22 new KPIs across the Purchasing, Sales, Logistics, Quality, Human Resources, Occupational Health and Safety, Research and Development, and Finance departments of the company. The new indicators implemented were applied to all the group's companies and standardized throughout the companies' group. As a result, the implementation of new indicators and the consultation of graphs and visual elements present in the dashboards developed using Power BI enabled senior managers to make detailed and precise analyses, which led to faster and more considered decisions. It also enabled senior managers to make comparisons between the results of the group's different companies by looking at dynamic, interactive graphs. The methodologies and tools discussed (KPIs and dashboards) have broader applications across different industries, highlighting the relevance and versatility of KPIs and dashboards in organizational performance management.

Keywords: key performance indicators (KPIs); surveys; dashboards; Power BI; organizational performance; operations design

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1. Introduction

The implementation of key performance indicators (KPIs) and the development of dashboards have been critical challenges for organizations looking to optimize their processes and achieve greater efficiency.

Throughout this case study, we endeavored to implement new indicators for each department of the automotive components companies' group, since measuring performance through KPIs is essential for companies to make informed and strategic decisions. Today, in an increasingly evolved context, where digitalization and automation predominate, the ability to monitor and analyze data in real time is increasingly important (Cruz Villazón et al. 2020; Schrage et al. 2024). Thus, solving this problem is vital for companies' competitiveness, since KPIs that are well-defined and displayed on dashboards allow for a dynamic and proactive approach, which is essential for adjusting and improving a company's departments (Kaganski et al. 2018).

Several studies have shown that the application of methodologies such as AHP, Lean, and machine learning are effective for implementing new indicators, but they are often complex and require advanced technical knowledge (Kodali and Chandra 2001).

In this context, the solution proposed in this study was based on carrying out surveys since this methodology offers a practical and accessible alternative, where the surveys were distributed among the heads of departments and some of the companies' employees, ensuring that the responses were useful in meeting the proposed challenge.

This method stands out for the fact that it involves employees in the process of defining the KPIs, thus promoting greater acceptance and commitment to the indicators implemented. It also allows KPIs to be customized according to a company's characteristics, an aspect that many other approaches are not always able to offer.

Compared to other approaches, the use of surveys provides a more flexible and less technical solution that can be adapted quickly to the specific needs of each organization.

The active participation of employees in the choice of KPIs also promotes a culture of continuous improvement and responsibility, aspects that are crucial to the long-term success of companies.

From an academic point of view, this study contributes to the development of knowledge around performance management by demonstrating a practical and participatory approach related to the implementation of KPIs in an industrial context.

This case study provides empirical evidence to support the involvement of employees in the process of defining KPIs, improving employee acceptance and commitment.

Furthermore, this study addresses a gap in the current literature by integrating emerging technologies such as Power BI to facilitate real-time data analysis and visualization, thus offering a modern perspective on how digital transformations can impact the management of organizations.

Professionally, the results of this study are highly relevant to managers and decision makers in both the automotive and other industries.

In this way, this study offers a viable solution for companies looking to improve their performance measurement systems without the need to resort to complex and technically demanding methodologies. This approach consists of using surveys to gather the perspectives of employees from various departments, thus ensuring that KPIs are adjusted to a company's needs and characteristics, promoting a spirit of responsibility and collaboration among all those involved.

As such, this proposal aims to ensure that all participants feel valued and involved in defining KPIs. In addition, the research work also explores the integration of emerging technologies, such as the Power BI tool, to create data visualization solutions that promote more efficient and virtual business management. It is, therefore, recognized that this approach provides senior managers with a cohesive basis for making informed, strategic decisions based on the analysis of data presented via dashboards.

Thus, this study makes an academic and professional contribution by providing a participatory and integrated approach with new technologies for implementing KPIs. In this way, this approach not only improves the performance and competitiveness of organizations but also promotes a culture of continuous improvement.

2. Literature Review

This section of the article includes a review of the literature about key performance indicators (KPIs). During this review, some definitions of KPIs are given, and the four types of performance measures that exist are presented. In addition, the importance of performance measurement for organizations is presented, and some common mistakes that are made when using KPIs are highlighted. Finally, some practices and techniques that allow for the successful implementation of key performance indicators in a real-world context are discussed.

2.1. Key Performance Indicators

Globalization and the intense competition that organizations face today have created a different business environment for companies (Koh et al. 2007). Organizations are forced to work in the face of high and fierce competition, with reduced budgets and, above

all, under strong pressure in terms of the prices they charge. All of this means that companies have to deal successively with various indicators across different business areas (Shahin and Mahbod 2007).

As a result, different companies and organizations measure a variety of elements. This measurement is carried out by institutions to keep them on the right track and, above all, to realize where they can improve, always in line with the strategy they have defined (Keyte 2018). In this way, KPIs are referred to as quantifiable and strategic measures that reflect a company's success (Zhu et al. 2017). KPIs can be defined as quantifiable or qualifiable measures that enable organizations to assess their effectiveness, with a focus on achieving strategic and operational objectives. These indicators are commonly used by managers and executives to determine whether they are complying with the previously defined strategic plan (Hedvičáková and Král 2019). In a way, these indicators can also be used by industry to evaluate an individual's success and effort concerning the work they do (Bishop 2018).

There is, therefore, a great need today on the part of organizations to understand what key performance indicators are, as it is common for companies to have aggregate KPIs with ill-defined tasks and metrics that make it difficult to understand what an indicator is (Keyte 2018).

To remedy the incorrect use of these indicators, Parmenter (2010) presented four types of performance measures. There are, thus, four types of performance measures:

- Key Result Indicators (KRIs): responsible for demonstrating the results achieved by an organization and, in this way, showing how the organization has met its challenges;
- Result Indicators (RIs): These indicators report on what has been achieved;
- Performance Indicators (PIs): fundamental for indicating what the organization needs to do;
- Key Performance Indicators (KPIs): show the company what it needs to do to increase performance. In this way, it is possible to distinguish between the different performance measures, given the different information that each one conveys.

2.2. The Importance of Performance Measurement

In this day and age, measurement must be timely, since a key performance indicator provided to senior management a few days late can become useless (Parmenter 2010).

In this way, KPIs not only support the execution of the organization's strategy but also make it clearer and make it possible to correct any deviations that may arise concerning what has been outlined by monitoring data (Matos 2021). In this way, indicators make it easier to manage companies and are responsible for identifying and aligning strategy with initiatives and ultimately realizing it.

In short, organizations do not rely solely on financial information to make decisions so KPIs become an essential monitoring tool.

In other words, from these indicators, companies can not only observe the financial component but also another set of factors that may or may not lead to success.

Therefore, a correct collection of indicators allows organizations to steer their path toward success (Matos 2021).

2.3. Mistakes Made with KPIs

It sometimes takes organizations a while to realize that many of their problems related to performance measurement stem from some harmful habits, and so it is essential to lose them if organizations are to stay on the right track (Kerzner 2017).

In this way, seven bad habits related to KPIs have been highlighted. The first relates to the fact that companies use vague words to articulate the organization's objectives.

That is, many organizations resort to a fusion of words such as "effective", "efficient" and "sustainable" to describe their strategies.

Although these words convey some degree of importance, they are not important because they do not communicate something that can be verified in a real context. It is,

therefore, essential to define goals clearly and simply, which allows people to visualize the idea of what is required, thus allowing them to be measured. The second habit is linked to brainstorming to achieve indicators. Although brainstorming generates a lot of ideas, it rarely produces good measures as it does not require much knowledge on the part of all those taking part. Another recurring bad habit with KPIs has to do with people's acceptance of the indicators. This habit is quite common, as many people associate indicators with a boring data collection routine and are often afraid of the comparisons that might be made. It is, therefore, essential that this process is seen as a natural activity at work and that all these data are only used to obtain feedback.

One of the other undesirable behaviors associated with KPIs is the assumption that everyone is familiar with how to implement the measures.

Thus, it is important to define performance indicators that are enlightening and, above all, avoid wasting time and misinformation.

The fifth behavior relates to the use of performance reports. Performance reports are crucial when they provide content that matters to managers, but this is not always the case because the layout of the reports is often unorganized, thus diverting the manager's interest.

The penultimate habit is associated with the performance comparisons that are commonly made in organizations, namely comparing the current month's performance with that of the previous month.

According to the author, performance is something that is constantly varying so comparing performances will always result in a difference, which does not allow concrete conclusions to be drawn. The last habit is that organizations often deal with performance reports in isolation from planning and defined strategies.

This process is recurrent and wrong since performance measurement is connected to management processes (Kerzner 2017).

Still along these lines, Marr (2021d) pointed out some common mistakes that organizations make with key performance indicators. According to Marr (2021d), the lack of alignment between KPIs and organizational strategies is one of the main problems. It is also pointed out that there is often a trend to measure everything easy to measure, leading to a practice of evaluating only what "moves and moves". Another error identified is the selection of measures that are used by other organizations, without considering the context of the organization itself. In addition, Marr (2021d) mentions that not separating strategic KPIs from other data and linking KPIs to incentives are common mistakes when defining indicators. Thus, it is also highlighted that useful knowledge is not extracted from KPIs and that KPIs are often neither updated nor questioned. Finally, a significant error usually occurs because action is often not taken based on the data provided by the KPIs.

2.4. Implementing Key Performance Indicators

The process of selecting KPIs involves identifying them to see which ones are most appropriate and relevant and, above all, identifying those that meet the interests of organizations in the various areas that make up industries today.

There are several methods adopted by companies to identify KPIs, such as literature reviews, interviews, and questionnaires.

Many scientific publications, particularly review articles, present some examples of indicators for different business areas, obtained by reviewing the literature. Interviews are a common technique for identifying indicators to be used in a specific company or area. The use of this method is common because it provides a better understanding of solutions to a particular problem (Andersson and Thollander 2019). In addition to literature reviews and interviews, questionnaires are also another indispensable tool for identifying KPIs.

The use of questionnaires at the same time as interviews makes it possible to obtain a broader view, i.e., both quantitative and qualitative information that is fundamental to the indicators (Andersson and Thollander 2019). Therefore, to effectively implement key performance indicators, it is essential to adopt methodologies that ensure significant results. Given the importance of KPIs, Marr (2021b) also presented ten steps to consider guaran-

teeing the successful implementation of key performance indicators. The first step begins with defining the strategy. In this initial phase, it is important to define the company's strategy clearly so that it is understood by everyone involved. In the second stage, the author stresses the importance of identifying the questions to which the organization needs answers, which Marr (2021b) defines as KPQs (Key Performance Questions).

In this way, a KPQ can be understood as a management question that captures what managers need to know when it comes to strategic objectives.

KPQs are, thus, fundamental, as they direct the attention of those involved to what needs to be analyzed (Marr 2021e). In this way, KPQs are in some ways more important than the KPIs, since it is through these questions that the information and data needed to answer them are identified, thus helping to select the most appropriate indicators (Marr 2021e). Having said this, Marr (2021a) presented six steps for constructing effective Key Performance Questions.

The steps are as follows (Marr 2021a):

- Start the process taking into account the organization's strategy;
- Involve the people linked to the strategic objectives in the development of KPQs;
- Define the KPQs as open questions to obtain more detailed answers;
- Focus KPQs on the present and future;
- Develop clear KPQs, i.e., do not make them difficult to understand;
- Improve the KPQs as they are used.

In this way, the process proves to be fundamental since these questions will force the people involved to realize what data they will need to collect to obtain the answers and consequently help identify the KPIs that are needed. Next, in the third step, the author advises realizing and identifying the data that will be needed to define the KPIs and metrics that will be used to answer the questions (KPQs) selected earlier. The fourth step consists of checking what data and methods are already being used in the organization to improve them so that they can deliver what is desired.

The fifth step is to collect and select the right data, i.e., only the data that have the potential to provide information relevant to the organization's strategy.

The sixth stage, defined by Marr (2021a) as "Determining the appropriate measurement methodology and frequency", consists of realizing which measurement methodology is the right one. For this reason, the author stresses that it is always appropriate to decide on the frequency of measurement concerning how and when the data are used within the organization since all data have an expiry date. It can, therefore, be concluded that data must be collected and consequently presented at the right time so that they do not lose their impact. The seventh step consists of assigning responsibilities to the KPIs. In other words, you need to define a person responsible for interpreting the meaning of each KPI and managing it. Another responsibility is linked to data collection. In this way, the person responsible for transferring data from one database to another or even collecting them manually should always be defined. Although this data collection process can be done by hand, nowadays, some technologies make it possible to automate this process, making it more reliable. In the eighth phase, the author stresses that everyone within the organization must understand the importance of the KPIs and, above all, feel involved so that everyone is on the same path and the objectives set are achieved.

The penultimate stage centers on understanding the best way to communicate KPIs. Often, KPIs are reported in lengthy reports made up of various numbers, tables, and graphs, which, in a way, make the process of analyzing difficult and those responsible lose interest. It is, therefore, essential to create a way of presenting the KPIs in such a way that the interested parties clearly understand what you want to convey. The final step focuses on reviewing the key performance indicators. The author argues that it is essential to frequently review the KPIs being used to ensure that they are useful and not a waste of time for organizations.

3. Methodology

To apply the knowledge described above, this study was carried out in a companies' group, the Automotive Compounding Industry (ACI). This organization is responsible for the production of various polymeric compounds, such as Polyvinyl Chloride (PVC), Polyethylene (PE), Polypropylene (PP), and Silicone, which are then used in the coating of electrical cables that are subsequently used in the automotive sector. The ACI group is currently made up of five companies, which are based in various countries, such as Portugal, México, Tunisia, Romania, and China. For this study, the company in China was not considered, focusing only on the other group companies. The aim was to define and implement key performance indicators (KPIs) in all the departments of the companies' group and to use Business Intelligence (BI) solutions, specifically Power BI, to monitor and visualize company performance. Based on a review of the literature on KPIs, it reveals their importance in industrial environments and so a method was identified, developed by Oliveira (2017), based on the assumptions of Marr and Parmenter. This method included the selection of indicators, involving the opinion of employees. The method involved carrying out surveys with Key Performance Questions (KPQs), which were ranked from 1 to 5 according to the importance each person attached to having answers to the questions presented. Several KPQs were presented which contained associated KPIs and, in this way, the indicators whose KPQs obtained the highest ratings were implemented. After analyzing this method, it was concluded that it could be adjusted to ACI, thus enabling the established objectives to be achieved. The next section describes the application of this method in detail.

In addition to carrying out the surveys, this case study sought to develop dashboards, using the Power BI tool, which would make it possible to see the indicators already used by the companies and, above all, the new indicators implemented. So, a way of displaying the indicators was developed, since, until now, there had been no way of presenting the indicators that provided a detailed and quick interpretation and analysis of the data.

Thus, carrying out the surveys was essential to identify and implement new indicators. This process was crucial for creating the visualization panels, as these were built based on the indicators already in use and on the new indicators.

In addition to the surveys, this case study focused on the development of dashboards in all the group's companies, using graphs and visual elements that are essential for decision makers to be able to consult the indicators at any time and in any place and, thus, make more considered and fact-based decisions.

4. Case Study

During this case study, the method identified above was placed into practice to implement new indicators and standardize them across the group. Initially, 10 meetings were held with the heads of each department in the companies' group to identify the indicators currently used by the company in Portugal, as well as other information related to the frequency of measurement and the display of the indicators. For the other companies in the group, all this information was collected via email. After an initial analysis, it was realized that only the numerical values of the KPIs were presented on Excel sheets, and there were also differences between the indicators used by the companies in the group, which made it difficult to analyze and interpret them. Thus, all the companies in the group were divided into departments, without hierarchization, as there was no number of employees to justify this division. The division into departments is the same for all the factories except for the Research and Development department, which only exists at ACI Portugal. Thus, the division of departments is represented in Figure 1.

In the context of this study, KPQs were developed, which were associated with indicators that are normally used throughout the departments that make up the companies in this group. To give an idea of the type of questions that were asked, below are some examples of the KPQs presented. In the Quality department, questions were asked: "How are we coping with product returns?" and "How has the product rejection rate evolved

over time?". An example of these questions asked in the logistics department includes the following: "How has supplier performance been?" and "What efforts have been made to reduce order cycle time?".

Concerning the purchasing and sales department, some of the KPQs presented were as follows: "What has been the sales behavior of the company as a whole?" and "What has been customer satisfaction with our products?". Thus, each of the KPQs was then rated by the employees using surveys using Microsoft Forms to ease the answering process and collecting the data. The surveys took place during March 2024, and 54 responses were obtained out of the 60 that were sent, resulting in a high participation rate.

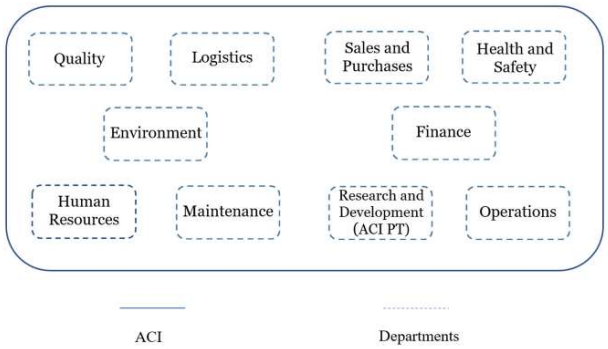


Figure 1. Division by departments.

This study, thus, had a total of 54 respondents. This number is because the questionnaires were specifically targeted only at people whose answers were considered essential to the topic in question, in this case, KPIs, and therefore required an appropriate level of knowledge. The respondents selected were mainly the heads of the departments of each company in the group, as well as other employees in those same departments; in this case, engineers and people with relevant positions throughout the companies were selected.

The limitation to 54 respondents across the four companies studied is due to their organizational structure, where, in some cases, the departments are made up of just one or two people, and in other cases, the same person takes responsibility for more than one department. Also, concerning the selection of respondents, it should be emphasized that the choice was made in conjunction with the company´s general manager, due to his in-depth knowledge of the employees, thus enabling him to identify those who could make a significant contribution to the study.

After carrying out the surveys, it was decided that the indicators whose KPQs had obtained an overall average rating of more than 4 would be implemented whenever possible. All the results obtained are presented and analyzed in the next section.

5. Results

Throughout this section, the answers obtained in the surveys are presented, and the results are analyzed to identify the KPIs that received higher ratings, in this case, higher than 4. From this analysis, it was possible to define new KPIs. Since, in some cases, some KPQs had KPIs associated with them, which were already used by companies, the fact that they obtained a high rating reinforced the importance of continuing to measure these same indicators.

Regarding the responses to the surveys, all the answers were collated in an Excel sheet. In this Excel sheet, the ratings obtained for each of the questions were entered for each department of the companies in the group, and then the average of the ratings obtained for each question was calculated for each department. This process was carried out for

each company in the group, and then the overall average was calculated for each question, i.e., considering the averages for each company and, thus, obtaining an overall average of the ratings obtained for each of the questions. The entire data analysis process was carried out in Excel, and all the questions that obtained an overall average of more than 4 were considered. The overall average ratings obtained throughout each department are represented in Figure 2, with questions that obtained an overall average higher than 4 in green.

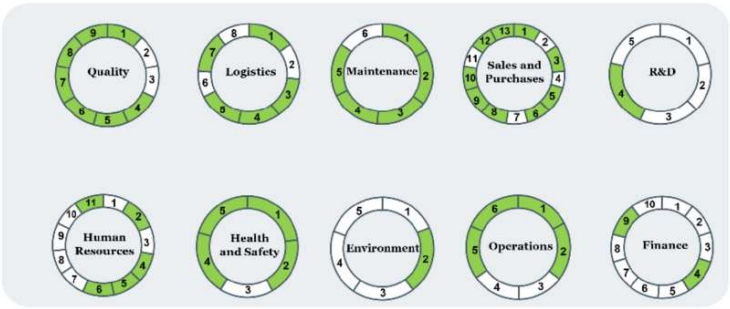


Figure 2. Results obtained from the surveys.

Analyzing the average scores of the questions, it was found that most questions obtained scores close to 5. Since the objective was to select just a few indicators, the results were discussed with the general manager so that the most accurate KPIs could be implemented. Therefore, it was decided to implement indicators that were easy to calculate and interpret to motivate employees and ensure that the indicators were understandable to anyone analyzing them. In general, many questions throughout each department obtained an average rating above 4. However, there are some exceptions, such as the R&D department and the Environment department, where only one question had an overall average higher than 4.

In the case of the R&D department, a meeting was held with the head of the department, where it was communicated that many of the KPQs presented in the research referred to KPIs that, in their view, did not make much sense to be measured, since some of them addressed issues that the company has no control over and, therefore, would not even be possible to measure and address. This situation was, thus, highlighted by Neely et al. (2005), where they both emphasized that the relevance of indicators is crucial to ensure that they truly reflect the areas that need to be monitored and improved. According to the authors, the lack of alignment between the indicators and the department's specific objectives can lead to their rejection, as was partly observed in the R&D department. Concerning the Environment department, many of the KPQs presented referred to indicators that were already used by the companies. Thus, it was interpreted that there may not have been a correct understanding on the part of employees about what was intended with the inquiries, and, therefore, only one question received an overall average rating above 4.

Regarding the Logistics department, as mentioned, in addition to the classifications obtained, a suggestion for a KPI to be measured was also obtained. This KPI was not presented during the research and was suggested by one of the collaborators. This indicator was entitled "Deliveries planned vs. Realized" and was considered quite relevant to the area. Thus, it was also implemented to convey to respondents that their opinions were considered and, in this way, were involved in the company decisions.

As Parmenter (2010) mentioned, it is important to involve employees in defining KPIs, as this process can increase employee commitment and ensure that the indicators are perceived as relevant and valuable. The KPI "Deliveries Planned Vs Realized" exem-

plifies the effectiveness of involving employees in creating metrics that really meet the department's needs.

Although, in the literature, it is not advisable to measure many indicators but rather those indicators that are relevant, the Sales and Purchases department was treated differently compared to other departments. After a meeting with the general manager, it was realized that in the case of the Sales and Purchases department, another type of information and more information would be needed. Therefore, after analyzing the data from this department, it was observed that almost all issues were seen as important, and, thus, eight different indicators were implemented throughout this department.

This is in line with Stephen Denning (2018), who state that, in some contexts, the inclusion of multiple indicators can be beneficial to capture the complexity of operations and provide a comprehensive view of performance.

As for the other departments, as previously mentioned, some questions associated with indicators already used were presented, and there were examples of indicators that were only maintained; that is, they also obtained a high rating, meaning that it would be important to continue measuring these same indicators. This situation occurred predominantly in the Maintenance and Environment department.

After this analysis, 22 new indicators were implemented across seven departments, including Quality, Logistics, Sales and Purchases, Human Resources, Occupational Health and Safety, Research and Development, and Finance.

In summary, Table 1 presents the new indicators implemented in each department of the companies' group.

Table 1. New KPIs implemented in ACI.

Department	KPI
Quality	% quantity of rejected product Non- quality costs (returns)
Logistics	OTIF (On Time In Full) Supplier Performance Planned vs Realized deliveries
Sales and Purchases	Total sales by product family Gross Margin by product family Costs savings Conversion rate of potential customers into actual customers Customer satisfaction Business Opportunities Customer visits Participation in fairs
Human Resources	Efficiency of the recruitment process Qualification level Number of collaborators by gender
Occupational Health and Safety	Frequency index Severity index Average time between accidents PPE utilization rate
Research and Development	Average development time for new products
Finance	Revenue growth rate

Thus, it was also essential to define how to calculate each of them. As for new indicators, it is crucial that everyone understands what each conveys so that it can be useful for the organization and, in this case, for each department. Table 2 includes the formulas that allow for the calculation of the implemented KPIs.

Table 2. Calculation formulas for the new KPIs.

KPI	Formula
(1)	$\frac{Defective\ product\ (ton)}{Total\ Produced\ (ton)} \times 100$
(2)	Sum of all costs
(3)	$\frac{N\ orders\ OTIF}{N\ Total\ deliveries} \times 100$
(4)	$\frac{products\ delivered\ on\ time}{Total\ product\ received} \times 100$
(5)	$\frac{N\ of\ deliveries\ made}{N\ of\ planned\ deliveries} \times 100$
(6)	Total sales sum in euros
(7)	$\frac{Total\ revenue - cost\ of\ goods\ sold}{Total\ revenue} \times 100$
(8)	$\frac{Current\ price - initial\ price}{initial\ price}$
(9)	$\frac{actual\ customers}{potential\ customers}$
(10)	Conducting customer surveys
(11)	Recording number of business opportunities
(12)	Recording number of visits
(13)	Recording number of participations
(14)	$\frac{N\ of\ hires}{N\ of\ candidates} \times 100$
(15)	$\frac{N\ of\ qualified\ employees}{Total\ number\ of\ employees} \times 100$ (considering at least a bachelor's degree)
(16)	Indicate only the number
(17)	$\frac{N\ of\ lost-time\ accidents \times 10^6}{N\ of\ man-hours\ worked}$
(18)	$\frac{N\ of\ lost\ business\ days \times 10^3}{N\ of\ man-hours\ worked}$
(19)	Record the dates of all accidents that occurred and subtract the days between accidents.
(20)	$\frac{N\ of\ workers\ using\ PPE}{Total\ number\ of\ workers} \times 100$
(21)	$\frac{Total\ time\ involved\ in\ new\ products}{Total\ number\ of\ products\ developed} \times 100$
(22)	$\frac{Current\ month\ revenue - Previous\ month\ revenue}{Previous\ month\ revenue}$

Difficulties Encountered with the Implementation of KPIs

This study, as mentioned throughout this work, aimed to identify new KPIs for the companies' group, essential for monitoring organizational progress. However, the task proved challenging, as the group's companies already measured several important indicators. As a result, the search for new indicators required careful attention to avoid disruptive changes and keep employees motivated. Through the literature, it was possible to identify some indicators that are frequently used throughout each identified department.

However, the implementation of each of them was difficult, as many KPIs suggested in the literature are general and do not adapt to the specific context of an organization, as mentioned by Marr (2021d). One of the most common mistakes in implementing new indicators is selecting the same measures that other organizations measure.

Another aspect to highlight that caused some difficulty was the fact that, in some departments, there was a lack of different perspectives because they were made up of just one person and, in this way, limited the analysis that was carried out. The lack of suggestions was also an issue, but it is understood that questions, KPQs, were presented instead of KPIs throughout the surveys, also meaning that not many suggestions were obtained, and, in this way, it would have been easier to have asked about those which directly indicate the KPI.

Another major difficulty was the fact that some employees did not understand exactly what was intended with the surveys and did not answer as required. However, although these difficulties were witnessed and although not all departments implemented new

indicators, dashboards were developed for all of them, optimizing the visualization and interpretation of indicators.

6. Developing Dashboards for Each Department

6.1. The Importance of Dashboards and Their Advantages in Monitoring KPIs

Over time, dashboards have emerged as a solution for displaying indicators due to their effectiveness in visually presenting critical data. One of the main advantages of visualization dashboards is the clear and integrated data visualization they provide.

According to Jack G. Zheng (2017), dashboards provide an efficient way of consolidating and presenting complex data intuitively, allowing managers to identify errors. This ability to summarize data visually is essential for quick and accurate decision making. In addition, dashboards offer real-time updates, which are crucial in an increasingly dynamic business environment. According to Fernandes et al. (2021), the ability to access up-to-date data instantly allows managers to respond quickly to changes and operational challenges. Thus, dashboards that integrate data from different sources ensure that information is always up to date and accurate. On the other hand, dashboards have another strong point related to personalization. A study by M. Elias (2012) showed that it is possible to adapt dashboard visualizations according to a company's specific needs, increasing the relevance of the information presented and improving the efficiency of data interpretation.

According to a study developed by Yigitbasioglu and Velcu (2012), interactive dashboards allow users to explore data in greater depth, applying filters and adjusting visualizations as necessary. This interactivity makes it easier to analyze and discover valuable insights that would not be possible with static reports.

Another aspect of visualization dashboards is that they integrate with other tools and business systems. Fernandes et al. (2021) pointed out that modern dashboards can be integrated with a wide variety of management platforms, providing a holistic view of organizational performance.

Finally, the mobile accessibility of dashboards, as discussed by Merendino et al. (2018), ensures that managers can monitor indicators at any time and from anywhere, this flexibility being fundamental in an increasingly dynamic and interactive world.

6.2. Development of Dashboards in the Companies' Group

Once the KPIs had been defined for all departments, Power BI was used to build visualization panels that would allow the indicators to be better understood and monitored. In this way, what was envisioned was the creation of dashboards that presented the KPIs clearly and appealingly and where senior managers could consult the performance of each organization in the group in real time, anywhere, and using their devices. Therefore, Excel tables were developed for each department to be filled in with the respective KPI values. The new tables developed underwent only a few necessary changes concerning the previous tables that were already being used by the company in Guarda, but they were not disruptive so that those responsible for filling in the data would not feel a really big change, thus preventing them from no longer being filled in. In this way, files were implemented so that all the necessary information could be filled out in Excel and then transferred to Power BI correctly.

Thus, a connection was set up between Power BI and the new Excel sheets developed for filling in KPIs, so that the collection of Power BI data from Excel was carried out automatically, i.e., whenever the data in Power BI were constantly up to date. Since the indicators have been standardized across the group´s companies, the dashboards are similar, with only a few differences between some of them. These differences occur particularly in the Operations (Production) and Maintenance departments, because the group´s companies do not all produce the same polymer compounds, nor do they have the same number of machines/lines.

The following three figures show three examples of the dashboards developed. In this particular case, Figure 3 represents the dashboard for the Maintenance department, Figure 4 represents the Logistics dashboard, and Figure 5 represents the Operations dashboard.

To create each of the dashboards, graphics were used that were deemed appropriate for each indicator, and, above all, they were organized in such a way as to make them easier to understand. In this way, the visualization panels developed for ACI Portugal are represented, but it is important to stress that in the following figures, the values shown are hypothetical, i.e., they are fictitious values that were assigned to each indicator so that it would be possible to present the dashboards developed, thus safeguarding the information of the company in question.

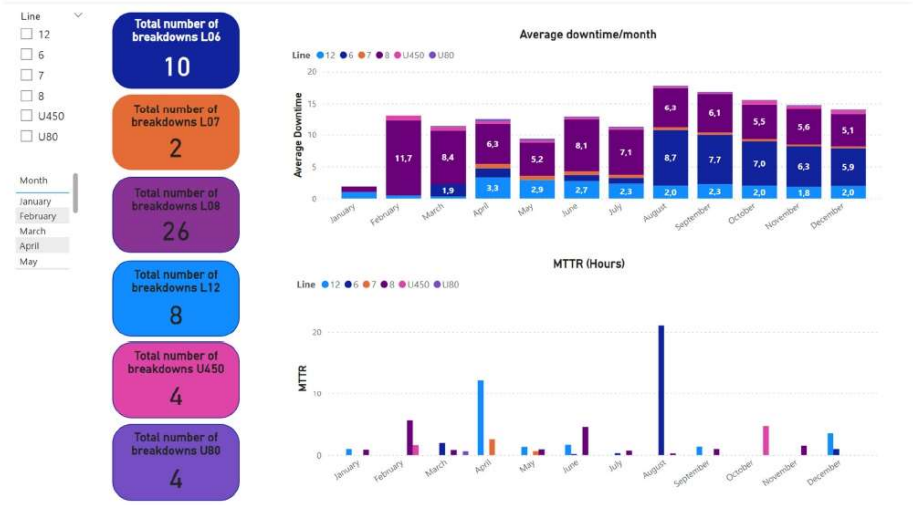


Figure 3. Dashboard developed for the Maintenance department.



Figure 4. Dashboard developed for the Logistics department.



Figure 5. Dashboard developed for the Operations (Production) department.

7. Discussion

The results of this study showed that the implementation of new KPIs across several departments was successful. Most of the KPIs evaluated received high ratings, indicating that they were considered relevant and effective. Common indicators such as MTBF, MTTR, and OEE received high ratings, thus reinforcing their importance in measuring performance. In addition, the new KPIs that were implemented were also evaluated, with other less common indicators receiving high ratings, suggesting that all the new KPIs that were implemented were seen as an asset.

The results indicate that the introduction and positive evaluation of the new KPIs corroborate the idea that adapting and continually updating indicators are crucial for organizational effectiveness. The high ratings obtained for the indicators already measured by the companies show that these indicators are effective in terms of the information they provide, thus going against what is advocated by Marr (2021c), where the author defends the continuity of indicators that ensure operational stability. On the other hand, the introduction of new KPIs demonstrates a positive response to needs, in line with the literature, which emphasizes the importance of adapting indicators to the specific conditions and challenges of each area (Neely and Haines).

In this way, analyzing the results of this study demonstrated the importance of aligning indicators with the overall strategy of companies. The theory highlights that KPIs should reflect and support an organization's strategic and operational objectives, and this study reinforces this perspective by showing that the clarity and relevance of KPIs are crucial to ensuring that these indicators do not just measure performance but contribute to achieving objectives.

The inclusion of KPIs suggested by employees, as observed in the Logistics department, reinforces (Parmenter 2010) the idea regarding employee involvement in the creation of metrics. This study, thus, contributes to the literature by demonstrating that the active participation of employees can increase their commitment to the indicators implemented.

On a more practical level, applying a structured process for defining KPIs, including analyzing feedback and considering the needs of each department, has resulted in more

effective metrics aligned with company objectives. So, this approach can serve as a model for other organizations looking to optimize their measurement systems.

The development of dashboards was also a significant practical contribution. The creation of visual tools for monitoring performance enables indicators to be analyzed more quickly and more comprehensibly, facilitating decision making. Thus, this practical aspect exemplifies how technology can be used to improve performance management.

In conclusion, this study makes valuable theoretical and practical contributions to performance management. Theoretically, it reinforces the importance of aligning KPIs with the organizational strategy and involving employees. On a practical level, it offers a model for defining and implementing indicators, as well as examples of personalized dashboards, which are essential for performance management. All these contributions can, therefore, guide other organizations in improving their performance and implementing effective management practices.

8. Conclusions

The search for better management and monitoring of organizational performance has gained substantial interest given the technological advances that have taken place in an increasingly demanding world. Thus, the implementation of KPIs combined with the development of visualization dashboards has been a crucial strategy to respond to this interest. This study was carried out in the automotive industry, focusing on the implementation of new indicators for the departments of a companies' group and the development of dashboards using Power BI. Initially, meetings were held, and the data collected were analyzed to assess the situation of the KPIs in the group's organizations. It was found that there were departments with a lack of indicators, so there was a significant gap in the presentation of data.

Studies such as those by Stephen Denning (2018) have highlighted the importance of data visualization in making quick and informed decisions, and so the companies' group felt the need to improve this aspect.

To involve all employees in choosing the new indicators, surveys were carried out, a practice recommended by Fernandes et al. (2021), to ensure that the KPIs are relevant and well understood by all levels of the organization. The collection of responses allows one to implement of new indicators across the Sales and Purchase, Logistics, Quality, Human Resources, Occupational Health and Safety, Research and Development, and Finance departments. Additionally, it was possible to standardize the indicators across the companies' group, in line with M. Elias (2012) recommendations, which state that standardizing indicators allows for better consistency and comparability.

The design of visualization panels across all departments allowed for a better presentation and understanding of the indicators, in line with the conclusions drawn by Yigitbasioglu and Velcu (2012) regarding the importance of dashboards in the clarity with which data are transmitted. The dashboards developed in Power BI eased consultation regarding the indicators, through the availability of all kinds of data anywhere and at any time. They are crucial for managers to monitor performance continuously and effectively. Therefore, the implementation of new KPIs in seven different departments aligned with the development of dashboards throughout the companies' group, promoting continuous monitoring of operations and a clearer understanding of the information by decision makers.

9. Recommendations for Future Research

Although this study has made important progress in implementing new KPIs and creating dashboards in this specific companies' group, several areas can be explored in future research to deepen and broaden the results obtained.

One specific recommendation is to carry out questionnaires in which KPIs are presented directly, rather than KPQs, to obtain more precise and relevant suggestions from employees. This process can facilitate the identification of indicators.

Furthermore, it is suggested that a longitudinal study be carried out to monitor the impact of the implementation of new KPIs and dashboards over time. This approach will help assess the effectiveness of the indicators and identify opportunities for improvement.

Integrating a system of continuous employee feedback related to the usefulness and clarity of KPIs could also be an important study. On the other hand, investigating the use of advanced data visualization technologies such as artificial intelligence and augmented reality could also be pertinent, in that new ways of presenting and analyzing KPIs could emerge, making the information even more accessible and understandable.

Finally, it may be important to explore how the introduction of KPIs and dashboards impacts organizational culture and employee commitment. Qualitative studies can be beneficial in gaining valuable insights into the perception and acceptance of these tools, helping to ensure that their implementation not only improves organizational performance but also strengthens employee commitment and motivation. All these recommendations can, thus, contribute to the existing knowledge, offering new perspectives and approaches to managing and monitoring organizational performance.

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Service Process Modeling in Practice: A Case Study in an Automotive Repair Service Provider

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Abstract: The automotive industry, especially the after-sales service segment, faces significant challenges due to economic changes and market dynamics. In this context, the optimization of service processes becomes essential to increase the performance and profitability of organizations in the industry. However, there is a lack of research that specifically and in detail explores how to model service processes to improve performance in this sector. Most studies focus on general aspects of quality management or process optimization without addressing the particularities of after-sales services in the automotive industry. This paper aims to identify and analyze how to model service processes in an automotive repair service provider organization to increase performance and ensure customer satisfaction. This research was conducted using data from service activity reports and participatory direct observation within an automotive repair service provider organization. Statistical analysis of key performance indicators, such as productivity, efficiency, and customer satisfaction, was performed. This study identified several critical success factors and proposed concrete measures for shaping service processes, including optimizing resource allocation and customer communication, improving customer intake and communication, ensuring technical competence and procedural compliance, and improving the process of handing over and collecting feedback. The implementation of these measures can lead to increased efficiency, customer satisfaction, and, by extension, the financial performance of automotive repair organizations.

Keywords: process modeling; service performance; automotive industry; customer satisfaction; quality management; efficiency; profitability

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1. Introduction

The automotive industry is experiencing accelerated dynamics, particularly in the after-sales service sector, because of economic fluctuations and changing consumer preferences. The economic crisis has accentuated this dynamic, pushing customers towards the low-cost and second-hand car market segments. In this context, after-sales services have become a vital source of revenue and profitability for after-sales organizations.

Although there is an awareness of the importance of after-sales services, there is still a lack of research that specifically and in detail explores how to model service processes

to improve performance in this sector. Most studies focus on general aspects of quality management or process optimization without addressing in depth the particularities of after-sales services in the automotive industry.

Most studies analyze service processes in isolation, without considering the interdependencies between them and their cumulative impact on performance. Although there is research on process modeling in other industries, there is a need for specific studies that address the challenges and particularities of the automotive industry. Many scientific papers remain at the theoretical level, without providing concrete and applicable guidance for managers and practitioners in automotive service.

Based on the analysis of the level of performance related to the after-sales service department activity at the end of 2022, the scientific research aims to identify ways in which the service processes within the automotive repair service segment can be analyzed and subsequently modeled.

This study aims to make an original contribution by

- Analyzing service processes in a holistic way, considering their interconnections and their impact on overall performance.
- Investigating the specific challenges and opportunities of the automotive sector and proposing context-specific solutions.
- Translating research results in concrete and applicable measures to improve performance in automotive service.

By addressing these gaps in the literature, this study provides valuable insights for both academics and practitioners in the automotive industry. The development of a service process model tailored to the automotive repair service context represents a key contribution of this research.

The following research hypotheses were formulated to guide the study:

- Modeling service processes in an automotive repair service provider organization has a positive impact on efficiency and customer satisfaction.
- Optimizing resource allocation and customer communication positively influences the effectiveness of vehicle scheduling and reception processes.
- Ensuring technical competence and procedural compliance in the diagnosis and repair processes leads to improved service quality and reduced errors.
- Implementing a standardized handover process and actively collecting customer feedback enhances customer satisfaction and loyalty.

This paper is structured as follows: Section 2 presents a review of the literature supporting the trends and research gaps discussed in this introduction. Section 3 outlines the research methods employed in this study, including the data sources, analysis techniques, and model development and validation processes. Section 4 presents a detailed analysis of the service processes in an automotive repair service provider organization, identifies critical success factors, and proposes concrete measures for process modeling and optimization. Section 5 discusses the results of the study, highlighting the positive impact of process modeling on organizational performance. Finally, Section 6 concludes the paper with a summary of the key findings, implications for academics and practitioners, and directions for future research.

2. Theoretical Considerations

Performance in the automotive after-sales service context is a multidimensional concept that encompasses financial, operational, and customer satisfaction aspects. From a financial perspective, performance is reflected in indicators such as profitability, return on investment, and revenue growth.

Productivity and efficiency are two key indicators of operational performance, with the former measuring the utilization of available resources and the latter reflecting the ability to complete the work within the standard time allocated. Finally, customer satisfaction is a key performance indicator, reflecting the extent to which the customer's experience with after-sales services was positive and met or exceeded their expectations.

Process modeling is a systematic and structured approach to analyze, design, and optimize workflows and activities in an organization. In the context of automotive after-sales services, process modeling involves identifying, documenting, and improving the steps involved in service delivery, from the initial customer appointment to the completion of the repair and handover of the vehicle. The main goal of process modeling is to eliminate inefficiencies (as Crosby points out with the concept "Quality is free" [1]), reduce costs, and increase the quality of the services provided, thus contributing to the improvement in the overall performance of the organization.

Quality in the automotive industry is a critical success factor in both vehicle production and after-sales service. In the context of after-sales services, quality refers to the degree to which the services offered comply with technical and safety standards, meet customer requirements and expectations, and are provided in an efficient and professional manner. Ensuring quality of service involves diligence, use of original spare parts, adherence to working procedures, and continuous training of staff, as emphasized by Crosby's "Do it right first time" concept [1].

Customer satisfaction is a central concept in service marketing and represents the extent to which the customer's experience with after-sales services was positive and met or exceeded their expectations [2,3]. Customer satisfaction is influenced by several factors, including service quality, response time, effective communication, friendliness, and professionalism of staff, as well as price and perceived value of services. An important level of customer satisfaction leads to customer loyalty, positive referrals, and increased revenue and profitability for the organization, an idea also supported by Sevel and Brown in "Customers For Life" [4].

The literature abounds in studies demonstrating the positive correlation between process modeling, quality management, and organizational performance [5,6]. Drucker [7], in his work "On Decision Making and Effectiveness", emphasizes the role of effective managerial decisions and results orientation in achieving organizational goals [8,9]. Jenson [10], in "The Pyramid of Success", argues that organizational success is intricately linked to employee development and motivation, highlighting the importance of investing in human capital [11,12].

In the specific context of the automotive industry, Collins [2], in his book "Business Excellence", identifies several principles and practices that underpin successful companies, including discipline, strategic thinking, and a strong organizational culture. Imai [13] and Ohno [14] outline the principles and practices of the Toyota Production System, which revolutionized the automotive industry and can be adapted and applied to the after-sales service field, emphasizing the importance of eliminating waste and continuous improvement [15–18].

Oprean and co-workers [19] conducted several relevant studies on quality management, process analysis, and customer satisfaction in the automotive industry, emphasizing the importance of effective communication, complaint handling, and document quality assurance in the automotive repair process [20–25]. Authors such as [26–30] have made significant contributions in the field of experimental research and data processing, providing a sound methodological framework for the study of processes and organizational performance. Service activities in the automotive industry are subject to a multitude of internal and external factors that can influence organizational performance [31–33].

Internal factors include the aspects mentioned below:

Staff competence and motivation: Employees are an organization's most valuable resource, and their level of qualification and motivation has a direct impact on the quality of service and customer satisfaction [34–36].

Availability of spare parts and equipment: Ensuring an adequate stock of spare parts and modern, high-performance equipment is essential to respond promptly and efficiently to customer demands [37–39].

Efficiency of internal processes: Streamlining workflows, eliminating bottlenecks, and reducing waiting times contribute to increased productivity and improved customer experience [4,40].

Organizational culture: A customer-focused organizational culture that promotes the values of quality, innovation and continuous improvement has a positive impact on after-sales service performance [41,42].

External factors include the aspects mentioned below:

Technological developments: The automotive industry is undergoing a continuous technological transformation, and automotive services need to adapt quickly to modern technologies and train their staff accordingly [43].

Changes in regulations: Legislative and regulatory changes may impose new requirements and standards for automotive services, which may require additional investments and adaptation of internal processes [44].

Competitive pressure: Fierce competition in the automotive industry is putting pressure on service providers to offer quality services at competitive prices, which requires efficient cost management and a focus on innovation [45].

Customer expectations: Customers are becoming increasingly demanding and knowledgeable, expecting fast, personalized, and high-quality services [46]. Meeting these expectations is essential for the long-term success of an automotive after-sales service.

The economic context: Economic fluctuations can influence the demand for after-sales services, and automotive after-sales services need to be prepared to adapt to changes in the market.

Quality management is a strategic tool for increasing performance in automotive service organizations [47]. By implementing a quality management system, organizations can achieve the following:

Continuously improve processes and services: By identifying and eliminating the causes of non-conformances, organizations can constantly improve the quality of the services provided and prevent problems from occurring in the future [4].

Increase customer satisfaction and loyalty: By delivering high-quality services that meet or exceed customer expectations, organizations can build strong and long-lasting customer relationships [48,49].

Reduce costs and increase profitability: Eliminate waste, optimize processes, and increase productivity [1]. In addition, Daniels emphasizes the importance of performance management in aligning employee efforts with organizational goals and maximizing results [36].

The literature provides a solid theoretical foundation for the importance of process modeling and quality management in increasing after-sales service performance in the automotive industry [44,50–55].

Previous studies have explored various dimensions of performance, including operational efficiency, customer satisfaction, and financial performance. Some studies have focused on the impact of process modeling on specific operational metrics, such as productivity [56], cycle time [57], and error rates [58], while others have investigated the relationship between quality management practices and customer satisfaction and loy-

alty [59]. Additionally, several studies have examined the financial implications of process modeling and quality management, such as cost reduction, revenue growth, and profitability. While the specific results and dimensions explored can vary depending on the context, industry, and research methods employed, there is a consensus on the positive impact of these approaches on organizational performance.

In the context of globalization, strategic collaboration has become increasingly important for driving innovation and maintaining competitiveness [60]. The literature on innovation highlights two main approaches: the systemic approach, which emphasizes the broader innovation system, and the networks and inter-organizational relationships approach, which focuses on the role of collaboration between firms [60]. The latter approach supports the idea that innovation is not a linear process within a single firm but rather an evolutionary, non-linear, and interactive process established between the firm and its external environment [60].

As [60] argues, a wide range of agents, together with the firm's assets, contribute to acquiring external resources, knowledge, and information essential for developing productive and innovative activities. Relationships with science partners have a crucial role in promoting cooperation in innovative practices and stimulating product innovation [60].

These concepts are highly relevant to the automotive industry, where collaboration is increasingly important for developing new technologies and service solutions. For example, automotive service providers can collaborate with technology companies to develop advanced diagnostic tools, with parts manufacturers to optimize supply chains, or with online platforms to enhance customer service and engagement. By embracing strategic collaboration, automotive service organizations can foster innovation in their service processes, improve efficiency, and enhance customer satisfaction. While the literature provides a valuable foundation for understanding service processes and performance in the automotive industry, several critical gaps remain unaddressed.

First, there is a lack of research that specifically and in detail explores how to model service processes to improve performance in this sector. Most studies focus on general aspects of quality management or process optimization without addressing the particularities of after-sales services in the automotive industry.

Second, most studies analyze service processes in isolation, without considering the interdependencies between them and their cumulative impact on performance.

Third, although there is research on process modeling in other industries, there is a need for specific studies that address the challenges and particularities of the automotive industry.

Finally, many scientific papers remain at a theoretical level, without providing concrete and applicable guidance for managers and practitioners in automotive service.

This study aims to make an original contribution by:

Taking an integrated perspective: Analyzing service processes in a holistic way, considering their interconnections and their impact on overall performance.

Focusing specifically on the automotive industry: Investigating the specific challenges and opportunities of the automotive sector and proposing context-specific solutions.

Providing practical recommendations: Translating research results into concrete and applicable measures to improve performance in automotive service.

By addressing these gaps, this study provides valuable insights for both academics and practitioners in the automotive industry.

In summary, the literature review highlights the importance of process modeling and quality management in enhancing organizational performance in the automotive industry. Previous studies have explored various dimensions of performance, including operational efficiency, customer satisfaction, and financial performance. However, there is a lack of

research that specifically and in detail explores how to model service processes to improve performance in this sector. Most studies focus on general aspects of quality management or process optimization without addressing the particularities of after-sales services in the automotive industry. This study aims to address this gap by providing a comprehensive analysis of service processes in an automotive repair service provider organization and proposing concrete measures for process modeling and optimization to increase efficiency and customer satisfaction. This study is motivated by the need for practical and applicable guidance for managers and practitioners in the automotive industry to improve their service operations and achieve superior performance.

3. Materials and Methods

This scientific research adopts a mixed-methodological approach, combining both quantitative and qualitative techniques to gain a comprehensive understanding of the service processes and factors influencing performance in the automotive industry.

This research involved data collection and analysis over the period from January 2023 to June 2023. The primary data collection focused on the service activities and performance indicators during this period. To provide a comparative perspective and identify trends, data from the previous year (2022) were also incorporated into the analysis, particularly for evaluating changes in performance metrics.

3.1. Research Design and Data Sources

The research design involved a multi-stage approach:

1. Data Collection:

Quantitative data were extracted from service activity reports generated by the organization's electronic management system. These reports provided detailed information on key performance indicators such as productivity, efficiency, average repair time, and number of hours billed.

Qualitative data were collected through participatory direct observation.

To complement the quantitative analysis and gain a qualitative insight into the service processes, participatory direct observation was used. The authors spent time within the organization, observing and documenting workflows, interactions between employees and customers, and how different situations and challenges are managed. This allowed a deeper understanding of the operational context and the human factors that can influence performance.

The observation and evaluation of employee–customer interactions were guided by a framework focusing on the following parameters, derived from the literature on service quality and customer satisfaction [44,50]:

Communication: Clarity, completeness, and effectiveness of communication between employees and customers. Effective communication is essential for understanding customer needs, managing expectations, and building trust [51].

Empathy and Professionalism: Demonstration of empathy and understanding towards customer needs and concerns, and maintenance of a professional demeanor throughout the interaction. Empathy and professionalism contribute to a positive customer experience and enhance perceptions of service quality [52].

Problem-solving: Efficiency and effectiveness in addressing customer issues and resolving conflicts. The ability to effectively resolve problems is essential for maintaining customer satisfaction and loyalty, particularly in challenging situations [53].

Customer Focus: Extent to which employees prioritize customer needs and satisfaction. A customer-focused approach emphasizes the importance of meeting customer requirements and exceeding their expectations [54].

Process Adherence: Compliance with established service processes and procedures. Adherence to processes ensures consistency in service delivery and reduces the likelihood of errors or inconsistencies [55].

These parameters were derived from the literature on service quality and customer satisfaction and were used to systematically observe and evaluate the quality of employee–customer interactions.

Customer feedback was collected through questionnaires and other satisfaction assessment tools to understand customer perceptions of service quality.

Data Analysis:

Descriptive statistics, correlational analysis, and statistical tests were used to analyze the quantitative data.

Qualitative data were analyzed to identify themes and patterns related to service processes and customer interactions.

Model Development and Validation:

A service process model was developed based on the combined analysis of quantitative and qualitative data.

The model was validated through expert review and a pilot study.

The service process model was developed based on the combined analysis of quantitative and qualitative data. The model development process consisted of identifying the key stages of the service process, mapping the workflows, and analyzing the factors that influence process performance.

3.2. Purpose of Research Stages

Data Collection: To gather comprehensive data on service processes, performance indicators, and customer perceptions.

Data Analysis: To identify key factors influencing performance, uncover relationships between variables, and assess the statistical significance of findings.

Model Development and Validation: To create a robust and reliable service process model that can be used to guide improvement efforts.

3.3. Analytical Tools

Several analytical tools and techniques were used to analyze and interpret the data, such as the following:

Descriptive analysis: Calculating means, medians, and standard deviations to characterize and summarize the collected data.

Comparative analysis: Comparing data from different time periods (2022 and 2023) and service processes to identify trends and changes.

Qualitative data analysis: Identifying themes and patterns in the observational data and customer feedback to provide a context and explanation for the quantitative findings.

The analysis focused on identifying key trends and patterns in the data, rather than performing complex statistical modeling or econometric analysis.

3.4. Case Study Description and Rationale

The case study organization is a large, authorized dealership service center. It employs a significant number of technicians and service advisors and has a substantial number of service bays. The organization provides a comprehensive range of after-sales services, including routine maintenance, complex repairs, and warranty work.

This organization was selected due to its accessibility and willingness to provide detailed service activity reports. It represents a typical example of a large, authorized dealership service center in the region, making it relevant to the study's aim of understanding common service process challenges and improvement opportunities.

While this case study focuses on a single authorized dealership, many of the service processes and challenges identified (e.g., vehicle scheduling, customer communication, and parts management) are common across other types of automotive service providers, such as independent repair shops and multi-brand service centers. However, the specific implementation of these processes may vary.

A key limitation of this single case study is the limited generalizability of the findings. The results may not be directly transferable to smaller independent repair shops or service centers with different organizational structures or customer demographics. Further research involving multiple cases is needed to confirm the generalizability of these findings.

The large size of the case study organization may have led to a higher degree of formalization in its service processes compared to smaller workshops. This formalization could influence the effectiveness of certain improvement measures. Additionally, the focus on a single brand might affect the findings related to spare parts management and technical expertise.

3.5. Theoretical Framework

This section outlines the key theoretical concepts that inform our research and provide a framework for understanding our approach to service process modeling and performance improvement. Our study draws up several established theories and principles:

Service Process Management: Service process management involves the design, control, and improvement of service delivery systems to enhance efficiency and customer satisfaction. We utilize this framework to analyze and model the sequence of activities within the automotive repair service context, aiming to optimize resource allocation and workflow.

Quality Management: Quality management principles, such as continuous improvement, customer focus, and defect prevention, are integral to our approach. We emphasize the importance of adhering to standards, minimizing errors, and consistently meeting customer expectations to achieve service excellence.

Performance Management: Performance management theories guide our selection of key performance indicators (KPIs) and our methods for measuring and evaluating the impact of service process improvements. We assess performance across multiple dimensions, including operational efficiency, customer satisfaction, and financial outcomes.

Lean Principles: Where applicable, lean principles, derived from the Toyota Production System, inform our strategies for eliminating waste, streamlining processes, and maximizing value for customers. We seek to identify and remove non-value-added activities to enhance productivity and reduce turnaround times.

4. Service Process Analysis and Modeling

Our approach to service process modeling involved a combination of statistical analysis of service report data and participatory direct observation. The statistical analysis helped identify key performance indicators and their relationships with various influencing factors. The participatory direct observation allowed for a deeper understanding of the operational context and the human factors that can influence performance. This integrated approach enabled the development of a service process model tailored to the specific context of automotive repair services.

A thorough understanding of the key processes within the service department and the factors that influence them is essential to achieve the proposed objectives. This section presents a detailed analysis of the main service processes, identifies critical success factors, and proposes concrete modeling measures to increase efficiency and customer satisfaction.

The service process model presented in this study was developed based on a combination of statistical analysis of service report data and participatory direct observation.

The statistical analysis helped identify key performance indicators and their relationships with various influencing factors. The participatory direct observation allowed for a deeper understanding of the operational context and the human factors that can influence performance. The model was validated through a two-step process. First, the model was reviewed by a panel of experts in the automotive industry, including service managers, technicians, and customer service representatives. Their feedback was incorporated to refine the model and ensure its accuracy and relevance. Second, the model was tested in a pilot study involving a small group of automotive service organizations. The results of the pilot study confirmed the model's effectiveness in identifying and addressing key service process improvement opportunities.

4.1. Identifying and Analyzing the Main Service Processes

The service process within an automotive repair service provider organization can be understood as a series of five key stages, as illustrated in Figure 1. While Figure 1 presents these as distinct stages, it is important to recognize that, in practice, there are often interdependencies and feedback loops between them, rather than a strictly linear progression.

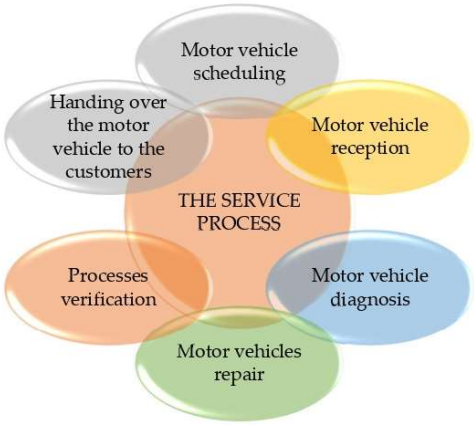


Figure 1. Key stages in the service process.

Vehicle Scheduling: This initial stage involves the judicious allocation of resources (technicians, spare parts, equipment) to meet customer requests and ensure optimal utilization of workshop capacity. Effective scheduling sets the stage for a smooth vehicle reception process.

Vehicle Reception: At this stage, the service advisor takes the vehicle from the customer, conducts an initial check, and collaborates with the customer to define the scope of the required service. This stage builds upon the scheduling and transitions into the diagnosis phase.

Diagnosis: Specialized technicians perform an assessment to identify and analyze the vehicle's technical issues, employing specific equipment and procedures.

Repair: This stage encompasses the execution of the necessary repair work and the replacement of any defective components, adhering to the diagnosis and quality standards

Vehicle Handover: The concluding stage involves the service advisor presenting the completed work and associated invoice to the customer and ultimately returning the

vehicle. The handover stage also provides an opportunity to gather customer feedback, which can inform and improve future iterations of the service process.

Figure 1 is an original contribution of this study, visually representing the five key stages of the automotive service process. It emphasizes the interconnectedness and flow between stages, rather than a strictly sequential progression.

4.2. Critical Success Factors and Improvement Measures for Each Process

At the end of the first semester of 2023, a detailed analysis of the evolution of the level of performance achieved by the after-sales service department in terms of service activity compared to the same period of 2022 was conducted.

According to the 2023 budget, the specific targets for the number of billable hours to be achieved monthly by each service shop are shown in Table 1. It is extremely important that each team member is aware of both the strategic and operational goals of the organization. To this end, the income and expenditure budget should be broken down to the basic level of the organizational structure at the job level so that each employee knows the performance standard they are expected to achieve and against which they are being measured.

Table 1. Invoiced hours according to income and expenditure budget.

Motor Service/Month	Cars Motor Service	Commercial Motor Vehicles Motor Service	Damaged Motor Vehicles Motor Service	Total of Motor Service Hours 2023
January	650	650	950	2250
February	850	800	1150	2800
March	930	850	1360	3140
April	930	850	1360	3140
May	930	900	1360	3190
June	930	950	1360	3240
July	930	950	1360	3240
August	930	950	1360	3240
September	930	950	1360	3240
October	930	950	1360	3240
November	930	950	1360	3240
December	750	750	100	2500
Total in 2022	10,620	10,500	15,340	36,460

One of the key indicators that should be continuously monitored is the average number of hours sold per vehicle serviced. The reference values for this indicator are different depending on the workshop whose activity is being evaluated:

- passenger car service workshop (PKW)—3.5 h invoiced per passenger car;
- commercial vehicle service workshop (LKW)—5 h invoice per commercial vehicle;
- damaged vehicle service workshop (ATV)—10 h invoiced per damaged vehicle.

4.2.1. Vehicle Scheduling: Optimizing Resource Allocation and Customer Communication

Vehicle scheduling is the first essential step in the service process, with the primary objective of efficiently allocating available resources (technicians, spare parts, and equipment) to respond promptly and effectively to customer requests. Well-managed scheduling ensures optimal use of workshop capacity, minimizes waiting times for customers, and contributes to increased customer satisfaction.

Critical success factors (Figure 2):

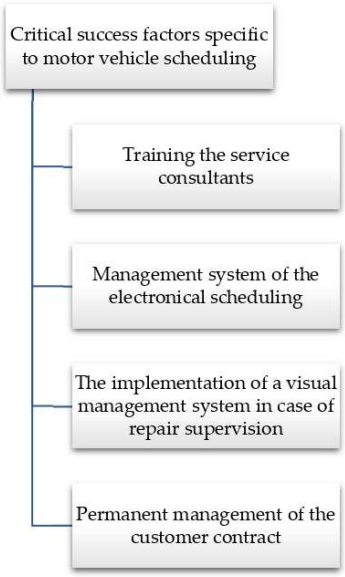


Figure 2. Critical success factors for motor vehicle programming management.

Preparation of service advisors: Service advisors are the interface between the organization and customers, responsible for scheduling work, communicating with customers, and managing customer expectations. Adequate training of the advisors, both technically and in communication and customer relationship skills, is essential for effective scheduling and to ensure positive customer experience.

Implementation of an electronic scheduling management system: Such a system allows real-time visualization of the availability of resources (technicians, spare parts, and equipment), and their optimal allocation according to customer requests and the complexity of the work.

Proactive communication with customers: Effective and proactive communication with customers, including confirming appointments and informing them of any changes, is essential to manage customer expectations and reduce no-shows.

Figure 2 is an original contribution of this study. Figure 2 illustrates the critical success factors for each step. This figure, like Figure 1, is intended to provide a clear and concise overview of the service process model and its key components.

Proposed improvement measures:

Training service advisors: In addition to sound technical knowledge, service advisors need to be trained in effective communication, active listening, objection handling, and selling techniques. This training will enable them to better understand customer needs, provide appropriate solutions, and promote additional services, thereby helping to increase revenue and customer satisfaction.

Implementing a visual management system: Using a visual management system, such as a scheduling board or specialized software, can make it easier to monitor the progress of work in real time, quickly identify any delays, and take corrective action.

Use automated confirmations and notifications: Automating the process of confirming appointments and sending notifications to clients can reduce human error, improve communication, and reduce no-shows.

Real-time electronic scheduling: This allows more flexible and efficient scheduling management, allowing quick adjustments according to resource availability and customer requests. In addition, workshop managers can intervene in real time to redeploy work if a technician becomes unavailable, ensuring that delivery deadlines for customers are met.

Involving Info Desk staff: To reduce waiting times for customers and free up service advisors for more complex tasks, Info Desk staff can be trained to take appointments for low-complexity maintenance and repair work.

Check parts availability and reserve parts: It is important to check availability and reserve the necessary spare parts at the time of scheduling to avoid delays due to lack of parts.

Informing customers on how to pay: To facilitate the payment process and avoid misunderstandings, customers should be informed at the time of booking how they can pay for the service.

Proactively managing delays: In case of delays in completing the repairs, the service adviser should proactively contact the customer to inform them and explain the reasons for the delay. This transparent approach can help to maintain a positive relationship with customers, even in inconvenient situations.

Verification of the interventions set by the manufacturer: When scheduling an appointment, the receptionist should check whether there are any technical campaigns or service recalls for the vehicle in question, so that the necessary parts can be supplied in time and delays can be avoided.

By implementing these measures, auto repair service provider organizations can significantly improve the scheduling process, increasing efficiency, customer satisfaction, and financial performance.

4.2.2. Vehicle Reception: Ensuring Effective Customer Intake and Communication

The reception is an important moment in the interaction between the service and the customer, having a significant impact on the customer's perception of the quality of the service offered. This stage involves not only the physical pick-up of the vehicle, but also effective and transparent communication with the customer and a careful assessment of the technical condition of the car.

The efficiency of service activity at this stage is influenced by several factors, including the following:

Accurate recording of working times: Using an automated tracking system, such as bar coding, can ensure an accurate record of the time allocated to each operation, contributing to better resource planning and transparent billing.

Payroll system: A payroll system that rewards both productivity and quality of work can motivate employees to pay attention and provide high-quality service.

Availability of spare parts: Ensuring an adequate stock of spare parts and efficient spare parts management are essential to avoid delays in the repair process and increase customer satisfaction.

Critical success factors and improvement measures are shown in Figure 3.

Thorough check of the vehicle: A thorough check of the vehicle on receipt, both from aesthetic (washing the car before receipt) and technical (checking the on-board indications and faults) points of view, is crucial to identify any problems and to establish a correct diagnosis. This prevents subsequent misunderstandings with customers and ensures that all relevant aspects are considered in the repair process.

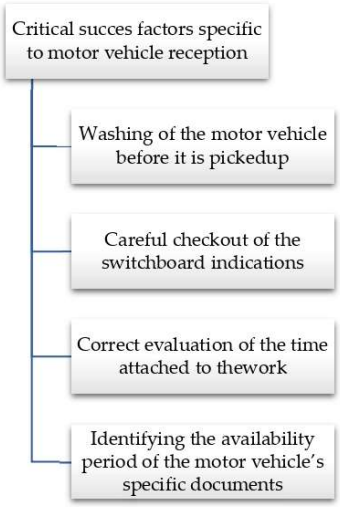


Figure 3. Critical success factors for managing the motor vehicle pick-up.

Clear and transparent communication: The service adviser should explain to the customer, in a clear and understandable way, what interventions are required, the estimated duration of the repair, and the associated costs. The customer should also be informed in writing about the timeframe for completion of the work and any other relevant details, such as the need for additional interventions or the expiry of important documents (MOT, MTPL insurance, etc.).

Realistic time and cost estimates: An accurate estimate of repair time and costs is essential to manage customer expectations and avoid dissatisfaction related to unexpected delays or additional costs. The use of digital tools can facilitate this process and increase transparency.

Demonstrate empathy and professionalism: The service advisor should demonstrate empathy and understanding of the customer's needs and concerns, providing complete and detailed answers to questions, and reassure the customer that their vehicle is well cared for. Also, the use of vehicle protection during vehicle acceptance and repair can demonstrate care for the customer's good and contribute to increased customer satisfaction.

Implement a standardized acceptance process: A clear and well-defined process, including detailed vehicle inspection, completion of an acceptance sheet, and transparent communication with the customer, can increase efficiency and reduce the risk of errors and misunderstandings.

Use of digital tools: Technology can play a significant role in improving the reception process. The use of tablets or other mobile devices can allow service advisors to quickly access vehicle history information, provide customers with cost and time estimates, and obtain customer approval for proposed work.

Train service advisors in communication skills: Effective communication is essential in building a trusting relationship with customers. Service advisors need to be trained in active listening techniques, nonverbal communication, and handling objections to understand customer needs and provide appropriate solutions.

By implementing these measures, organizations can turn the inbound process into a positive customer experience, helping to increase customer satisfaction and strengthen the company's image.

4.2.3. Diagnosis: Ensuring Technical Competence and Procedural Compliance

The diagnostic process is an essential step in after-sales service, having a direct impact on customer satisfaction and the operational efficiency of the car service. Accurate and rapid fault diagnosis enables efficient repair planning, reduces customer waiting times, and avoids costly errors.

Critical success factors:

Technical competence of staff: Technicians must have a thorough knowledge of the different systems and components of motor vehicles, as well as practical skills in the use of diagnostic equipment. Continuous training and specialization on specific make or models of vehicles can help to increase technical competence and improve the quality of diagnostics.

Use of high-performance diagnostic equipment: Technology plays a crucial role in modern vehicle diagnostics. Investing in state-of-the-art diagnostic equipment allows rapid and accurate fault identification, reducing the time needed for diagnosis and increasing the efficiency of the process.

Complying with the manufacturer's recommended diagnostic procedures: Each vehicle manufacturer provides specific diagnostic procedures that must be strictly followed to ensure diagnostic accuracy and reliability. Failure to follow these procedures can lead to diagnostic errors, delays in the repair process, and customer dissatisfaction.

Effective communication: Clear and open communication between technicians and service advisors is essential to ensure a correct understanding of the problems identified and the proposed solutions. This enables advisors to provide customers with accurate and complete information about the condition of the vehicle and the estimated cost and duration of repairs.

Proposed improvement measures:

Invest in ongoing technician training: The automotive industry is constantly evolving technologically, and technicians need to continually update their knowledge and skills to effectively diagnose and repair new vehicle models. Organizations need to invest in training and specialization programs for both existing and new technicians.

Purchase state-of-the-art diagnostic equipment: Technology is evolving rapidly, and diagnostic equipment is becoming increasingly sophisticated and more powerful. Investing in such equipment can bring significant benefits in terms of diagnostic speed and accuracy, as well as customer satisfaction.

Implement a knowledge management system: Such a system allows centralization and organization of technical information, diagnostic procedures, and best practices, facilitating rapid access to these resources by technicians and contributing to increased efficiency and quality of diagnosis.

Use of digital tools: Technology can also be used to improve communication and documentation in the diagnostic process. Using specialized applications or platforms, technicians can record and share diagnostic results with service advisors and customers, ensuring transparency and better understanding of problems and proposed solutions.

Consultation of service history: Information about previous work conducted on the vehicle can provide valuable clues for the current diagnosis. By reviewing the history, technicians can identify possible recurring problems or better understand the context in which the current faults occurred.

Scheduling work according to complexity: Diagnostic work should be allocated to technicians according to their level of competence and the complexity of the problem. This approach ensures that each job is managed by the most qualified person, which can lead to faster and more accurate diagnosis.

Checking for technical campaigns: Before starting diagnostics, it is important to check whether there are any technical campaigns or service recalls for the vehicle model in question. This can help to quickly identify known problems and apply the solutions recommended by the manufacturer.

Strict adherence to diagnostic procedures: Technicians must strictly follow the diagnostic procedures specified by the manufacturer to ensure correct diagnosis and avoid errors.

Consulting up-to-date information from the manufacturer: Technology and diagnostic procedures are constantly evolving, and technicians must stay current with the latest information and repair methods provided by the manufacturer.

By implementing these measures, organizations can significantly improve the diagnostic process, increasing accuracy, efficiency, and customer satisfaction. Accurate and timely diagnosis is essential to ensure efficient repair and to build a trusting relationship with customers, thus contributing to the long-term success of the car service.

4.2.4. Repair: Optimizing the Repair Process and Ensuring Customer Satisfaction

The repair process is the central stage of after-sales service, where faults identified in the diagnostic stage are rectified and the vehicle is returned to a roadworthy condition according to the manufacturer's specifications. The quality and efficiency of this process has a direct impact on customer satisfaction and on the reputation of the car service.

Critical success factors:

Technician qualifications and adherence to procedures: Technicians must possess the necessary knowledge and skills to perform repairs correctly and efficiently. Strict adherence to the manufacturer's recommended repair procedures is essential to ensure the quality of the work and to avoid future problems.

Spare parts availability and efficient stock management: To avoid delays in the repair process, it is crucial to ensure the availability of the necessary spare parts. Effective stock management, based on accurate forecasting and close communication with suppliers, can help to reduce waiting times and increase customer satisfaction.

Initiative-taking communication with customers: In the event of unforeseen delays or additional costs, it is essential to communicate proactively and transparently with customers. This open and honest approach can help manage customer expectations and prevent dissatisfaction.

Proposed improvement measures:

Implementing a visual management system: Using a visual management system, such as a Kanban board or specialized software, can facilitate real-time monitoring of the repair status. This allows any bottlenecks or delays to be quickly identified and corrective action to be taken to ensure on-time delivery to customers.

Optimizing the spare parts supply process: Reducing waiting times for spare parts can be achieved by better planning of parts requirements, collaborating closely with suppliers, and using digital technologies to automate and speed up the ordering and delivery process.

Use of digital technologies for customer communication: Implementing a digital communication system that allows customers to follow the status of the repair in real time and receiving notifications of any changes can increase transparency and improve customer experience.

Consultation of technical documentation and up-to-date information: Technicians must have access to complete and up-to-date technical documentation provided by the

vehicle manufacturer to conduct repairs correctly and according to specifications. It is also important to regularly consult the technical information and bulletins issued by the manufacturer to keep abreast of the latest repair procedures and methods.

Highlighting the deadline and proactively informing the customer: The deadline for completing the repair should be clearly communicated to the customer and should be continuously monitored by the workshop manager and service advisor. If unforeseen delays or problems arise, the customer must be informed immediately, and their agreement must be obtained for any changes to the deadline or costs.

Obtaining customer agreement for additional work: Any additional work, not initially agreed with the customer, must be approved by the customer before it is conducted. This transparent and ethical approach helps to build trust with clients.

By implementing these measures, organizations can ensure an efficient, high-quality, and customer-focused repair process, helping to increase customer satisfaction and enhance the reputation of the car service.

4.2.5. Vehicle Handover: Improving the Handover Process and Collecting Feedback

Vehicle handover is the final stage of the service process and has a significant impact on the customer's overall perception of the quality of the service provided. This stage involves not only the physical return of the vehicle, but also transparent and detailed communication with the customer and ensuring that the customer is fully satisfied with the results of the intervention.

Critical success factors:

Final quality check: Before handing over the vehicle, it is essential to conduct a rigorous final check of the quality of the work conducted and the general appearance of the car. This includes both a thorough visual inspection and a test drive in conditions like those described by the customer, to confirm that the faults have been fully rectified, and that the vehicle is working properly.

Clear explanation of the invoice and the work conducted: The service adviser should clearly and transparently present the details of the invoice to the customer, explaining each piece of work conducted and the associated costs. This transparent approach helps to build trust and avoid misunderstandings.

Collecting feedback and handling complaints: Customer feedback is a valuable source of information for continuous service improvement. The systematic collection of feedback and the implementation of an effective complaint handling process enable the organization to identify and correct any shortcomings, contributing to increased customer satisfaction.

Proposed improvement measures:

Implement a standardized handover process: A clear and well-defined process, including a rigorous final quality check, a detailed presentation of the work conducted, and a transparent explanation of the invoice, can ensure positive and consistent customer experience.

Preparing the vehicle for handover: Before being handed over to the customer, the vehicle must be washed and cleaned, and all traces of the work must be removed. It is also important to check that the exterior and interior condition of the car corresponds to that at the time of receipt and to inform the customer if there are any differences.

Delivery of replaced parts: Replaced parts should be delivered to the customer in their original packaging, properly protected to prevent fluid leakage. This practice demonstrates transparency and professionalism.

Use of digital tools: Technology can facilitate the handover process by allowing customers to pay online or via mobile terminals, as well as provide direct feedback via dedicated applications or platforms.

Implementation of an effective complaint handling system: In the event of a customer being dissatisfied with the service provided, it is essential to have a clear and transparent complaint handling process in place to allow for a quick and amicable resolution of the situation.

Scheduling the handover and avoiding overcrowding: The service advisor should schedule the handover at a time that is convenient for the customer, thus avoiding overcrowding and excessive waiting times.

Collecting feedback and implementing loyalty programs: After the handover, it is important to collect feedback from the customer about their experience with the service. This feedback can be used to identify areas for improvement and to develop loyalty programs that reward loyal customers and encourage them to return.

Figure 4 summarizes the critical success factors in the vehicle handover process, highlighting the importance of final quality checks, transparent communication, feedback collection, and complaint handling.

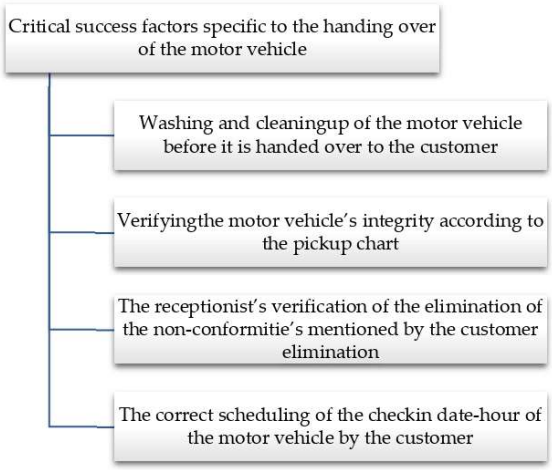


Figure 4. Critical success factors for the management of motor vehicle checking by the customers.

Figure 5 illustrates the importance of quality assurance at all stages of the service process, from scheduling to handover, to achieve customer satisfaction and increase organizational performance.

By implementing these measures and adopting an initiative-taking, customer-focused approach, organizations can turn the process of handing over vehicles into a time to strengthen customer relationships and increase customer loyalty, thereby contributing to the long-term success of the car service.

In addition, this paper emphasizes the importance of continuously measuring performance and identifying areas for improvement. By collecting and analyzing feedback from customers, organizations can gain valuable insights into their perceptions of service quality and identify opportunities for continuous improvement.

Finally, the authors propose a simple survey based on three key questions that can be used to assess customer satisfaction and identify areas where service can be improved.



Figure 5. Ensuring the quality of the service processes.

By implementing these recommendations and adopting a customer-centric and quality-focused organizational culture, automotive service organizations can achieve superior performance and build strong, long-term relationships with their customers.

4.3. Performance Targets and the Need for Continuous Improvement

To assess the service department's performance and identify areas for improvement, the research team, in collaboration with the service department management, conducted an analysis of service activity reports from the first half of 2023, comparing it to the same period in 2022. A key indicator used in this assessment is the average number of hours sold per vehicle entered for service. The benchmarks for this indicator vary by type of workshop: 3.5 h for passenger cars, 5 h for commercial vehicles, and 10 h for damaged vehicles.

These benchmarks are derived from industry standards and best practices, based on historical data and expert recommendations within the automotive service sector. They represent the average number of hours that a well-managed workshop should be able to invoice for each type of vehicle, considering factors such as the complexity of repairs, technician efficiency, and resource availability.

Although progress has been made in terms of average hours invoiced per workshop order, there is still a gap with the benchmarks, as can be seen in Table 1. This gap indicates that there is still potential to increase revenue and profitability by optimizing processes and increasing efficiency. Also, analyzing customer feedback can reveal opportunities to improve service quality and customer experience, helping to increase customer satisfaction and loyalty.

Therefore, service process modeling is a necessity for organizations that want to improve their performance and remain competitive in the automotive after-sales market.

Implementing the measures proposed in this section can help achieve these goals and ensure the long-term success of the organization.

5. Results and Discussion

Data analysis and implementation of service process improvement measures have led to several positive results demonstrating the impact of process modeling on performance in the automotive industry.

5.1. Enhanced Efficiency and Productivity Through Process Optimization

This subsection presents the results of our analysis of service activity reports and participatory direct observation, focusing on the impact of process optimization measures on efficiency and productivity. The data analyzed includes key performance indicators such as downtime, technician productivity, and communication efficiency, measured before and after the implementation of the proposed process improvements.

Data from the service activity reports indicate that careful monitoring of the diagnostic process and more efficient allocation of resources has reduced downtime and increased technician productivity.

Observations from the participatory direct observation revealed that the implementation of digital tools and a visual management system has facilitated communication between departments and allowed for better coordination of activities, contributing to the overall efficiency of service processes.

Analysis of the service activity reports shows that efficient management of spare parts stocks has reduced waiting times and ensured the availability of parts needed for repairs, leading to increased productivity and customer satisfaction.

5.2. Improved Customer Satisfaction Through Effective Communication and Personalized Service

This subsection presents the results of customer feedback collected through questionnaires and satisfaction assessment tools, along with observations of employee–customer interactions, focusing on the impact of communication and personalized service on customer satisfaction. The analysis includes data on customer satisfaction scores, feedback comments, and observed communication practices.

Customer feedback analysis indicates that constantly informing customers about the status of repairs, delays, or additional costs has helped to increase transparency and confidence in the services provided. Implementing automatic notification systems and digital communication tools can facilitate this process and improve customer experience.

Observations of service advisor interactions with customers revealed that taking a personalized approach to each customer and demonstrating empathy for their needs and expectations has led to increased satisfaction and loyalty. Service advisors trained in communication and active listening techniques can make a significant contribution to building strong customer relationships.

Service advisors play an important role in building strong customer relationships. They are the primary point of contact for customers and are responsible for managing their expectations, addressing their concerns, and ensuring their satisfaction.

The selection of service advisors is based on a combination of factors, including the following:

- Technical Expertise: Possessing a strong understanding of automotive systems, repair procedures, and industry standards.
- Communication Skills: Demonstrating excellent interpersonal and communication skills, including active listening, empathy, and clear articulation.
- Customer Focus: Exhibiting a genuine commitment to customer satisfaction and a willingness to go the extra mile to meet their needs.
- Problem-Solving Abilities: Having the ability to effectively address customer issues, resolve conflicts, and find solutions that meet both customer and organizational needs.

Once selected, service advisors undergo comprehensive training programs that cover various aspects of their role, including the following:

- Technical Training: In-depth knowledge of vehicle systems, repair procedures, and industry standards.
- Customer Service Training: Development of effective communication, active listening, and conflict resolution skills.
- Sales and Marketing Training: Techniques for identifying customer needs, offering appropriate solutions, and promoting additional services.
- Software and Systems Training: Proficiency in using the organization's electronic management system and other relevant software tools.

The assignment of responsibilities for service advisors is based on their experience, expertise, and performance. They are typically assigned to specific teams or departments within the service organization, where they are responsible for managing customer interactions, scheduling work, and ensuring the smooth flow of service processes.

Data from the complaint handling system shows that the implementation of an effective complaint handling system has allowed for quick and amicable resolution of any grievances, helping to maintain a positive relationship with customers.

5.3. Positive Impact on Financial Performance

This subsection presents the results of the analysis of financial data extracted from the organization's electronic management system, focusing on the impact of process improvements on financial performance. The data analyzed included revenue from service and parts sales, operational costs, and average billed hours per shop order.

Analysis of financial data shows that by optimizing processes and increasing efficiency, an increase in the number of hours billed and revenue generated from the sale of parts and services was achieved. Service advisors trained to offer and sell additional services can contribute to increased revenue, as shown in this paper.

Eliminating inefficiencies and downtime has led to a reduction in operational costs, contributing to increased profitability. For example, the implementation of an automated working time monitoring system can help to identify and eliminate non-value-adding activities.

As illustrated in Figures 6–9, the positive evolution of average billed hours per shop order demonstrates the direct impact of process modeling on performance. These figures show a significant increase in the average number of hours billed per shop order in 2023 compared to 2022, especially in the first semester. This increase indicates better utilization of resources and increased efficiency in service processes.

Figures 6–9 illustrate the evolution of invoiced hours, a key indicator of service department performance. In these figures, the *X*-axis represents the months of the year, while the *Y*-axis indicates the average number of hours invoiced per service order or the total invoiced hours. The bars are color-coded to distinguish between the data from 2022 (blue) and 2023 (orange), allowing for a direct comparison of performance across the two years.

Figures 6–8 specifically show the average number of hours invoiced per order for each vehicle type (passenger cars, commercial vehicles, and damaged vehicles, respectively). An increase in this metric from 2022 to 2023 suggests improved efficiency in service delivery, as technicians are, on average, billing more hours per service visit. This could be attributed to factors such as better diagnostic procedures, optimized repair workflows, or increased sales of additional services.

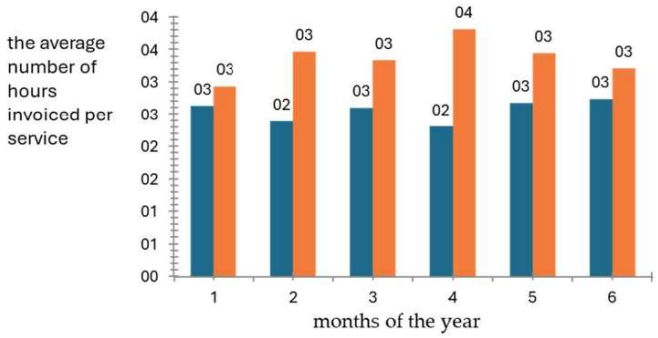


Figure 6. Average invoiced hours per order for motor service, comparing 2022 (blue) and 2023 (orange), measured in hours.

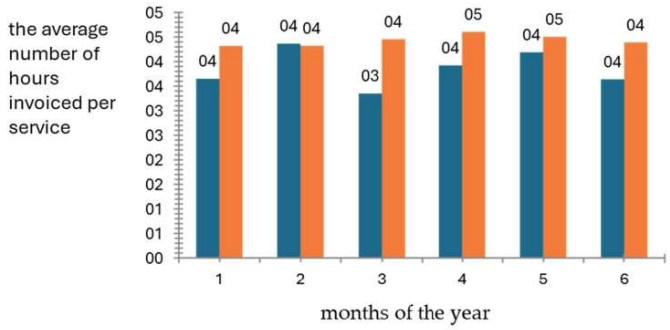


Figure 7. Average invoiced hours per order for commercial motor vehicles, comparing 2022 (blue) and 2023 (orange), measured in hours.

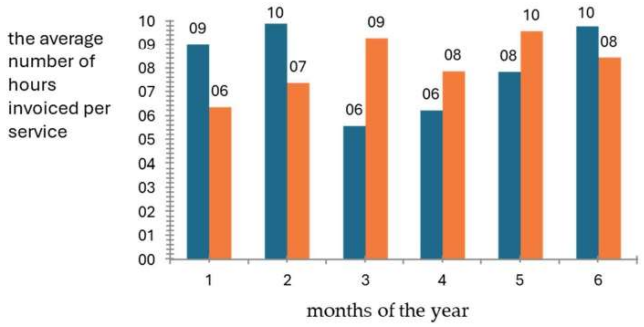


Figure 8. Average invoiced hours per order for damaged motor vehicles, comparing 2022 (blue) and 2023 (orange), measured in hours.

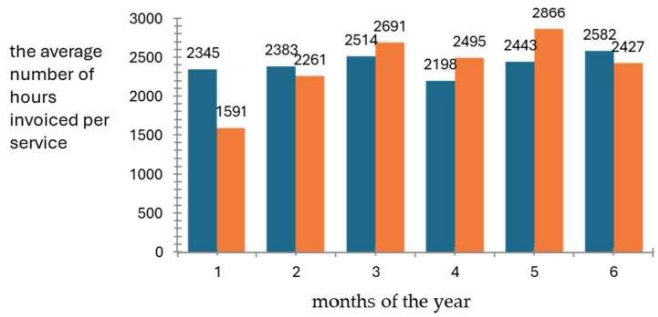


Figure 9. Total invoiced hours for motor service, comparing 2022 (blue) and 2023 (orange).

Figure 9 presents the total invoiced hours for all service types combined. While it shows a slight decrease in 2023 compared to 2022, it is crucial to consider this in conjunction with the average hours per order. As observed in Figures 6–8, the increased average invoice value may compensate for the reduced volume, indicating a shift towards higher-value services.

It is important to note that the data presented in Figures 6–9 represent the first six months of 2022 and 2023.

The positive evolution of average billed hours per shop order, illustrated in Figures 6–8, demonstrates the direct impact of process modeling on performance. It is important to note that the data presented in Figures 6–9 represent the first six months of 2022 and 2023. These figures show a significant increase in the average number of hours billed per shop order in 2023 compared to 2022, especially in the first semester.

It is important to note that these figures reflect the performance of a single service provider organization and may be influenced by specific local market conditions and operational factors. Further research involving a larger sample size could provide a broader perspective on these trends.

5.4. Discussion

The results of this study confirm the positive impact of service process modeling, indicating that managers can use process optimization as a tool to achieve significant improvements in efficiency, customer satisfaction, and profitability.

By optimizing service processes, such as vehicle scheduling, acceptance, diagnosis, repair, and handover, organizations can achieve significant improvements in efficiency, customer satisfaction, and profitability.

The implementation of the proposed measures, such as optimizing resource allocation, improving customer communication, ensuring technical competence, and enhancing the handover process, has led to tangible benefits for the organization studied.

These results demonstrate the effectiveness of service process modeling as a strategic tool for improving service operations and achieving superior performance in the automotive industry.

Our findings are consistent with previous research highlighting the importance of process modeling and quality management in enhancing organizational performance.

Crosby [1] emphasizes the importance of "getting it right the first time" and defect prevention, which are the principles underlying process modeling and quality management. Implementing standardized processes and rigorous checks can reduce errors and increase efficiency, as demonstrated in this study.

Imai [13], in his "Kaizen" concept, promotes continuous improvement to increase efficiency and eliminate waste. Implementing a visual management system and collecting customer feedback can be useful tools for identifying and implementing continuous improvement.

Ohno [14], through the Toyota Production System, demonstrated that eliminating non-value-added activities and optimizing workflow can lead to significant increases in productivity. In the context of after-sales service, this can translate into reduced waiting times, ensuring the availability of spare parts, and improved communication between departments.

This study makes several unique contributions to the understanding of service process modeling in the automotive industry.

First, it provides an integrated perspective on service processes, considering their interconnections and their impact on overall performance. This holistic approach allows for a more comprehensive understanding of how different service processes interact and influence each other, leading to a more effective identification of improvement opportunities.

Second, it focuses specifically on the automotive industry, investigating the specific challenges and opportunities of the automotive sector and proposing context-specific solutions. This targeted approach ensures that the findings and recommendations are relevant and applicable to the unique context of the automotive industry.

Third, it provides practical recommendations, translating research results into concrete and applicable measures to improve performance in automotive service. This actionable guidance enables managers and practitioners to implement the findings of this study and achieve tangible improvements in their service operations.

The findings of this study have important implications for both academics and practitioners. For academics, this study contributes to the theoretical understanding of service process modeling and identifies future research directions.

By examining the interdependencies between service processes and their impact on overall performance, this study provides valuable insights into the dynamics of service operations in the automotive industry.

Moreover, this study's focus on the specific challenges and opportunities in the automotive sector contributes to the development of context-specific knowledge and best practices.

For practitioners, this study offers practical guidance for improving service operations. Managers can use the identified critical success factors to prioritize areas for improvement, and the proposed measures provide concrete steps for optimizing specific service processes. For instance, the recommendations on implementing electronic scheduling systems can help managers to improve resource allocation and reduce customer waiting times, while the emphasis on training service advisors in communication skills provides a clear action plan for enhancing customer satisfaction.

The concrete and applicable recommendations presented in this study can be readily implemented by service managers and technicians to optimize their service processes, enhance customer satisfaction, and improve financial performance.

It is important to acknowledge that due to the nature of this single case study within a large, authorized dealership, the generalizability of these results to smaller independent repair shops or service centers with different organizational structures may be limited.

This study contributes a service process model tailored to the specific context of automotive repair services, providing a practical tool for organizations in this sector to improve their operations.

6. Conclusions

This study aims to address the following research questions:

- How can service processes be modeled in an automotive repair service provider organization to increase performance and ensure customer satisfaction?
- What are the critical success factors for each service process, and how can they be optimized to achieve superior performance?

Based on the analysis of service activity reports and participatory direct observation, the study has reached the following conclusions:

- Optimizing service processes, such as vehicle scheduling, acceptance, diagnosis, repair, and handover, has been shown to lead to significant improvements in efficiency, customer satisfaction, and profitability, as demonstrated by the increased number of hours billed and positive customer feedback (see Sections 5.1–5.3).
- Critical success factors for each service process include optimizing resource allocation and improving customer communication, which were addressed through measures such as implementing electronic scheduling systems and training service advisors (see Section 4.2).
- Implementing the proposed measures provides managers with a roadmap for achieving tangible benefits, such as reduced downtime and increased revenue from service and parts sales (see Sections 5.1 and 5.3).
- Continuous staff training and investment in modern technology are key factors in ensuring superior performance and rapid, enabling service organizations to maintain a competitive edge (see Section 5.4)

These conclusions provide valuable insights for both academics and practitioners. Managers can leverage the findings to implement targeted interventions that improve service efficiency, enhance customer relationships, and drive financial performance. This study also offers academics a foundation for further research on service process optimization in the automotive sector.

While this study provides valuable insights into service process modeling in the automotive industry, it is essential to acknowledge its limitations.

- Single Case Study: This research focused on a single automotive repair service provider organization, which may limit the generalizability of the findings to other contexts. Future research could expand the scope to include multiple organizations to explore the potential influence of organizational size, structure, and culture on service process effectiveness.
- Focus on Operational and Financial Performance: This study primarily focused on the impact of process modeling on operational and financial performance, without exploring in detail the effects on other dimensions, such as employee satisfaction, environmental sustainability, and social responsibility. Future research could investigate these aspects to gain a more comprehensive understanding of the benefits of process modeling.
- Data Collection Period: The data collection period was limited to a specific timeframe, which may not capture the full range of seasonal or cyclical variations in service demand and performance. Future research could employ a longitudinal approach to track changes over a more extended period.

A key contribution of this research is the development of a service process model that integrates key performance indicators and best practices for service optimization in automotive repair.

To further validate these findings, future research should expand the scope to include a diverse sample of automotive service organizations, encompassing different sizes, structures, and service models.

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Original Article

Enhancement of On-time Delivery Maintenance Services by Lean Manufacturing Tools in an Automotive Industry

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Abstract *- In recent years, the automotive industry has continued to develop exponentially. However, this has led to an increase in the demand for maintenance services that automotive repair companies are unable to provide (representing significant losses for automotive companies). Thus, to maximize the number of maintenance services performed each day and reduced the costs associated with penalties, automotive repair companies try to optimize maintenance service hours. According to the current analysis, the main problem that causes the greatest financial loss in a Peruvian auto repair company is the high percentage of maintenance services that are not performed. The company considers the issue to be crucial not only for the economy but also for the connection it maintains with its customers, as they are very likely to choose to travel to other auto repair centers if there are delays in deliveries. The company's assistance and data collection made it possible to identify the main causes of these delays. As a result, it is proposed to create a model based on the Lean Manufacturing technique, using the 5S tool, ABC analysis and standardized work, with the aim of optimizing the delivery times of the company's existing vehicle repair service. In the end, the approach reduced delivery time violations by 19.94%. In conclusion, the company was able to satisfy its customers and avoid delays as a result of the improvement made.*

Keywords *- Automotive, Lean manufacturing, Maintenance Service Optimization, Standardized work, 5S.*

1. Introduction

The automotive industry has expanded dramatically in recent years, year after year [1]. Due to mass production and significant demand for automobiles and replacement components, the automotive industry is now one of the most significant industries in the Peruvian economy [2]. Sales of light vehicles (cars, vans, SUVs and pickup trucks) are expected to increase by 43.1% in 2021 compared to 2020 [3]. In addition, due to the pandemic, maintenance repair times have been lengthened as a consequence of supply chain problems that make it difficult to locate replacement components for cars. Finding a new replacement component, for example, can take anywhere from one day to six weeks [4]. Also, domestic production increased by 3.47% in November 2021 compared to the same month in 2020 [5], mainly due to the good performance of most economic sectors.

Additionally, they found that the trade sector grew by 3.82%, mainly due to subsectors such as the automobile trade, which had an increase of 8.53% [6]. However, given that there are already 78,000 auto repair shops in Peru, serving some 2.9 million vehicles, this growth does not match the availability of auto repair businesses in the country [7]. Due to saturation problems and the resulting high demand for maintenance services that workshops are unable to provide, customer service waiting times are increasing. [8]. Therefore, companies in the automotive industry work to maximize maintenance service times in an effort to reduce the percentage of non-compliance and avoid economic losses.

Considering these factors, it is safe to say that, over time, service times will become an issue. Given the significant impact of this issue, a considerable number of authors have suggested solutions using various Lean technologies. First, according to the research presented by one of the authors, Masaki SAC is forced to improve its manufacturing processes to meet the demands of its customers due to the increased demand for maintenance services. The DMAIC technique and the five whys were the main tools used to meet this challenge [9]. Positive results were obtained: 39% to 23% fewer cars entering the workshop and not being removed on the same day. Positive results were obtained: 39% to 23% fewer cars entered the workshop and were not removed on the same day [10].

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The second problem was the clutter of components, the accumulation of superfluous paperwork, and the lack of organization and cleanliness in the offices and corridors. Therefore, the main objective was to improve the structure and cleanliness of the warehouse in order to be able to find things more quickly [11]. The 5s technique was suggested as a strategy to address this problem. The organization increased compliance with the suggested objectives from 16.47% to 92.94% after applying the 5s technique [12].

To ensure customer satisfaction, the author proposes to reduce picking times and redesign the warehouse in research conducted in a warehouse of a high-end automotive repair company [13]. Using a flow chart, ABC approach and Monte Carlo method for space simulation, he offers a solution. In addition, it shows how picking times can be shortened by shortening the distances that spare parts must travel from their location in the warehouse to the delivery counter [14]. Another investigation describes the problem that a plastics manufacturing company had as a result of the Covid-19 pandemic.

The authors detected productivity and efficiency problems in this Small and Medium Enterprises (SMEs). The authors suggest applying a dual-approach optimization model that values both operational improvement and working conditions to address the problem that resulted in delays in delivering orders to consumers, leading to their dissatisfaction. This strategy makes use of lean tools such as Single Minute Exchange of Die (SMED) and 5S. Its main results include a 13.4% improvement in order fulfilment rate, a 62% decrease in operator effort, and a 57% reduction in setup time [15].

Although the Lean approach has been very successful in the industry, it has been observed that there is not much research focused specifically on the automotive sector. This study aims to improve the processes of a developing market, such as the automotive industry, by applying the lean manufacturing methodology, streamlining maintenance procedures, organizing the warehouse and improving purchasing management through the use of 5S tools to improve inventory management, order and cleanliness of the warehouse and work areas; standardized work which will help us to perform maintenance service processes faster and ABC analysis which will facilitate the management of spare parts purchasing [16]. The study will be carried out with the help of the 5S tools.

The structure of this project is as follows: Chapter 2 provides a literature review; Chapter 3 demonstrates the contribution of the case study; Chapter 4 demonstrates in detail the validation of the proposal; Chapter 5 presents the project discussions; Chapter 6 presents the conclusions; and the chapter concludes with the bibliographical references.

2. Literature Review

2.1. Lean Manufacturing in the Automotive Sector

To understand how lean manufacturing works, which is a set of tools of the lean philosophy aimed at streamlining a company's operations, it is necessary first to understand how it works.

In relation to the above, some authors state that lean manufacturing is a strategy that, according to most research, produces efficient operations, manufacturing processes and logistics. Productivity, efficiency, decrease in the number of labour hours required, optimal use of space, and correct inventory records are the metrics that typically benefit [17-19]. The authors also include some of the most popular project management technologies, such as 5s, standardized work, SMED, Kanban, Andon and Heijunka, among others.

According to studies conducted by many authors, implementing lean manufacturing technologies has led to improvements in various processes in a wide range of companies around the world. One such study was the implementation of lean manufacturing in an automobile manufacturer in northern India, which led to a reduction in cycle time by 87.59%, WIP by 76.47%, production time by 95.41%, and value-added ratio by 66.08% [20]. The authors used the Value Stream Mapping (VSM) tool to design the Lean phases for project execution and suggested a future VSM perform a simulation and obtain the results described above [8][21][23].

In this sense, the objective of this project is to apply the best tools of the lean manufacturing methodology to challenging company operations related to the activities of the case studies mentioned above. In each of these examples, similar improvements can be observed in the processes examined, resulting in faster delivery of cars [24]. Despite the fact that some authors claim that this technique can be successfully used in any industry, it is of concern that there are so few studies on lean manufacturing methodology in the automotive industry.

2.2. Inventory Management

We are going to study the management of materials storage and purchasing in relation to inventory management. The ABC tool is perfect for achieving these objectives since it is responsible for creating a purchasing strategy by determining the value of each good that the company must purchase [5].

High operating and warehousing costs in supermarkets are a problem that causes low efficiency in the flow of goods, according to a case study conducted in a supermarket distribution center in China. The authors propose implementing a novel model to address the shortcomings of conventional distribution techniques using the ABC tool. The installation results, which resulted in a 34.72%

reduction in operating and warehousing costs, were as expected [26]. Moreover, other authors support the same point of view, noting that the ABC tool allows the segmentation of goods according to their consumption quantity and that reliable Key Performance Indicators (KPIs) must be managed for it is a pany that sells spare parts to national and global distributors. This company's main problem is delayed delivery times to its customers, so delays were reduced by 24.08% by using ABC analysis and prioritizing the most popular spare parts in advance [30].

The numerous case studies that have been previously evaluated have shown that the ABC tool allows for improving the management of spare parts purchases since the right supplies will always be available for preventive maintenance, which is crucial for this project [31]. In order to optimize the logistics procedures of the investigated automobile factory, ABC analysis will be employed as a technique in this research project. Furthermore, as seen in the case studies, many techniques will be applied throughout the phases of this tool to ensure the optimization of the mentioned procedures. To support the improvement of the research processes, it is crucial to validate and disseminate the use of ABC analysis and other complementary Lean tools in the automotive industry. [32].

2.3. Warehouse Management

Several authors argue that the 5s tool should be used to organize the warehouse, as it focuses on order and best practices in a well-established part of the company. The selection of items according to their relevance, the separation of those that are useful from those that are not, the physical arrangement of previously selected materials and, finally, the cleaning of workplaces and materials are some of the most commonly used techniques [33].

According to other authors, the 5S tool was implemented in hospitals as the main objective of the research conducted in Egypt in order to improve the work environment in terms of cleanliness, order and inventory management to decrease patient waiting times [34]. The results were favorable, as patient waiting times decreased by 25% and patient satisfaction increased by 43.5% [35].

Along the same lines, research conducted in a retail distribution company identifies that the high proportion of returns (12.45%) is the main problem caused by the following factors: orders arriving late, not complete or damaged when they do [36]. The drafters made the decision to apply various Lean tools, and the 5S system was selected to look at all aspects of the company's warehouse. First, red cards were used to identify all materials in the warehouse, as well as extraneous items. Second, colored ribbons and labels were used to identify shelves and floors. In addition, cleaning guidelines and product labels were established for the warehouse. Finally, the product rejection rate was reduced from 12.45% to 5.5% once the 5S tool was implemented [37].

The 5S tool works best when accompanied by another tool, such as VSM or Kanban, as it allows faster implementation, improves the processes to be performed and is more efficient, according to research that the authors have studied and analyzed [38]. The implementation costs of 5S can be quite significant for companies wishing to use them; hence there are not many studies that mix them with other technologies.

2.4. Standardized Work

The uniformity of the procedures used in the washing area is another crucial factor in reducing service times. In order to have clear production processes, standardized work is a method that aims to provide each employee with the same amount of work and time [39]. It also refers to the importance of assembly lines and how they are designed to follow a specific order to produce more uniform goods [40]; according to a case study conducted in a company engaged in the printing business, rejected orders due to delays and poor-quality products cost $4.3 million to the company's operations. To solve this problem, the cars proposed implementing standardized work and different lean manufacturing tools; when these improvements were completed, productivity increased by 30.7% [41]. Similarly, standardized work was used in similar research in a beverage company to increase the efficiency of manufacturing processes [42]. The company used this tool during batching, labeling, bottling and spraying operations. Finally, when the indicated processes were improved, the number of abandoned pouches decreased by 34% in the following months [7].

Since it is quite likely that operations in an automotive shop are standardized to maximize the optimization of work time, standardized work is well suited to our study project.

3. Innovative Proposal

3.1. Rationale

Figure 1 shows the proposed project model to meet the research objectives. For the development of this model, the model developed in a research study was taken into consideration developed in research [44], from which it was possible to extract the need to analyze the current situation of the company under study through different diagnostic tools and then use lean manufacturing tools to optimize the company's operational processes. As in this proposal, this model details the key elements to reduce service times to achieve the objectives set out in the research. Similarly, in another study, it was determined that by applying lean manufacturing tools, it is possible to increase the efficiency of processes to reduce service time.

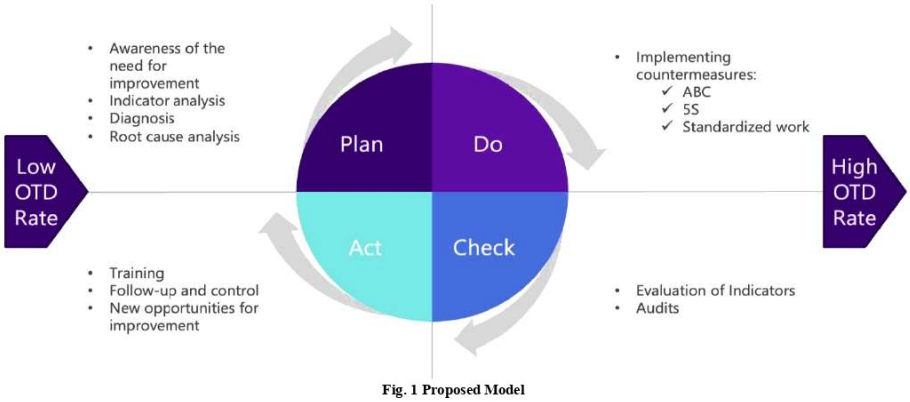


Fig. 1 Proposed Model

On the other hand, the value generation of this proposal is based on the tools mentioned in state of the art, integrating each of them into the proposed model, which is developed based on a PDCA continuous improvement model, which aims to reduce the cycle time of the maintenance service. This model consists of four phases and has as its main reference the lean manufacturing philosophy [11, 45]. Also, ABC, 5'S, and standardized work tools were combined to improve the same problem.

The root causes of this problem are poor purchasing management (with an impact of 17.43% on the problem), products without specific location (with an impact of 15.07% on the problem), inefficient final inspection of the vehicle (with an impact of 13. 19% impact on the problem), the disorder in the warehouse (with an impact of 12.24% on the problem), error in the purchase of spare parts (with an impact of 11.15% on the problem) and absence of washing process activities (with an impact of 9.89% on the problem).

Taking the previously mentioned diagnosis as a starting point, the present research project has developed the management model under the lean manufacturing approach detailed in Figure 1 to mitigate non-compliance in maintenance service deliveries. The purpose of this study is first to validate and then disseminate the implementation of the lean manufacturing methodology in a practically new scenario and little studied by the literature, with the objective of leaving a precedent that can help to optimize the service times of the automotive sector and thus, counteract the low supply of automotive workshops that exists in the market, seeking to increase revenues and thus improving customer satisfaction. Consequently, it is necessary to highlight this model that integrates in a novel way the ABC tools, 5S and standardized work with the objective of optimizing the delivery times of the vehicle maintenance service in an automotive company.

3.2. Proposed Model

The diagnosis made to the processes of a Peruvian company in the automotive sector determined that the main problem is the high ratio of non-compliance in the delivery time of the vehicle maintenance service. After performing the analysis of this research, it was found that preventive vehicle maintenance services are the ones with the highest ratio of failure to deliver on time, with 30.2% in the year 2021. As a result of this diagnosis, it was possible to know. The root causes of this problem are deficient purchasing management (with an impact of 17.43% on the problem), products without specific location (with an impact of 15.07% on the problem), inefficient final inspection of the vehicle (with an impact of 13.19% on the problem), lack of coordination (with an impact of 15.07% on the problem), inefficient final inspection of the vehicle (with an impact of 13. 19% impact on the problem), the disorder in the warehouse (with an impact of 12.24% on the problem), error in the purchase of spare parts (with an impact of 11.15% on the problem) and absence of washing process activities (with an impact of 9.89% on the problem).

Taking the previously mentioned diagnosis as a starting point, the present research project has developed the management model under the lean manufacturing approach detailed in Figure 1 to mitigate non-compliance in maintenance service deliveries. The purpose of this study is first to validate and then disseminate the implementation of the lean manufacturing methodology in a practically new scenario and little studied by the literature, with the objective of leaving a precedent that can help to optimize the service times of the automotive sector and thus, counteract the low supply of automotive workshops that exists in the market, seeking to increase revenues and thus improving customer satisfaction. Consequently, it is necessary to highlight this model that integrates in a novel way the ABC, 5S and standardized work tools with the

objective of optimizing the delivery times of the vehicle maintenance service in an automotive company.

The main objective of the solution model design is to reduce the company's current cost overruns by eliminating all activities that do not add value to the vehicle maintenance service.

Having said this, the first component of the model is the Plan phase, which seeks to organize the project, define the main problem of the company and define the objectives of the project, which refers to raising awareness of the top management of the company in order to facilitate the development of the proposal, implementing work teams that will be trained The project also includes the implementation of work teams that will be trained on the tools to be implemented, which will make it easier to monitor each of the implementation stages. The stages to consider for the implementation of this phase are the following:

- Generate management commitment.
- Implement teamwork.
- Train the work team.

The second component of the model is the Do phase, where the solution tools that will help achieve the implementation objectives are applied, which refers to the implementation first of the ABC analysis in order to determine the spare parts needed in the warehouse, then the implementation of the 5'S tool, which seeks to reduce delays in the dispatch and finally, to implement the standardized work to improve the washing process. The stages to be considered for the implementation of the tools in this component are as follows:

3.2.1. ABC

In this first stage of phase C, the aim is to identify those essential spare parts belonging to class A that should not be missing in the warehouse to avoid delays generated by the lack of stock of spare parts. To this end, the following activities are carried out:

- Data collection.
- Classification of spare parts.
- Define safety stock.

3.2.2. 5S

In this second stage, the aim is to increase the efficiency in dispatch times, reducing the delay in the search for spare parts. In order to implement this tool, it was decided to divide it into three phases:

Planning and analysis
- Reach an agreement with the company.
- Establish objectives.
- Drawing up a timetable.
- Train personnel.

Execution of the Model
- Seiri implementation.
- Seiton implementation.
- Implementation of Seiso.
- Implementation of the Seiketsu.
- Implementation of the Shitsuke.

Follow-up and improvement
- Evaluate and follow up on the improvements implemented.
- Establish an improvement plan.

Standardized Work

In this last stage, what is sought through the implementation of the tool is to mitigate delays in the washing service, thus improving the washing process by reducing the cycle time and eliminating those activities that do not add value to it. To this end, the following activities are carried out:

- Planning and analysis.
- Execution.
- Carry out proposed WTP.
- Carry out a final inspection.

The third component of the model is the Check phase, where the objective is to perform a detailed comparative analysis after implementing the solution tools. This is done by means of periodic audits together with some measurement indicators.

The fourth and last component of the model is the Act phase, where some reports will be made based on the data collected from the audits and indicators that will allow having first feedback that will help to develop continuous improvement.

3.3. Design of the Proposed Method

Figure 2 shows in detail the complete sequence of activities to be followed to develop the implementation of the proposed model. This starts with the execution of the first component, where the commitment with the company's top management is generated, and work teams are formed; then follows the execution of the second component, where the improvement tools are implemented (first the ABC analysis, then the 5'S methodology and finally the standardized work); followed by the execution of the third component where the indicators are compared, and improvement audits are performed, and finally the fourth component is executed where the implementation of continuous improvement is sought.

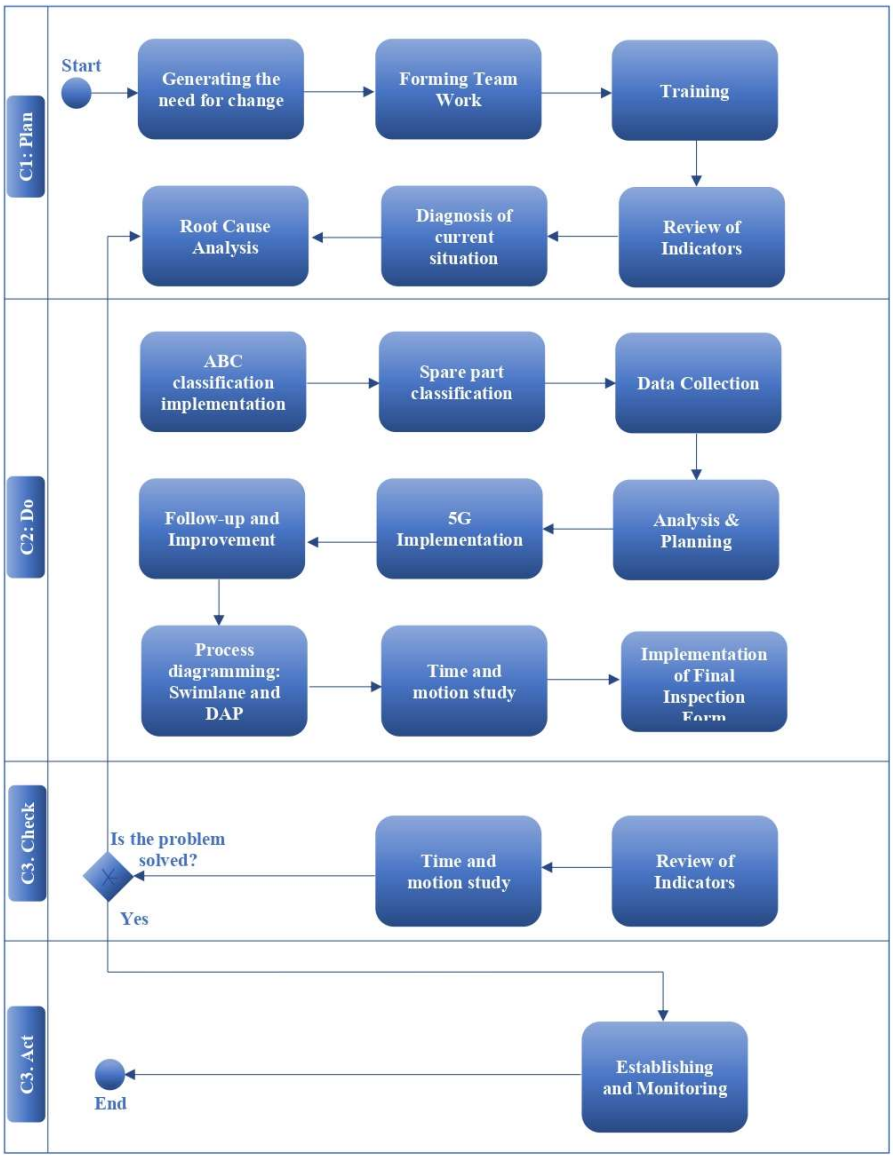


Fig. 2 Proposed method

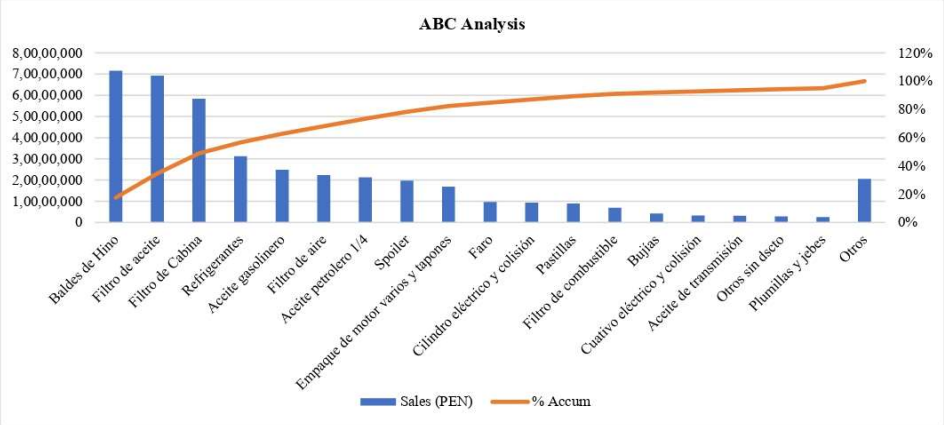


Fig. 3 ABC analysis

3.3.1. Component 1: Plan

Generate Commitment from Top Management

For this first phase, a meeting is held with the management of the company under study to generate awareness about implementing the solution model that will mitigate the impact generated by the main problem identified (high ratio of non-delivery of maintenance service). This creates commitment on the part of the hierarchy to facilitate the implementation of the solution tools.

Implement Work Teams

In this phase, the people who will make up the work team overseeing and monitoring the implementation are selected, and their roles are defined as shown in Table 1.

Table 1. Positions of team members

Member	Position in the company	Functions
Team Leader	Head of services	Organize the work team Follow-up of implementation activities
Team Coach	Administrator	Train workers involved in the implementation Ensuring the proper performance of each of the activities
Team Assistant	Spare parts assistant	Documentation of the implementation steps Providing assistance to internal staff

Training of Work Teams

In this phase, the respective training on the PDCA model and the solution tools used throughout the implementation will be carried out. Likewise, the solution schedule and its following sequence will be explained in detail.

It should be noted that all proposals made by the workers will be taken into consideration and will serve as feedback for improvement.

3.3.2. Component 2: Do

Conduct data collection

In this phase, the first thing to do is to collect information from the company's system, which will identify all the spare parts available in the warehouse and then proceed to classify them.

Perform ABC Classification of Spare Parts

In this phase, the classification of spare parts is carried out to identify those that are the most important during maintenance services, so they are the ones that should never be missing in the warehouse since they are also the ones that have the highest rotation. Once the first general classification of all the spare parts has been made, they are separated according to the family to which they belong to make the ABC classification as shown in Figure 3 finally.

Phase 1: Planning and Analysis

In this phase, a detailed warehouse study is carried out to determine the factors that intervene in the delays in the search for spare parts generated by the disorder in the warehouse and the products without a specific location. Likewise, a chronogram will be implemented where the

phases and the progress of the 5'S methodology will be reflected.

Phase 2: Execution of the 5S Model

In this phase, the 5'S methodology is implemented in the warehouse. To do this, we begin with the implementation of the first "S", which is Seiri (Select), and its main objective is to separate the necessary materials from the unnecessary ones, for which red cards will be used to represent the frequency of use of each of these as shown in Figure 4.

Then, the second "S" is implemented, which is Seiton (Organize), and its main function is to organize the previously selected elements to reduce spare parts search times and reduce operator movements. Figure 5 shows the implementation in the company.

Next, implementing the third "S" Seiso (Clean) is performed, which consists of cleaning to remove dust, dirt, and any contaminants found in the work area.



Fig. 4 Seri implementation

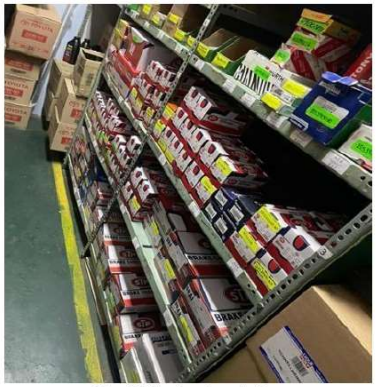


Fig. 5 Seiton implementation

Then, the fourth "S" Seiketsu (Standardize) is used, whose main function is to improve the 3 "S" previously mentioned; otherwise, the 5s methodology will not be implemented successfully.

Finally, the fifth "S" Shitsuke (Self-discipline) has as its main objective that the methods and standards mentioned in the rest of the "S" become a habit for the operators and adopt Deming's circle to obtain a continuous improvement in the work.

Create a Process Flowchart

During this phase, the implementation of the standardization of the washing service, whose main objective is to eliminate the reprocesses generated in the washing of the vehicle, causing delays in the final delivery time of the car.

Perform Final Inspection Form

At this stage, a new final inspection form is made so that the operators can verify if the car is delivered in perfect condition to avoid reprocessing that may cause delays in the final delivery of the vehicle. Table 2 shows the inspection form.

Table 2. Final car inspection sheet

Responsible	Task/Activity	Good	Bad	Observations
JC	Clean car interior	X		
JC	Tires clean and siliconed	X		
JC	Engine clean and siliconed	X		
JC	Rinsing process	X		
JC	Drying process		X	Bad drying
JC	Good internal vacuuming	X		
JC	Shiny vehicle		X	Lack of shampoo

3.4. Model Indicators

The indicators proposed to measure the model's performance are detailed below.

- Non-compliance ratio in maintenance service delivery times.
- Work orders were delayed due to a lack of stock of spare parts.
- Time spent searching for tools.
- Audit compliance.
- Washing cycle time.
- Productive activities in the washing process.

4. Validation

To demonstrate the effectiveness of the designed solution, the pilot plan was chosen as a validation method. The pilot plan system was developed taking into account the processes of vehicle maintenance management, purchasing management and washing in an automotive company.

4.1. Description of the Scenario

To demonstrate the effectiveness of the designed solution, the pilot plan was chosen as a validation method. The pilot plan system was developed, taking into account the processes of vehicle maintenance management, purchasing management, and washing in an automotive company.

4.2. Diagnosis of the Company Under Study

The preventive maintenance service presents a high ratio of non-delivery in the company under study throughout the year 2021, which was 30.2%, representing an economic loss of PEN 166,500.00 for penalties, equivalent to 5.7% of the total income generated in that year.

In relation to the study division, 36.2% of the work orders were delayed due to a lack of stock of average spare parts search time of 7 minutes per work order, a wash cycle time of 63.4 minutes and 77.33% of productive activities in the washing process.

4.3. Validation Design and Results

Initially, an analysis of the company's current situation is carried out to determine each company's processes and identify the main problem. Once identified, we proceed to determine the causes that are generating it and then identify the most appropriate solution tools to implement in order to reduce the impact generated by it.

For the execution of the proposal, the pilot plan is developed based on the continuous improvement model to reduce the initial indicators. To begin with, the number of samples needed to demonstrate the reliability of the implementation was established using the formula for finite population, concluding that the pilot test should be conducted in a minimum amount of 347.98 maintenance services, which is equivalent to 3 months.

4.3.1. ABC

The ABC classification of the spare parts in the warehouse was carried out, as shown in Table 3.

From this analysis, it was determined that the company has 291 types of spare parts, which represent 22.33% of the total inventory of inputs and, at the same time, represent 80% of its value. In this sense, efforts should be focused on optimizing the management and control of the inventory of this type of spare parts.

Table 3. ABC classification

Classification	N° Spare Sparts (SKU's)	% Spare Sparts (SKU's) Acumulado	% Valued	Valued
A	291	22.33%	79.96%	1,300,924.90
B	390	52.26%	15.03%	244,465.51
C	622	100.00%	5.02%	81,631.08
	1303			1627021.49

In addition, policies were implemented to improve inventory management, as detailed in Table 4 below.

Table 4. Inventory management policies

N°	Inventory management policies
1	Maintaining a safety stock of spare parts present in the A-Class
2	Warehouse will have to record all stock receipts to SAP.
3	Conduct a warehouse inventory in the months of April and November.
4	Meet ERI indicator >= 95%.
5	Performing a new ABC Classification after the last inventory of every year

Once the ABC methodology was implemented, in line with compliance with inventory management policies, it was possible to identify a reduction in the number of maintenance service work orders registered in the company's automotive management system (EMS) that were delayed due to a lack of spare parts in stock.

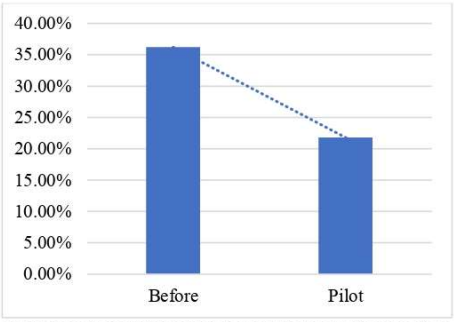


Fig. 6 Comparison of work orders delayed due to lack of spare parts in stock

4.3.2. 5S

We started with the planning and analysis phase and then implemented each one of the 5'S and carried out an audit on the compliance of the same, determining that there was an increase of 32%, as shown in Figure 7.

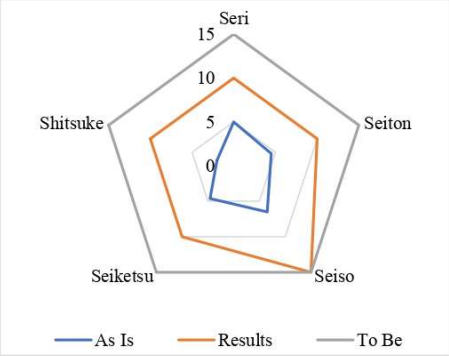


Fig. 7 5S Audit comparison

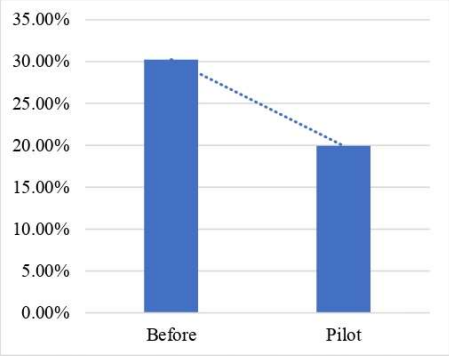


Fig. 8 Comparison of the rate of compliance in delivery times

The improvements obtained from implementing the 5'S methodology are reflected in the spare parts search time, which before was 7 minutes. After the improvements, a time of 4.11 is obtained, being 2.5 minutes as the ideal time. The improvement obtained is shown in Table 5.

Table 5. Comparison of spare parts search time before and after process improvements

	Formerly	Now
Spare parts search time	7 minutes	4.11 minutes

4.3.3. Standardized Work

It was used to correct two types of errors, the absence of activities in the washing process and the inefficient final inspection of the vehicle. To this end, a new flow of activities to be carried out by the person in charge of the washing process was created, and then a new activity diagram of the process was drawn up.

From this, it is determined that there is an increase in the percentage of productive activities by 11.29% compared to the activity diagram of the process before implementation. Likewise, the cycle time of the washing service was reduced by 11.9 minutes, and the improvement obtained can be seen in Table 6.

Table 6. Comparison of indicators before and after process improvement

	Formerly	Now
Productive Activities	0.7733	0.8462
Washing process time	63.4 min	51.5 min

Finally, it was possible to validate that the implementation of the management model under the Lean Manufacturing approach allowed a significant reduction in the ratio of non-delivery of the maintenance service, from 30.2% to 19.94% (a reduction of 10.26%), achieving the main objective set out in the research.

5. Discussion

5.1. New Potential Scenarios

Through the pilot plan, it was possible to determine the effectiveness of the proposed improvement proposal to reduce non-compliance in the delivery times of preventive vehicle maintenance services; this means that the results were satisfactory.

However, to demonstrate the reliability of the results, the implementation in other scenarios will be analyzed. That said, we will consider the services that have similarities with the preventive vehicle maintenance service, which are the corrective vehicle maintenance service and the bodywork and painting service.

5.1.1. Corrective Maintenance Service

With a longer service time than preventive maintenance, this type of service has a non-compliance ratio of 27.4%, the second with the highest non-compliance ratio. Like preventive maintenance services, this type of service also has the same causes that generate this non-compliance and the same indicators.

However, unlike preventive maintenance services, this type of service also has the same causes of non-compliance, as well as the same indicators. This service has spare parts with a lower frequency of rotation, so it is more likely that they are not in stock.

5.1.2. Results in Potential Scenarios

Based on the scenarios proposed for the vehicle corrective maintenance service, an evaluation of the improvements obtained is presented.

From the results presented in Table 7, it can be determined that the improvement model proposed in this project would achieve favorable results for the other types of services the company provides.

Table 7. Results

Indicator	Current Value	Final Result
Non-compliance ratio in delivery times	27.40%	18.36%
% of work orders delayed due to lack of spare parts stock	24.20%	15.83%
Audit compliance	46%	58%
Tool search time	7min	4.11min
Washing cycle time	63.4min	51.5 min
% productive activities	77.33%	95%

5.2. Analysis of Results

5.2.1. Economic Analysis

For the economic evaluation of this project, a 5-month projected financial cash flow was made, taking into account all the costs of the implementation of the improvement proposal, as well as the reduction of the maintenance service non-delivery ratio by 10.26%, which incurs a greater number of services performed during these months. Likewise, the revenues and investment involved in the same were taken into account.

Based on the cash flow, the financial indicators of Net Present Value (NPV), Internal Rate of Return (IRR), Discounted Payback Period (DRP) and Benefit Cost (B/C) were identified (Table 6). It is determined that a net present value (NPV) of PEN is 48,707.30. In addition, the internal rate of return (IRR) for the same scenario is 63%, which means that being higher than the COK makes it viable, in addition to a payback period of 1.72 and a benefit/cost ratio of 1.51. For all these reasons, it can be concluded that the project is viable for the company. Table 8 shows the results of the economic evaluation.

Table 8. Economic results

Results	NPV (PEN)	48,707.30
	IRR	63%
	Payback	1.72
	B/C	1.51

5.2.2. Future work

After finishing the present investigation, to expand the limits of the acquired knowledge and seek to contribute to the different areas to optimize their processes, reducing the delivery times, the future works to be carried out are shown.

- Investigate, propose and validate a possible implementation of Lean Manufacturing to mitigate other problems related to process improvement in the automotive sector.
- To expand lean manufacturing knowledge in industries other than automotive; in other words, to investigate, propose and validate implementing a management model based on Lean Manufacturing in other industries.
- Investigate the compatibility of other Lean Manufacturing tools for possible future implementation in process optimization.

6. Conclusion

This research was able to diagnose that the high ratio of non-delivery of the maintenance service is the main problem presented by the company in the automotive sector and, at the same time, is the one that generates the greatest amount of economic loss. Likewise, it was determined that poor purchasing management, products without location, inefficient final inspection of the vehicle, the disorder in the warehouse, error in the purchase of spare parts and the absence of washing process activities, with an impact of 17.43%, 15.07%, 19.19%, 12.24%, 11.15% and 9.89% respectively, are the main root causes of the problem.

Recognizing the problem and its root causes from the beginning facilitated the use of the solution tools used in the project. Different companies from different industries have implemented the tools implemented, obtaining positive results, such as those reviewed in the success stories of this work.

The lean manufacturing management model applied to the processes of an automotive company can mitigate the ratio of non-delivery of maintenance services by 10.26%. Likewise, it was possible to reduce the spare parts search time and the washing cycle time by 44.7% and 18.8%, respectively, in addition to reducing the number of work orders with delays due to the absence of spare parts by 14.4%.

The project is economically viable with an NPV of S/. 48,707.30, an IRR of 63% and a B/C ratio of 1.51, which are positive values.

In addition, on the one hand, the present research allows expanding the literature referred to process optimization through the implementation of ABC analysis, the 5'S methodology, and standardized work. On the other hand, consider expanding the implementation of the proposed model in other services with similar characteristics to the preventive maintenance service to continue mitigating the non-delivery ratio.

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Net Promoter Score (NPS) and Customer Satisfaction: Relationship and Efficient Management

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Abstract: The NPS index is used in the hotel industry to measure customer loyalty and, by extension, customer satisfaction. Many hotel companies set their annual budget based on this index and include it, together with annual economic results, for evaluation when deciding on a potential management bonus. For managers in some companies, achieving a high NPS becomes nearly as important as achieving strong economic results. The purpose of this research is to deepen the study of the NPS index by analysing the existing relationship that the model has with customer satisfaction, focusing on the following main areas of a hotel: reception, cleanliness and room comfort, and gastronomy. To do so, this study uses fuzzy set qualitative comparative analysis (fsQCA). New evidence of value is offered based on the analysis of a sample of six hotels (4 and 5*) located in the Balearic Islands, Spain (Mallorca, Minorca, and Ibiza). In total, 557 surveys were completed in August 2021 and 571 surveys were completed in August 2020, and therefore both sample groups were impacted by a Black Swan (BS) event, the COVID-19 pandemic, in two different stages of its trajectory. The results suggest that in the study sample, the key factor in achieving a high NPS was (1) gastronomy in 2021 (after more than one year of the COVID-19 pandemic), and (2) cleanliness and room comfort in 2020 (at the beginning of the COVID-19 pandemic). These results offer insights for hotel managers, as well as for academics who can develop new lines of research on the subject.

Keywords: Net Promoter Score; customer satisfaction; tourism; hotels; Black Swan; COVID-19; fsQCA

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1. Introduction

Since the exchange of goods and services began, companies have focused on establishing process improvements to offer quality products that meet customer needs. Marketing specifically focuses on strategies to achieve these improvements [1]. During the mid-1990s, the development of technology, computing, and the emergence of the Internet had a significant influence on the market, and data processing is now key to designing marketing strategies [2]. This has led to a commercial projection focused on communication, with a new approach to measuring customer perception in line with the advancement of digital services.

Tourist accommodation is a highly competitive sector. Since the 1990s, demand and expectation for a high-quality service has increased. Presently, the quality of service in the hotel sector goes beyond the facilities themselves, with a specific focus on customer service, customer relations, resolving customer issues, promotions, and facilities access [3].

Wirtz and Lovelock [4] argued that satisfaction can be defined as an attitude judgment after a purchase action or a series of interactions between the consumer and product. Considering this definition, customer satisfaction is the result of the perception of the service received in accordance with the expectation projected by it.

To measure customer satisfaction, it is common for companies to use their own independently prepared questionnaires, in electronic or paper format. The questionnaires are presented to customers and comprise a series of questions in relation to satisfaction with the purchase of a particular product or service. These questionnaires might offer a

closed response option (such as multiple choice or a rating scale), an open response option (allowing customers to include extra comments), or a combination of both [5]. Some companies choose not to use independent questionnaires, preferring to opt for those related to quality models previously formulated and verified in different industries. These include the SERVQUAL or SERVPERF models (which both use approximately 22 questions), or various customer experience metrics such as the Customer Satisfaction Score (CSAT), Customer Effort Score (CES), or the previously mentioned NPS.

NPS was presented by Reichheld in the Harvard Business Review, in an article entitled 'The Only Number You Need to Grow' [6]. The procedure is very simple: customers are asked the single question, 'How likely are you to recommend our company to a friend or colleague?' and are given a response option of a rating scale from 0 to 10. Customers answering 0 to 6 are to be considered 'detractors', 7 and 8 'passive', and 9 and 10 'promoters'. The NPS index, expressed in a percentage, is calculated by subtracting the detractors' scores from the promoters' scores and dividing the total by the number of questionnaires. Passive customers are not considered [7].

With this straightforward, direct, and relatively simple method, Reichheld defended the argument that complex surveys are not necessary and that NPS can replace this method as a more effective way for organizations to determine customer loyalty and even achieve positive financial results [6]. However, some scholars have questioned the reliability of using this 'magic' index as a standalone method [7–11]. Therefore, many companies, from various industries, run a client satisfaction questionnaire with approximately 25 questions, and one of these questions, usually the last one, happens to be NPS. A balance between several detailed questions about the product or service sold together with NPS seems to be the preferred option.

In December 2019, COVID-19 was first detected in Wuhan, China, and the unprecedented outbreak rapidly spread globally. It has since impacted all aspects of society, forcing governments globally to search for and implement solutions [12]. This unprecedented pandemic has harmed both tourism and the global economy [13], and economic forecasts have predicted slowed financial growth and a bleak outlook for populations in countries affected most severely by the COVID-19 outbreak.

According to Taleb [14], a 'Black Swan' (BS) occurrence has three main characteristics: (1) rare, (2) unprecedented, and (3) has a significant impact on society. The COVID-19 pandemic is widely regarded as a BS event. Yet, interestingly, as founder of this theory, Taleb disagrees, presenting the argument that pandemics occur cyclically and that it could have been prevented. Similarly, Yarova Ya et al. [15] asserted that pandemics have existed since the beginning of time, and an extensive list of pandemics can easily be found online. In consensus, pandemics on a large scale such as COVID-19 are extremely uncommon. BS theory is used to classify these high-impact events.

The tourism industry has suffered a significant negative impact as a result of the COVID-19 pandemic. Decisions on travel destinations are heavily influenced by travellers' perceptions of safety and security. Tourists' perceptions of travel risk and management can impact their travel behaviour [16]. Consumer perceptions of danger in relation to travel and management of certain challenges are likely to shift as the disease spreads and uncertainty increases. Typically, tourists are likely to avoid 'dangerous' destinations, where the risk of disruption to travel is much higher. The impact of COVID-19 on tourism destinations has resulted in unanticipated consequences [17].

COVID-19 transmissions and infections have also affected customer loyalty and customer satisfaction within the hospitality industry. There have been instances where tourists have contracted the disease whilst at their holiday destinations [18]. The World Health Organization (WHO) recommended the restriction of movement between countries, advice implemented by the majority of countries globally. As a direct consequence, this change affected customers staying in hotels [19].

The research objective of this study was to propose a model that shows the degree of influence between the satisfaction expressed by clients staying in hotels in the key areas of

reception, cleanliness and room comfort, and gastronomy (dependent variables) and the satisfaction and loyalty expressed and measured by the NPS index (objective variable), in a sample of hotels in the Balearic Islands, Spain. The main investigation focuses on the month of August 2021, with an additional investigation conducted in the same circumstances in August 2020. In this way, it was possible to compare the situation at two different times, both of which were framed within the COVID-19 pandemic. The objective of the study is to understand how hotel managers should ideally approach this issue in order to increase the results in the NPS index. As previously mentioned, there are no known previous publications that have analysed the relationship between specific satisfaction results on areas of hotel services and results in the NPS index. This study makes a detailed contribution to the operation of NPS in the hotel industry that can provide insights to hotel managers and scholars conducting research into this area. In addition, the fsQCA model used in the data analysis presents new information in research on customer satisfaction within the hotel industry.

The main conclusions drawn from the research were the validation of the model, generating successful work options to achieve high levels of NPS, enhancing satisfaction with cleanliness and room comfort for the 2020 sample, and enhancing satisfaction with gastronomy in 2021. The analysis of both the model and the case presented provides novel and high-impact information for scientific studies focused on customer satisfaction, as well as those focused on the NPS index. In addition, it provides empirical insights to hotel owners, managers, and related companies who are interested in improving customer satisfaction and effectively transferring this to the numerical results in NPS.

2. Theoretical Background and Development of Propositions

2.1. Market Orientation and Quality of Services Related to Customer Satisfaction

The advances in customer communication (predominantly technological and digital) that have occurred since the end of the twentieth century have prompted an evolution from marketing initially defined as marketing 1.0 to the current marketing 4.0. According to Kotler et al. [20], marketing has evolved from being focused on the product (1.0), to focused on the consumer (2.0), to focused on values (3.0), to focused on a social purpose (4.0). This progression has stimulated the implementation of recommendation marketing, whereby customers recommend the brand or company to their personal social network based on their experience. This is amplified in social networks with the use of reviews as a source of brand feedback to measure customer satisfaction [21].

Customers are offered a diverse set of products and services to meet their needs, and their purchase decision is based on expectations. Experiencing a certain level of satisfaction fosters loyalty, with customers then transmitting their experiences and promoting the product or service [1]. The scope of the recommendation is essential for the feedback regarding the brand. Therefore, the ability to adequately measure customer satisfaction is invaluable for strengthening the marketing strategies of companies.

Customer satisfaction is directly associated with the quality of the service. The evaluation of customer satisfaction is a way of obtaining operational information on the quality of the service offered by the company [22]. The dynamization of the market instigated by continuous changes is a result of the competitiveness of organizations to generate value and comply with high quality standards that satisfy the needs of customers. Consequently, this effect has brought with it the prioritization of services, which are focused on health, tourism, and education, amongst other sectors, as an economic factor of global interest [23].

The growth of the services sector is notorious in the case of Spain. After the financial crisis of 2008–2009, a sustained annual increase began from 2013 to 2018, which was dramatically affected in 2020 due to the emergence of the COVID-19 pandemic, according to data from official sources [24,25].

In general, companies must prioritize a solid understanding of customer needs, in order to be able to satisfy them and subsequently guarantee customer loyalty, in such a

way that the quality strategy allows customer satisfaction [26]. This strategy motivates the selection of a suitable instrument to measure customer satisfaction.

A definition of customer satisfaction has been offered by numerous scholars. According to Zeithaml et al. [27], satisfaction can be defined as feelings of pleasure or disappointment that result from comparing the perceived performance of a product or result with expectations. If the performance does not meet expectations, the customer is unsatisfied as a result. If it matches expectations, the customer is satisfied or happy. Similarly, Wirtz and Lovelock [4] (p. 130) state that 'satisfaction is a judgement following a series of consumer product interactions'. Both definitions concur that customer satisfaction is the result of the perception of the service received in accordance with the expectation projected by it.

There are various methods for measuring customer satisfaction. From an operational perspective, some of these methods are simple, whereas others demand greater mathematical complexity in their application. To measure customer loyalty, metrics based on customer satisfaction questionnaires and repurchase intention are mainly used [28]. All methods considered, both implicitly or explicitly, there is a close relationship between service quality and customer satisfaction [29]. Therefore, it is common for companies to use independent questionnaires to measure customer satisfaction or to use pre-settled questionnaires from different quality models [5].

SERVQUAL is a quality model that has been utilized to successfully measure customer satisfaction and establish an evaluative criterion on the quality of the service offered [27]. This concept was developed by Cronin and Taylor [30], who created the SERVPERF model focused on service performance.

Models and indices continued to evolve, with the introduction of the Customer Satisfaction Score (CSAT), consisting of a questionnaire with five Likert scale response options with extreme values and a central value (very satisfied to very dissatisfied), with the percentage satisfaction determined by dividing the sum of the very satisfied and the satisfied by the total number of responses [31].

Another method that is used frequently in market research and regularly in companies is the Customer Effort Score (CES). In this approach, customer interaction with support services or help received by sales teams is evaluated on a scale of 1 to 10. Its aim is to mitigate the amount of effort the client has to exert [32].

In addition to the CSAT and the CES, another instrument that is used very frequently is the NPS, which measures customer recommendation. The purpose of this research was to deepen the study of the NPS index and its relationship with different aspects of customer satisfaction in the main areas of a hotel. No similar research has been found in previous studies, and so this research adds new insights to fill the existing gap between the NPS index and customer satisfaction.

2.2. Customer Satisfaction and NPS

The critical factor of consumer loyalty is happiness, a concept particularly relevant to the hospitality industry, which is an industry of happiness [33]. An unhappy customer as a result of a negative experience will have no doubts about taking their business elsewhere, especially given the wealth of options currently at their disposal. The idea of customer satisfaction is complex and comprises several factors.

As previously mentioned, NPS was founded by Reichheld in 2003, in a Harvard Business Review article with the attractive title of 'The Only Number You Need to Grow'. NPS looks at customer loyalty towards a company's products or services after use and is calculated by asking customers a single question—'How likely are you to recommend our company to a friend or colleague?'—with responses allocated on a scale from 0 to 10 [7].

NPS classifies customers according to the answer obtained from the question asked. According to Grisaffe [34], the response is designated on a scale of 0 to 10 points, where 0 indicates that it is extremely unlikely that the brand will be recommended, and 10 indicates that it is very likely that the brand will be recommended. This scale supports the classification of clients into three categories: promoters, passives, and detractors. Promoters

award 9 or 10 points and are clients who had a very positive experience with the company, and it is assumed that they will recommend it and issue positive reviews. Passives award 7 or 8 points and are customers who had a positive experience with the company, but are either not willing to recommend it or are indifferent. They do not usually issue reviews. The third category of customers, detractors, award between 0 and 6 points and are customers who had a negative experience with the company and are willing to comment on it by issuing negative reviews. The method for calculating the NPS index is very simple and easy to interpret. It is calculated by subtracting detractors from promoters—passives are not considered:

$$NPS(\%) = \frac{Promoters - Detractors}{Total \text{ number of respondents}} * 100$$

This percentage index will be defined as follows: $NPS(\%) \leq |100|$. Therefore, it can be both positive and negative. Its interpretation is just as easy to analyse [34].

According to Reichheld and Markey [35], a result of −100 to 0 would be unsatisfactory, with −100 to −50 being deficient, and −49 to 0 insufficient. Deficient means that the quality of the service is perceived in a significantly negative way by the client. Insufficient means that the quality of the service is perceived negatively by the customer. A result between 0 and 100 would be satisfactory, with 0 to 49 being sufficient and 50 to 100 excellent. Sufficient is understood to mean that the quality of the service is positively perceived by the customer. Excellent is understood to mean that the quality of the service is perceived in a significantly positive way by the customer.

Reichheld claimed that there was no need for extensive surveys, favouring NPS as a reliable standalone method to determine customer loyalty [6] and consequently achieve organic and sustainable business growth. The reality within the current hospitality sector is that this single question is merged with other more specific questions about the service offered by the particular company to create a satisfaction questionnaire. Management can then obtain an NPS score from the specific NPS question (applying the NPS calculations), in addition to customer satisfaction scores, according to the rest of the questions. An implication of this approach is that NPS and general customer satisfaction indexes can become mixed, distorting the actual value of the NPS and relating it completely to customer satisfaction. Management must be cautious, realistic, and recognize the need to use other tools alongside NPS when assessing the growth rate of a company [11].

There are limitations to the NPS method. For example, a reception manager who is focused on customer satisfaction and obtaining positive feedback about the customer experience might be reproached because of a low NPS score. However, this low NPS might be the result of negative customer experience in other areas of the hotel, such as food quality or noise interference. This superficial analysis can put pressure on departmental managers and negatively affect the ultimate aim of NPS, which is to improve customer satisfaction and loyalty. Due to this, various academics have raised doubts about the efficiency of this single question and the attractiveness of NPS for management [8,9]. Despite this, the success of NPS is to be expected and justified within certain industries, given its potential to offer a very simple and cheap way of obtaining a quantifiable measurement of customer loyalty and satisfaction. It can thus be easily traced, monitored, and used as a tool to apply pressure and regulate management responsibility.

Mandal [11] proved that there are certain industries where NPS is a less reliable indicator when used as a standalone method (an argument recognized even by Reichheld himself), such as database software and cable TV, amongst others.

After investigating six Dutch hospitals, Krol et al. [36] concluded that there is no certainty that NPS alone generates more reliable results for the management of patient satisfaction in comparison with other types of questionnaires. Similarly, following their study on the insurance industry in Denmark, Kristensen and Eskildsen [10] concluded that NPS is a weak predictor of customer loyalty and satisfaction, and that using NPS as the only ratio in business management could lead to misunderstandings in the measurement of these areas.

To predict customer behaviour and satisfaction, companies must adopt a multidisciplinary approach in order to avoid falling victim to a single question metric, which might hinder their final objectives [9,37]. According to Krol et al. [36], considering that the instrument is applied with the same structure to different companies, it facilitates in a simple and operational way the comparison of the quality of the service provided by the company.

2.3. *COVID-19 Black Swan and Its Impact on the Tourism Industry*

The COVID-19 pandemic surprised the world in late 2019/early 2020, causing a global economic and social crisis, with tourism being one of the sectors severely affected [38]. This unstable and uncertain economic environment discourages travel, leading to low demand for tourism [39]. There have been few studies on how to deal with a pandemic in the hotel sector [40], so it is necessary to deepen research that may allow this type of crisis to be adequately managed from all necessary perspectives: financial, operational, and customer satisfaction, amongst others.

The restrictions imposed and the experience of living through a pandemic generate distrust in services on the part of clients, which requires that the areas of interest of client satisfaction be adequately managed in the aftermath of the crisis [41]. With a pandemic, the recommendation system that originates with satisfied customers becomes critically important for accommodation services [42].

In this environment, to achieve customer satisfaction, it is very important to be innovative with services, since restrictions are likely to affect customer perception in one way or another [43]. In addition, given the feasibility of social networks, it is advisable to implement a system of suggestions or collaborative platforms by areas of interest that are part of the measurement of customer satisfaction [44].

The COVID-19 pandemic has been linked in numerous academic studies to the Black Swan (BS) theory. A BS is an event that is out of the ordinary and could have terrible consequences if it happens. BS events are infrequent, have a significant impact, and some argue that they were evident in the past [14].

Some academics, including Taleb, the founder of BS theory, have argued that COVID-19 is not a BS event, since pandemics occur regularly, and that a similar situation occurred some years earlier with SARS. According to Weber [45], it is well-known that coronavirus pandemics have occurred in the past. After a long and anxious wait, the SARS coronavirus outbreak was finally brought under control in 2004. Pandemic influenza and emerging novel diseases were both included in risk registers, though they were not explicitly labelled as such. In essence, it was discovered that a non-flu pandemic was possible.

Any issue affecting medical care, such as a Black Swan event, can lead to disturbances in the world of work, public health, and food supply chains [46]. The social and economic disruption caused by the pandemic is destructive, as it has led to the deaths of millions of people around the world, causing a major impact on society, as BS theory states for its events [15]. Consumers in general expect smooth services without restrictions, and a BS situation may affect these expectations [47,48]. Pandemics are unmanageable due to their suddenness, as has been seen with COVID-19, which clearly relates to BS theory.

The COVID-19 outbreak has undermined the development narratives in place before it. Governments worldwide have enforced the most extreme lockdowns in history to contain the spread of the virus. This disease has harmed many aspects of human existence and industry, including tourism. The pandemic's economic, travel, and social consequences can include long-term health issues for affected persons and loss of friends and family [49].

Strict safety regulations hurt the tourism sector and increase unemployment. Financial, sociological, geopolitical, political, and technological factors influence business today. These changes impact regional or worldwide corporate performance [50]. While wealthy nations have begun vaccination, most underdeveloped nations are still waiting. Patients, doctors, vaccines, and testing facilities for COVID-19 are insecure in many countries [51]. This situation in countries where vaccines are not in general use may affect the world again and slow down the recovery in the tourism industry.

2.4. Proposals for Research

After reviewing the empirical evidence on NPS and customer satisfaction, in these pandemic-affected years, this paper aims to demonstrate that:

- Proposition 1: High levels of customer satisfaction increase NPS.
- Proposition 2: High levels of satisfaction measured in key areas such as reception, cleanliness and room comfort, and Gastronomy increase NPS.
- Proposition 3: A key factor that leads to a high NPS can be identified.
- Proposition 3.1: High customer satisfaction with reception is the key factor that leads to a high NPS.
- Proposition 3.2: High customer satisfaction with cleanliness and room comfort is the key factor that leads to a high NPS.
- Proposition 3.3: High customer satisfaction with gastronomy is the key factor that leads to a high NPS.
- Proposition 4: The factor identified as key leading to a high NPS in 2021 should be the same in 2020.

3. Materials and Methods

This study analysed two samples: a main sample collected in August 2021, including comments from 557 clients, and an additional comparative sample collected in August 2020, including comments from 571 clients. Both samples were taken from the same 6 hotels (4- and 5-star), which belong to a Spanish chain that manages hotels worldwide. The 6 hotels are located in the Balearic Islands, specifically on the islands of Mallorca, Minorca, and Ibiza.

Clients of the hotels completed a voluntary online questionnaire sent after their stay, having agreed to be contacted at check-in without any type of benefit, in accordance with the usual management procedure of the hotel company.

The customer satisfaction discovery process requires the implementation of some perfect practices in relation to the research for an accurate score to be obtained. The entity running the research questionnaire should pay attention to its design, taking into consideration the research objectives, types of questions, and how it will be responded to, administered, and processed [52]. The online questionnaires used by the hotel company that shared the information for this study were designed by an external professional company and have been in use for several years, sent by email to customers 48 h after check-out.

The data from these surveys were shared by the hotel company in order to facilitate this study. Online questionnaires to measure satisfaction with hotel services have been common practice for many years now, replacing the paper questionnaires traditionally presented in-person during a client's stay. According to Riva et al. [53], online questionnaires are a valid alternative to traditional paper questionnaires if they have been previously validated.

The questionnaire used in the sample under study asked customers about their satisfaction with the service received in various departments of the hotel: the reception, cleanliness and room comfort, gastronomy, entertainment, and the spa. This was assessed using a 5-point response system. If the client rated their satisfaction at between 1 and 3, the system displayed an option to include a personalized comment, qualitatively (qualitive comments were not considered for this study, however). If the client chose 4 or 5, no option was displayed. The final question of the questionnaire asked the client about their intention to return to stay at the hotel and promote it amongst their acquaintances. This question offered a response system from 0 to 10 and corresponded to the NPS.

These online questionnaires were carried out ad hoc by ReviewPro, a Spanish company that is a world leader in applications for the hotel industry, with more than 60,000 clients in 150 countries [54]. According to Hensens [55], ReviewPro is a remarkable example of the software tools currently available on the market to manage customer comments on online sites. This tool facilitates the management of questionnaires made ad hoc for a designated company [56].

In the case of the company under study, customer satisfaction objectives were established based on the results of the online surveys sent to customers. The objective was established at 90% for 5-star hotels, and 86% for 4-star hotels. To obtain the results, the system evaluated the 5-point response system as 1 counting as 1%, 2 counting as 25%, 3 counting as 50%, 4 counting as 75%, and 5 counting as 100%. The result of the NPS is evaluated independently of this departmental satisfaction. NPS is evaluated based on clients' responses on an 11-point scale, as established by the NPS concept. The objective for 5-star hotels is to obtain a result higher than 65%, and for 4-star hotels to obtain a result higher than 45%. The annual objective-based bonus for hotel managers includes the achievement of these satisfaction objectives, for both departmental satisfaction questionnaires and NPS. As indicated by Chen et al. [57], the inclusion of non-financial objectives in the annual bonus for executives intensifies competition amongst them. This is one of the reasons why this study can provide insights to hotel managers, allowing them to better understand the operation of the NPS index. In this way, the aim is to identify combinations of services offered by hotels that lead to an increase in the NPS index of customer satisfaction.

A sample analysis based on fsQCA was used, which is a set theory methodology that considers cases as configurations of causes and conditions, instead of treating each independent variable as analytically distinct and isolated from the rest. This empirical methodology examines the relationships between the outcome of interest (in the case of this study, a high NPS) and all possible combinations (high/low or absent) of its predictors (reception, cleanliness and room comfort, gastronomy). FsQCA summarizes the linguistic 'if-then' rules. The interest in fsQCA is due, fundamentally, to Ragin, who has offered numerous contributions on the subject [58,59]. The main purpose of fsQCA is to fit the data to the theory by going beyond dependence on a single sample, which implies achieving predictive validity [60–63]. This method based on Boolean algebra is suitable for N-samples of small or medium size [64].

The conceptual basis of fsQCA starts from set theory. This allows a detailed analysis of how causal conditions contribute to an outcome. Instead of estimating the effects of individual variables, fsQCA uses Boolean logic to study the relationship between an outcome and all possible combinations of multiple antecedent conditions, allowing researchers to find different combinations of causal variables that suggest different theoretical pathways to a determined result [65]. According to Ragin [59], instead of investigating which factors are more important, fsQCA seeks to know which factors should be combined and in what combinations.

A fuzzy set can be viewed as a continuous variable that has been usefully calibrated to indicate the degree of membership in a well-defined and specified set. Such calibration is possible only using theoretical knowledge, which is essential for the specification of the three cut-off points or qualitative thresholds (full member, non-full member, and maximum ambiguity). For example, cases in the lower ranks of a conventional continuous variable may be totally outside the set-in question, with fuzzy membership scores truncated to 0.0, while cases in higher ranks of this same continuous variable can be totally within the set, with fuzzy membership scores truncated to 1.0.

The measure of consistency, analogous to correlation, is the proportion of cases that are compatible with the result, which is the number of cases that present a certain configuration of attributes and the result, divided by the number of cases that present the same configuration of attributes but do not display the result. This can be seen in the scatter plots. The coverage measure, analogous to the coefficient of determination, assesses the empirical relevance of a consistent subset. This refers to the proportion of the result explained by the model variables—in this case, by the solution. Coverage is based on a causal combination that guarantees that the cases that meet it cover a large enough part of the result to be empirically important. The proportion of members with the result—that is, with high satisfaction—is explained by the solution.

We have a sample of 6 hotels in the Balearic Islands, Spain, for which the NPS index (objective variable) is available, together with customer satisfaction metrics for cleanliness

and room comfort, reception, and gastronomy (dependent variables), calculated as the average of the customer ratings for each hotel. To apply the fsQCA methodology in this research, fsQCA 3.0 (Fuzzy-Set/Qualitative Comparative Analysis Version 3.0) was used. FsQCA methodology analyses have been used successfully in multiple studies in the social sciences [66–70].

The descriptive statistics shown below on the initial data provide a better way to understand the methodology, with each of the dimensions in its original mode (Table 1).

Table 1. Descriptive data.

Dimension	Valid N	Mean	Standard Deviation	Percentile 05	Median	Percentile 95
NPS	6	45.73	14.17	30.71	41.81	66.36
Reception	6	89.05	3.89	84.40	88.45	94.80
Cleanliness and room comfort	6	82.83	6.27	76.00	82.20	91.70
Gastronomy	6	81.92	2.16	79.80	81.50	85.50

Both the analysis of the model and the analysis of the specific case presented add novelty to scientific studies focused on customer satisfaction and in-depth insights into the NPS index. They also provide empirical insight to hotel owners, managers, and those in similar consumer industries.

4. Results

Prior to the realization of the fuzzy model, calibration was carried out, which in this research indicates the extent to which hotels can be considered members of groups that vary according to the NPS index, and the services offered.

In this investigation, four factors were analysed (Table 2).

Table 2. Factors to be analysed.

Condition/Outcome		Code	Items
Outcome	NPS index	NPS	Degree of customer satisfaction with their stay at the hotel expressed as a recommendation to third parties.
Antecedent conditions	Satisfaction with reception	Reception	Degree of customer satisfaction with the service in the reception area (check-in, etc.).
	Satisfaction with cleanliness and room comfort	Clean_conf_room	Degree of customer satisfaction with cleanliness and room comfort.
	Satisfaction with gastronomy	Gastronomy	Degree of customer satisfaction with the service and quality of food offered for breakfast, lunch, dinner, and room service.

Each of these quantitative variables was calibrated to grant degrees of membership or belonging to previously defined groups. The details are given below, where the first value corresponds to the calibrated value 1 (full member), the middle corresponds to the ambiguous calibrated value 0.5, and the third value corresponds to the calibrated value 0 (non-member):

nps_fz = calibrate (nps, 66.36, 41.81, 30.71).
recep_fz = calibrate (reception, 94.80, 88.45, 84.40).
hcflp_fz = calibrate (h_confclean, 91.70, 82.20, 76.00).
gastro_fz = calibrate (gastronomy, 85.50, 81.50, 79.80).

These sets are shown in Table 3.

Table 3. Calibration factors.

Conditions		Set Membership
Outcome	NPS index	Hotels whose customers have a high NPS.
Antecedent conditions	Satisfaction with reception	Hotels whose customers are highly satisfied with reception.
	Satisfaction with cleanliness and room comfort	Hotels whose customers are highly satisfied with cleanliness and room comfort.
	Satisfaction with gastronomy	Hotels whose customers are highly satisfied with gastronomy.

4.1. Sufficiency Analysis

Once the results and all the conditions had been calibrated ('fz' indicates a calibrated variable), this study proceeded to extract the 'Truth Table', in which all the possible configurations are listed. According to Ragin [59], there are 2^k configurations or rows, where k is the number of conditions (in this case $2^3 = 8$ combinations). The value 1 in each setting indicates a calibrated variable score greater than or equal to 0.5 (that is, closer to the full member category) and 0 indicates calibrated variable values less than 0.5 (closer to the non-member category). They are ordered from the highest to the lowest number of cases with a membership score greater than 0.5 in that configuration (column 'number' is the accumulated %), and the consistency of each of them is shown based on the subset relationship with the result, as shown in Table 4.

Table 4. Truth Table.

recep_fz	hcflp_fz	gastro_fz	number	nps_fz	Raw Consist.
1	1	1	1 (16%)		0.992308
1	1	0	1 (33%)		0.989362
1	0	1	1 (50%)		0.419643
0	1	0	1 (66%)		0.764286
0	0	1	1 (83%)		0.892857
0	0	0	1 (100%)		0.524096
1	0	0	0 (100%)		
0	1	1	0 (100%)		

The next step is the selection of a consistency threshold to distinguish causal combinations that are subsets of the result from those that are not. Values below 0.80 in this column indicate substantial inconsistency [59]. This study selected 0.893 as the consistency threshold and assigned the value 1 to the result variable (nps_fz) when the consistency of that configuration exceeded the 0.893 threshold. Conversely, when it was below the threshold, it was set as 0, as shown in Table 5.

Table 5. fsQCA output.

recep_fz	hcflp_fz	gastro_fz	Number	nps_fz	Raw Consist.
1	1	1	1	1	0.992308
1	1	0	1	1	0.989362
1	0	1	1	0	0.419643
0	1	0	1	0	0.764286
0	0	1	1	1	0.892857
0	0	0	1	0	0.524096

The resulting intermediate solution is two combinations that sufficiently increase the customer's NPS index. We view complex and parsimonious solutions as the two extremes of a single complexity/parsimony continuum. Any solution that is a subset of the most parsimonious solution and a superset of the most complex solution is a valid Truth Table solution [71]. As shown in Table 6, these intermediate solutions use only a subset of the assumptions that were simplified and that are used in the more parsimonious solution.

Table 6. fsQCA output. Intermediate solution (reduced final set): leading to high NPS.

Sets	Raw Coverage	Unique Coverage	Consistency
hcflp_fz*recep_fz	0.633	0.498	0.995
gastro_fz*~hcflp_fz*~recep_fz	0.346	0.211	0.892
Solution coverage: 0.844 Solution consistency: 0.953			

The final solution can be expressed as follows:

hcflp_fz*recep_fz + gastrocfz*~hcflp_fz*~recep_fz

In fuzzy set theory, there are three common operations that are used in the present investigation. These are negation (represented by ~), intersection (logical AND, represented by *), and union (logical OR, represented by +):

Logical negation (~): (membership in the set ~ M) = 1.0—(membership in the set M).

Logical AND (*) is carried out by taking the minimum membership score of each case in the sets that are combined.

Logical OR (+) is carried out by taking the maximum membership score of each case in the sets that are combined.

The two combinations shown above in Table 6 sufficiently increase NPS in 95.3% of the cases and cover 84.4% of the cases. Both the combination of high satisfaction with the quality of cleanliness and room comfort and high satisfaction with reception and the combination of high satisfaction with gastronomy and low satisfaction with cleanliness and room comfort and reception lead to a sufficient increase in NPS. These attributes are in line with the statements of Dolnicar and Otter [72] about the important areas of a hotel to be measured in satisfaction surveys.

In view of the results, it seems clear that the category of the hotel (four- or five-star) and the segment to which the hotel belongs (five-star luxury hotel, four-star adults-only hotel, four-star family resort) decisively influences the fulfilment of the conditions and is consistent or inconsistent with the result. The consistent ones are the hotels whose second coordinate value is greater than or equal to the first, and the relevant consistencies are those where the first coordinate value is greater than 0.5 (therefore, both are greater than 0.5). The first value is the degree of belonging to the combination and the second is the degree of belonging to the result (high NPS). The inconsistent ones are those where the first value is greater than the second, and the seriously inconsistent ones are those where the second is greater than 0.5 (therefore, both are greater than 0.5).

In the model presented in this study, there are no serious inconsistencies:

hcflp_fz*recep_fz: 4* adults-only hotel #1 (0.95,0.95), 4* adults-only hotel #2 (0.59,0.62).

gastro_fz*~hcflp_fz*~recep_fz: 5* hotel (0.61,0.89).

In hotels that meet the first condition (four-star adults-only hotel #1, four-star adults-only hotel #2), the gastronomy service is not a determining factor in customer satisfaction if the reception and cleanliness and room comfort are rated highly. In hotels that meet the second condition (five-star hotel), gastronomy is relevant because, even with poor reception and cleanliness and room comfort, NPS will be high if gastronomy is good.

Figure 1 shows the consistency and coverage of the solution, in a scatter plot that compares the solution with the result: a combination that systematically has all the (calibrated) scores less than or equal to the result scores (upper triangle) is said to be a subset

of the result and the consistency is high. Hotels that are below the diagonal indicator are inconsistent with the result, and those that are above it are consistent. Note that there are no cases in the red zone, meaning there are no serious inconsistencies.

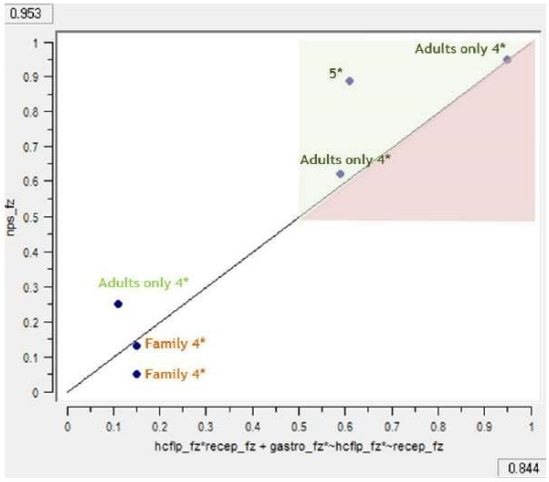


Figure 1. Plot of "nps_fz" against "hcflp_fz * recep_fz + gastro_fz * ~hcflp_fz * ~recep_fz".

According to Ragin [58], when analysing sufficiency, we compare the membership scores of the outcome not only with the score of each individual case, but also with the scores of all possible causal expressions. If all cases are above the diagonal indicator, this indicates that the membership scores of the outcome are consistently greater than the membership scores of the causal combination. The causal expression is therefore a subset of the outcome, which is the set-theoretic way to express sufficiency.

The green zone represents the most consistent cases with the solution, and the red zone represents the most inconsistent cases with the solution. Within each group, there are degrees of relevance depending on whether the score for belonging to the combination is less than or greater than 0.5 (upper right quadrant). An inconsistency in the red triangle is more serious ($Xi \geq 0.5$, $Xi > Yi$), and a consistency in the green triangle is more relevant ($Xi \leq 0.5$, $Xi \leq Yi$).

Regarding the most relevant consistencies in the global solution, there is the five-star hotel and two four-star adults-only hotels. Note that the two four-star family hotels are inconsistent with the global solution, in addition to both having very low satisfaction both in the combinations of parameters and in the overall NPS (they would be the worst-rated hotels).

As the fsQCA technique is not symmetrical, unlike other quantitative estimation techniques, it is advisable to look at which combinations of factors lead to a low NPS, since a result does not always explain its denial. The resulting configuration for the negative result is shown in Table 7.

With a coverage of 83.9% and a consistency of 89.1%, both the combination of low satisfaction in gastronomy and reception and the combination of high satisfaction in gastronomy and reception and low satisfaction in cleanliness and room comfort lead sufficiently to a low NPS. The first solution means that, in the presence of bad gastronomy and bad reception, cleanliness and room comfort is not decisive for NPS dissatisfaction. In the second solution, it is the opposite: if cleanliness and room comfort is bad, NPS will be low, even if reception and gastronomy are good.

Table 7. fsQCA output. Intermediate solution (reduced final set): leading to low NPS.

Sets	Raw Coverage	Unique Coverage	Consistency
~gastro_fz*~recep_fz*	0.669	0.488	0.867
gastro_fz*~hcflp_fz*recep_fz	0.350	0.170	0.973
Solution coverage: 0.839 Solution consistency: 0.891			

4.2. Necessity Analysis

When analysing necessity, researchers must look for causal conditions with membership scores that are consistently greater than outcome membership scores. If there is a causal condition where this happens in all cases, then this condition passes the test of necessity and the outcome is therefore a subset of the causal condition, which is the set-theoretic way to express necessity [73].

According to Table 8, the hcflp_fz condition, cleanliness and room comfort, is the one that is closest to the necessary condition, since its consistency is 0.799, close to 0.80. In the sufficiency analysis, it was foreseen that, to a certain extent, the quality of cleanliness and room comfort was a minimum condition and was therefore necessary for high satisfaction, since it appeared in both solutions. Therefore, it can be concluded that cleanliness and room comfort tends to be a necessary condition to obtain high satisfaction.

Table 8. Necessity analysis.

Necessity Analysis	Consistency	Coverage
gastro_fz	0.702	0.757
~gastro_fz	0.470	0.409
hcflp_fz	0.799	0.799
~hcflp_fz	0.422	0.392
recep_fz	0.661	0.649
~recep_fz	0.605	0.571

As demonstrated in Figure 2, half of the hotels are below the diagonal indicator, which is an essential condition for meeting customers' needs [73]. Therefore, two-dimensional scatterplots that represent the arithmetic relationship between the two conditions (result and predictor) help to visualize and understand this concept of a subset (the result is a subset of the condition).

Note the important difference between the application of the subset principle to the assessment of sufficiency and its applications to the assessment of necessity. To demonstrate necessity, the researcher must show that the outcome is a subset of the cause. To support an argument of sufficiency, the researcher must demonstrate that the cause is a subset of the outcome.

4.3. Comparative Study with 2020

If we apply the same model for the same hotels in 2020, we obtain the results shown in Table 9.

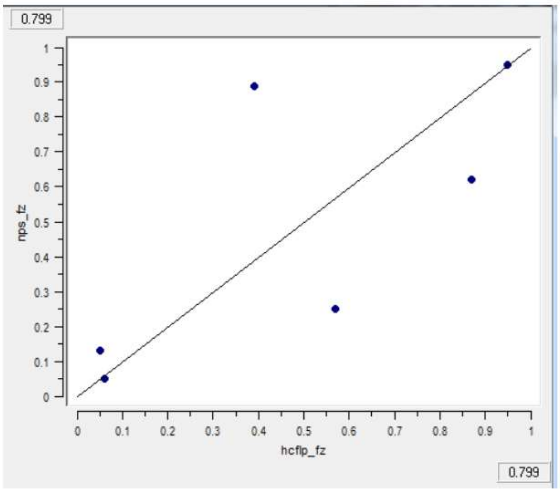


Figure 2. Plot of "nps_fz" against "hcflp_fz".

Table 9. fsQCA output. Intermediate solution (reduced final set): leading to high NPS in 2020.

Sets	Raw Coverage	Unique Coverage	Consistency
~gastro_fz*hcflp_fz*~recep_fz	0.450	0.184	0.992
gastro_fz*hcflp_fz*recep_fz	0.680	0.414	0.960
Solution coverage: 0.865 Solution consistency: 0.964			

Ragin asserts that 'to support an argument of sufficiency, the researcher must demonstrate that the cause is a subset of the outcome' [74] (p. 49). In this way, this study observes that cleanliness and room comfort is key in 2020. This condition, in addition, is necessary to achieve a high NPS. Following the same logic, it also has a central influence on achieving a low NPS. In the presence of poor cleanliness and room comfort, the NPS will be low no matter how the other services are rated.

As can be seen in Figure 3, there is a group of hotels with poor Gastronomy and Reception, and a group where these two areas are both highly rated. In both groups, if Cleanliness and Room Comfort is good, NPS will be high.

4.4. Differences between 2021 and 2020

In 2020, at the beginning of the COVID-19 pandemic, the key factor is cleanliness and room comfort. If this factor is positive, NPS will be high: four-star adults-only hotel #3 has poor reception and gastronomy, but its cleanliness and room comfort is rated highly. In the 2021 study, the key factor is gastronomy. There are hotels with poor cleanliness and room comfort and poor reception satisfaction but good gastronomy that are highly rated on the NPS (five-star hotel).

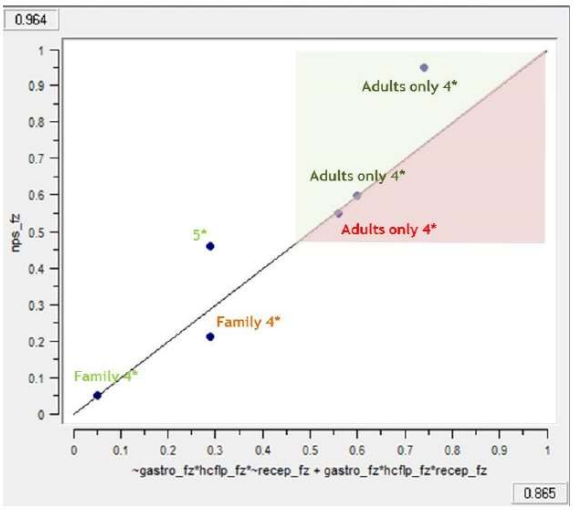


Figure 3. Plot of "nps_fz" against "~gastro_fz*hcflp_fz*~recep_fz + gastro_fz*hcflp_fz*recep_fz".

5. Conclusions, Limitations, and Future Research

The purpose of this research was to deepen the study of the NPS index and its relationship with different aspects of customer satisfaction within the hotel industry.

Currently, NPS is used by numerous hotel companies as a main indicator to measure customer loyalty and satisfaction, as well as a key element in the consideration of an annual bonus for hotel management. Any progress made in clarifying this operation will result in better management of hotel services, benefiting both hotel companies and their customers.

This research uses fuzzy set comparative qualitative analysis (fsQCA), an analysis methodology that has been proven to be adequate to analyse the relationship between an objective variable (NPS) and all the possible combinations of predictors according to the dependent variables of the study (customer satisfaction with reception, cleanliness and room comfort, and gastronomy). The fsQCA methodology manages to identify the possible combinations of these four factors in an optimal way.

The final solution for the month of August 2021 showed us two combinations that increased NPS sufficiently in 95% of the cases with 85% coverage. Specifically, high levels of satisfaction in cleanliness and room comfort and in reception sufficiently increase NPS. This study obtained the same result with high levels of gastronomy quality and service, even if accompanied by low satisfaction in cleanliness and room comfort and reception.

Given that, unlike quantitative estimation techniques, the fsQCA methodology is not symmetrical, it was considered interesting to study which combinations of factors lead to a low NPS. In this case, the combination of low satisfaction in cleanliness and room comfort and high satisfaction in gastronomy and reception leads sufficiently to a low NPS. Likewise, the unique combination of low gastronomy and reception satisfaction leads sufficiently to a low NPS.

Regarding the analysis carried out on the 2020 sample, the final solution also showed two combinations that increase NPS sufficiently in 96% of the cases with 87% coverage. Specifically, high levels of satisfaction in the three study variables sufficiently increase NPS; and this study obtained the same result with high levels of satisfaction in cleanliness and room comfort, even if accompanied by low satisfaction in gastronomy and reception.

Therefore, in August 2020, during the first year of the COVID-19 pandemic, the key factor is cleanliness and room comfort, whereas in August 2021, the key factor is gastronomy.

The 2020 results are in line with the research of Metha et al. [75], as well as that of Yu et al. [76], who identified the perceived hygiene attributes necessary to retain and satisfy customers during the COVID-19 pandemic. Customers typically expressed concern about the hygiene standards of a hotel and the efforts to provide a good experience [76]. During the COVID-19 pandemic, customers rated their satisfaction more highly with Chinese hotels through the website Tripadvisor when they saw that hotels were able to offer cleanliness and health security [77]. Visible hygiene practices directly impact customers' perceptions of cleanliness.

The focus of customers in the same hotels in 2021 appears to be different: in this sample, cleanliness is less of a consideration and gastronomy becomes the key factor to increase the NPS. Zhang and Kim [78] offered different results for a sample of 1493 online reviews about Disneyland Hong Kong between 2017 and 2021, where the quality of the food was negatively related to customer satisfaction.

It is understandable that at the beginning of the pandemic, customers who could afford to travel were more vigilant regarding cleanliness and room comfort, and that this was the decisive factor in boosting the NPS index. An understanding of this can be of use to the successful development of hotel operations, since technology development has facilitated increased communication and dissemination of customer experience [79]. Furthermore, operational failures or negative experiences are quickly exposed on social media. Hotel services focus on intangible elements that generate a lasting emotional impact on consumers, in the knowledge that subsequent reviews and recommendations have a significant impact on future engagement with the business [3].

Therefore, it is vital that the application of satisfaction surveys considers the values and services that are important to customers to ensure that businesses are able to act on them. Various authors have investigated this aspect extensively, using a variety of methods for the selection of items of interest to consumers [80]. For example, Dolnicar and Otter [72] reviewed 21 studies from 1984 to 2000 and were able to summarize the attributes in certain areas of the hotel: image, price/value, the hotel itself, room, services, marketing, food and beverages, others, security, and location. They also pointed out that satisfaction surveys should pay attention to the pre-stay, stay, and post-stay periods. Cleanliness and the location of the hotel were highlighted as the two most significant attributes for customer satisfaction.

Cobanoglu et al. [81] stated that service was the most important factor, followed by price and value, security, additional amenities, technology, room comfort, and food and beverages.

It is evident that, depending on the circumstances, customers may value individual aspects of the hotel differently, and this assessment will also influence their loyalty, expressed through ratios such as the NPS. Taking this into account, it is necessary to understand hotel operation as a living, changing entity, subject to different factors that can affect customer satisfaction. This consideration is vital for successful management in this sector.

In addition to this, the hospitality industry has undoubtedly changed radically due to the impact of COVID-19, which has acted as a BS event for the hotel sector. The perception of customer service has changed over the course of the pandemic. Notably, contact limitation measures such as contactless service may be here to stay, and the impact of these changes on customer satisfaction should be assessed [12].

This study presents some limitations that future research could address. Specifically, when considering the hotel category, NPS and customer satisfaction were analysed in a sample of hotels located in a holiday destination, as opposed to a city-break destination. Furthermore, all six hotels belong to the same hotel company. A direct limitation of this could be that the results cannot be extrapolated to other types of accommodation. Future studies could include city hotels in the sample, and it would also be interesting to use hotels from different companies and locations.

These results offer points of reflection for hotel owners, managers, and those in similar industries, as well as new approaches for scientific research in this area.

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Integrated Quality Management for Automotive Services—Addressing Gaps with European and Japanese Principles

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Abstract

In the current economic context, organizations providing automotive repair services face significant challenges in ensuring service quality, operational efficiency, and long-term sustainability. This paper examines the importance of implementing process monitoring systems through the integration of European quality frameworks and Japanese operational principles such as Kaizen, Lean Manufacturing, and Poka-Yoke, to improve the quality of services and increase performance within automotive repair organizations. The research is grounded in Sustainable Development Goals (SDG 9—Industry, Innovation and Infrastructure, and SDG 12—Responsible Consumption and Production), demonstrating how structured quality practices contribute to reducing waste, optimizing processes, and delivering responsible services. The main objectives of the study are to identify the elements that influence the performance of service-specific processes, to improve the quality management practices related to these processes, to eliminate non-conformities, and to enhance profitability and competitive differentiation through service quality assurance. A mixed-methods research design was applied, including direct participatory observation, performance monitoring, and correlational statistical analysis over a six-month period in two Romanian automotive service centers. Key performance indicators (KPIs) such as technician efficiency, rework rate, and order throughput time were collected and analyzed before and after the implementation of selected tools. Findings demonstrate measurable improvements: rework rates decreased from 7.8% to 2.6%, technician efficiency improved from 89% to 105%, and average service completion time was reduced by 1.6 days. Correlation analysis confirmed strong relationships between visual management adoption and rework reduction ($r = -0.75$), as well as between Lean implementation and technician efficiency ($r = +0.89$). The study's novelty lies in its integration of cross-cultural quality management practices into a replicable and sustainable operational model for post-sale service environments. The results validate that implementing monitoring systems, combined with Kaizen, Lean, and Poka-Yoke, supported by visual management and active employee engagement, can lead to superior service quality management, increased customer satisfaction, and long-term organizational success in the automotive repair industry.

Keywords: processes monitoring; quality indicators; services; strategy; modeling

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1. Introduction

In the current economic climate, customer satisfaction has become the deciding factor in selecting an automotive repair service provider. Car dealerships and authorized service networks are in fierce competition, and the quality of the services offered is essential for attracting and retaining clients. Although awareness regarding the importance of service quality has increased, there are still significant shortcomings in the implementation, standardization, and monitoring of operational processes within many organizations in the automotive repair sector.

At the same time, the growing societal emphasis on sustainability and efficient resource management places additional pressure on service organizations to align with global development strategies. This study is positioned within the framework of the United Nations Sustainable Development Goals, specifically SDG 9—Industry, Innovation and Infrastructure, and SDG 12—Responsible Consumption and Production. These goals emphasize the importance of efficient processes, reduced waste, and continuous innovation—objectives that are central to this research.

There are also notable gaps in academic literature related to quality management in automotive service environments. First, there is a lack of integrated conceptual and empirical models that unify European management principles (e.g., ISO 9001 process orientation, risk-based thinking) with Japanese operational philosophies such as Kaizen, Lean Manufacturing, and Poka-Yoke. Second, current research insufficiently defines or applies process-specific KPIs tailored to service operations such as diagnostics, mechanical intervention, or quality control. Finally, existing studies are often limited to manufacturing or logistics, leaving the practical application of these principles in after-sales services largely unexplored.

Most existing studies in the literature focus either on applying a single philosophy (e.g., Lean or Kaizen) or on analyzing them in large-scale manufacturing contexts. In contrast, this research addresses a major gap by proposing and empirically validating an integrated, hybrid model of quality management. The model combines Japanese principles (Kaizen, Lean Manufacturing, Poka-Yoke) with a European quality management framework, specifically adapted for the automotive service sector. Our paper demonstrates, with real-world data, that such an approach can be successfully implemented in small- and medium-sized enterprises (SMEs) and has a direct, measurable impact on operational performance and sustainability.

The originality and scientific contribution of this research lie in developing a hybrid quality management model that merges European and Japanese principles into a sustainable, replicable framework for automotive repair services. It proposes a holistic and operational approach, identifying and analyzing measurable performance indicators at the departmental level (efficiency, rework, throughput, customer satisfaction) and demonstrating the concrete impact of quality tools through real-world application in service environments. Unlike general conceptual models, this study provides empirical validation based on field data.

The main objectives of the research are:

- To design, implement, and quantitatively evaluate the impact of a structured process monitoring system in automotive repair operations;
- To identify, apply, and measure the causal impact of selected quality tools (Kaizen, Lean Manufacturing, Poka-Yoke) on key service KPIs;
- To analyze key performance indicators (e.g., technician efficiency, rework rates, order completion time) before and after the implementation of these tools;
- To assess the correlation between specific improvement tools and performance outcomes using statistical analysis.

To frame these improvements in relation to sustainability objectives, especially process stability, resource usage, and customer satisfaction.

The paper is structured as follows: Section 2 presents the theoretical considerations and quality management concepts used in this study. Section 3 details the methodology, including sampling criteria, data collection, and analytical tools. Section 4 describes the application of process monitoring systems and quality tools. Section 5 presents the results, including case studies and quantitative analysis. Section 6 summarizes the conclusions and contributions of the research. A complete bibliography and an appendix with anonymized performance data are provided at the end.

Through this structure, the study provides both a theoretical and a practical contribution by demonstrating how hybrid quality management practices, anchored in sustainability principles, can drive measurable performance gains in the automotive repair industry.

2. Theoretical Considerations

The integration of quality management systems in the automotive sector draws from two major paradigms: the European model, focused on standardization and formal process control (ISO 9001), and the Japanese model, oriented toward continuous improvement, defect prevention, and employee involvement. Although both models have demonstrated significant value in manufacturing, their coordinated application in automotive repair and service environments is less commonly studied.

From a European perspective, quality assurance frameworks emphasize documented procedures, measurable objectives, and compliance with regulatory standards. ISO 9001 [1] provides a structured approach to process control, risk-based thinking, and customer feedback mechanisms. In service environments, this translates into audit trails, structured work orders, and internal non-conformity management. However, the rigidity of standardized approaches may limit responsiveness in dynamic service contexts.

The Japanese management philosophy contributes with adaptive and employee-driven methods such as Kaizen, Poka-Yoke, Lean, and Visual Management, which complement and compensate for the prescriptive nature of European systems.

Kaizen (continuous improvement) fosters incremental innovation and decentralizes problem-solving to frontline employees. It enhances process awareness and motivates staff involvement through suggestion systems and visual metrics boards.

Lean Manufacturing, adapted to services, focuses on identifying and eliminating non-value-adding activities, optimizing workflow and layout (U-shaped cells), and reducing waste (Muda) in materials, waiting times, or overprocessing.

Poka-Yoke mechanisms serve to prevent human errors at the source—examples in service include checklist confirmations before release or sensor-based verifications during inspections.

Visual Management tools (color-coded work zones, progress boards, and kanban signals) improve transparency, coordination, and early detection of anomalies.

The theoretical compatibility of these systems lies in their complementarity: where ISO offers formalization, Kaizen ensures adaptability; where Lean reduces process redundancy, Poka-Yoke ensures robustness. This hybridization forms the conceptual foundation of the current study, which seeks to explore how the operational combination of these principles impacts real-time performance and service quality in Romanian automotive service centers.

Recent studies reinforce the value of this integrative view, particularly when cross-cultural quality management frameworks are applied to service-based industries. For instance, Ref. [2] demonstrated that combining ISO 9001 with Lean techniques led to a 38% reduction in rework rates in technical diagnostics departments across several European service chains. Similarly, Ref. [3] reported improved customer turnaround times and

satisfaction scores following the implementation of Kaizen suggestion systems and visual control boards in Japanese post-sale automotive centers.

The authors in [4] provided further support for Lean-Poka Yoke synergies in reducing procedural errors in complex service processes, especially in high-variability repair environments. The author in [5] focused on multi-location repair networks and confirmed that visual management tools enhanced cross-shift communication and compliance with SOPs. These findings align with [6], who integrated 5S and Poka-Yoke in engine component repair stations and observed a 21% improvement in throughput time.

Despite these positive developments, most implementations are concentrated in either highly standardized, corporate-led workshops or in controlled pilot projects, with limited evidence of systemic performance improvements in small-to-medium enterprises (SMEs). For instance, Ref. [7] highlights the adoption barriers of Lean tools in Eastern European service workshops due to low digital maturity and inconsistent staff training. In [8], the author argues that many Kaizen efforts fail to generate long-term impact in services when decoupled from structured performance metrics.

Furthermore, the literature still lacks consistent models that measure improvement outcomes through correlation with specific KPIs. Ref. [9] proposed a hybrid assessment method that combines customer satisfaction indexes with internal quality deviation rates, but this has yet to be validated in the automotive service sector. In addition, Ref. [10] emphasizes the growing importance of integrating sustainability indicators (e.g., energy consumption, parts reuse rate) within Lean-based service quality audits.

Taken together, these contributions underscore the necessity and relevance of developing a data-supported, cross-methodological model for quality management in the automotive repair service industry, particularly one that is both operationally feasible and strategically sustainable in SMEs.

The studies cited in this paper provide a solid conceptual foundation for understanding quality management tools. Our work extends these theoretical perspectives by demonstrating, through practical application, that these concepts can be integrated into a coherent system to generate synergies. Unlike studies that are limited to a qualitative analysis or a narrow scope, our research offers an empirical validation of effectiveness, using both quantitative metrics and qualitative observations to provide a complete picture of the improvement process.

This paper adopts the service operations management lens, emphasizing flow efficiency, employee autonomy, and process visibility, while anchoring practices in sustainability frameworks. By doing so, the proposed conceptual model aligns with the dual demands of regulatory compliance and operational agility, supporting customer-oriented innovation in automotive repair services.

2.1. Systemic Approach to Management

The systems approach to management, emphasized in the ISO 9001:2015 standard [11] and detailed in papers [12,13], is a fundamental concept in modern quality management that transcends the automotive industry. This approach perceives the organization as a complex and dynamic system, composed of a network of interdependent and interconnected processes, as also emphasized by [14,15] in the context of just-in-time production. Each process, regardless of its nature, contributes to the overall goals of the organization. This holistic perspective, also emphasized by Drucker [16] in his discussion on effectiveness, allows for a thorough understanding of how different processes interact and influence each other [17,18].

By identifying and managing these interdependencies, organizations can optimize workflow, eliminate bottlenecks, and ensure a more efficient and effective operation of the whole system, as [19,20] in their review of quality management.

An essential aspect of the system's approach is the identification and management of so-called "Key Quality Checkpoints" [21–23]. These are critical points in the system where non-conformities or quality problems may occur. By carefully monitoring and controlling these points, organizations can prevent defects from occurring, reduce the costs associated with their remediation, and ensure a high level of quality in the products and services offered, thus contributing to customer satisfaction and long-term organizational success [24–26].

In the specific context of automotive repair services, a systems approach to management involves a detailed analysis of all the processes involved, from the receipt of the vehicle to its handover to the customer. By understanding how each process influences the final quality of the service, organizations can identify opportunities for improvement and implement concrete measures to increase customer satisfaction and strengthen their position in the market [27–29]. Figure 1, which illustrates the drivers of quality, highlights the importance of a systemic approach to quality management, highlighting the key points where improvement measures can be implemented to ensure that customer and other stakeholders' requirements are met. This systems approach, as shown in the figure, includes:

- Inputs: Resources needed to carry out processes, such as materials, information, personnel and finances. The quality of these inputs has a direct impact on the quality of the outputs and therefore on customer satisfaction.
- Transformation processes: The activities by which inputs are transformed into outputs, i.e., finished products or services. The efficiency and effectiveness of these processes are essential to achieve quality results.
- Outputs: Finished products or services resulting from transformation processes. The quality of these outputs must meet the requirements and expectations of customers and other stakeholders.
- Input–Output Systems: The organizations and individuals that provide input and receive outputs, respectively. Relationships with suppliers and customers are essential to ensure the quality of input and to understand and meet customer needs.
- Management (decisions and measures): The management of the organization has a crucial role in setting objectives, making decisions and implementing the necessary measures to ensure quality at all stages of the processes.

Figure 1, which illustrates the quality influencing factors, highlights the importance of a systemic approach to quality management, emphasizing the key points where improvement measures can be implemented to ensure that customers and other stakeholders' requirements are met. In this context, the symbols Q1, Q2, Q3, Q4, and Q5 represent Key Quality Checkpoints or essential stages within the transformation processes, where monitoring and control are vital to prevent non-conformities and ensure the final quality of products or services.

Figure 1 emphasizes that all these elements are interconnected and interdependent. The quality of the outputs (products or services) is influenced by the quality of the inputs, the efficiency of the transformation processes and the management decisions and actions taken.

Therefore, a systems approach is essential to understand and manage all the factors that contribute to the final quality and to ensure the satisfaction of customers and other stakeholders.

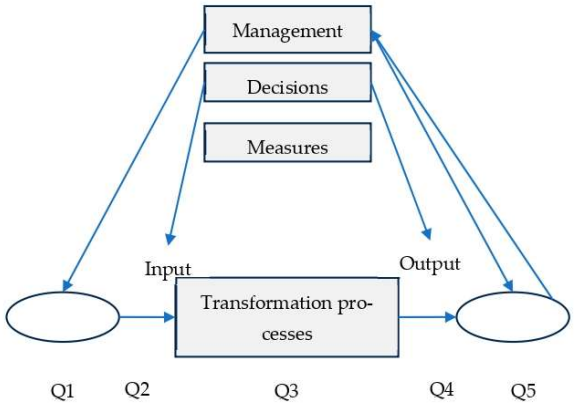


Figure 1. Quality influencing factors.

2.2. Process-Based Approach

The process-based approach is an essential pillar of quality management, as emphasized in ISO 9001:2015 and detailed in the referenced work [30–34]. This principle promotes the idea that an organization can achieve its desired outcomes more effectively when it structures its activities and resources in the form of well-defined and managed processes.

Essentially, the process-based approach involves a few key steps (Figure 2):

- Defining processes: Each process must have a clear purpose and be defined in terms of inputs, activities, outputs and responsibilities.
- Identify and evaluate inputs and outputs: It is important to understand what resources and information are going into the process and what results are expected at the output.
- Identify interfaces: Processes do not operate in isolation but interact with each other and with different functional entities within the organization. The identification and management of these interfaces is crucial to ensure a coherent and efficient workflow.
- Risk and impact assessment: Every process involves certain risks and may have an impact on customers, suppliers and other stakeholders. Assessing these risks and the potential consequences allows appropriate preventive and corrective action to be taken.
- Establish responsibilities and authorities: Each process should have a clear accountable person with the necessary authority to manage and improve the process.
- Identify stakeholders: It is important to identify all those who are affected by the process or have an interest in its outcomes to ensure effective communication and collaboration.
- Design the process: The design of the process should consider all relevant aspects, from the sequence of steps and activities to the resources required and the training needs of staff.

By understanding and optimizing process flow, as [30] also points out, organizations can identify and eliminate non-value-adding activities, reduce waste, and increase operational efficiency. In addition, by carefully managing inputs and outputs, organizations can ensure that processes deliver outcomes that meet customer requirements and expectations, thereby contributing to value-added and long-term success.

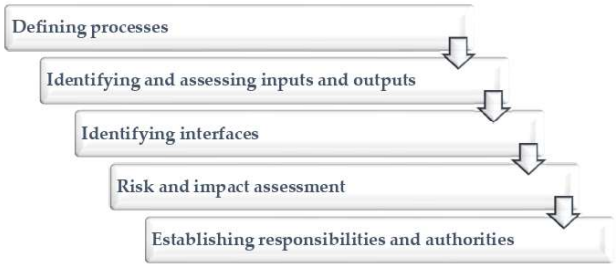


Figure 2. Key steps of the process-based approach.

2.3. Involvement of All Staff

The active involvement of employees, at all levels of the organization, is an essential pillar in the successful implementation and maintenance of an effective quality management system [35,36]. This principle, emphasized both in the literature and in international standards such as ISO 9001, recognizes that employees are an organization's most valuable resource. Fully involving them, by leveraging their skills, knowledge and experience, is crucial for achieving organizational goals, including those related to quality and customer satisfaction [36–38].

This active involvement can take various forms, from taking responsibility for solving problems and identifying opportunities for improvement, to participating in work teams and quality circles where employees can share their knowledge and experience [36]. Such a culture of involvement and collaboration, also promoted by the Kaizen concept, stimulates creativity and innovation, contributing to the development of effective solutions and continuous improvement of processes and services [39,40].

Moreover, employee engagement also has a positive impact on employee satisfaction and loyalty. When they feel listened to, valued and actively involved in the organization's decisions and activities, employees are more motivated and committed to their work [41,42]. This translates into an increase in productivity, an improvement in service quality and a strengthening of the organization's image in relation to customers and society in general [43–46].

In conclusion, involving all staff is not only an ethical desideratum, but also a pragmatic strategy for achieving excellence in quality management and ensuring the long-term success of organizations, especially in the service industry, where human interaction plays a central role in the customer experience [43–46].

2.4. Continuous Improvement

Continuous improvement, or kaizen in Japanese philosophy, is a fundamental principle of quality management that transcends the automotive industry and applies to any organization that wants to constantly optimize its processes, products and services [47,48]. This principle, essential in the dynamic context of the contemporary market, implies a constant concern for identifying and implementing improvements, no matter how small, which, cumulated over time, can lead to significant change and superior organizational performance [27,47,49].

Continuous improvement is not a static process but a dynamic cycle involving:

- Setting objectives: Clearly defining what you want to improve and setting measurable targets to evaluate progress.
- Planning: Identifying the root causes of the problems and developing an action plan to address them.

- Implementation: Putting the action plan into practice and monitoring the results closely.
- Evaluation: Analyzing the results achieved and comparing them with the objectives set initially.
- Corrective action: If the results are not satisfactory, corrective action is taken to adjust the action plan and restart the improvement cycle.

To facilitate this cyclical improvement process, organizations can use a variety of specific methods and tools, such as:

- The Deming Cycle (PDCA): an iterative model for continuous improvement consisting of four stages: Plan, Do, Check and Act [16].
- Kaizen techniques: a series of practical tools and methods, such as 5S, Kanban and visual management, that facilitate the identification and elimination of waste and promote employee involvement in the improvement process [14,15,50].
- Process reengineering: a radical approach to re-engineering processes with the aim of achieving significant improvements in cost, quality, service and speed [48].
- Process innovation techniques: creative and innovative approaches to identify and implement new ways of doing business with the aim of achieving superior results.

A key aspect of continuous improvement is recognizing and rewarding the efforts of employees [48]. By appreciating and valuing individual and team contributions to the improvement process, organizations can create a culture of excellence and boost staff commitment and motivation.

In conclusion, continuous improvement is a dynamic and essential process for any organization that wants to remain competitive and satisfy its customers in the long term. By taking a proactive approach and using specific methods and tools, organizations can make continuous improvements to their way of life and achieve ever higher levels of performance and quality.

2.5. Lean Manufacturing

The concept of Lean Manufacturing, inspired by the Japanese management model and described in detail by [43], is a management philosophy that transcends the automotive industry and is successfully applied in various sectors. Essentially, Lean Manufacturing focuses on maximizing customer value by systematically eliminating any form of waste (muda) from processes [43]. This holistic approach aims to increase operational efficiency and standardization, which leads to cost reduction, quality improvement and shorter lead times.

Lean Manufacturing is based on a few key principles and practices, including:

- Identify and eliminate waste: This involves carefully analyzing all process activities and eliminating those that do not add value to the customer, such as waiting times, unnecessary transportation, excessive inventory or production defects.
- Create a seamless flow: By reducing waiting times and bottlenecks, it ensures a continuous and smooth flow of materials and information through processes, leading to increased speed and efficiency.
- The pull system and just-in-time (JIT) production: products and services are created or delivered only when there is a demand from the customer, which reduces inventories and associated costs.
- Continuous improvement (Kaizen): the organization is constantly looking for opportunities for improvement, encouraging the involvement of all employees in this process.
- Respect people: Employees are considered the organization's most valuable resource, and their involvement and development are critical to the success of Lean Manufacturing implementation.

By applying these principles and practices, organizations can create a culture of operational excellence focused on meeting customer needs and eliminating waste. In the context of automotive services, Lean Manufacturing can help reduce customer waiting times, increase repair quality and optimize costs, leading to improved customer satisfaction and strengthening the organization's competitive position in the market [51,52].

2.6. Kaizen

Kaizen, a Japanese term that translates as "continuous improvement", is a management philosophy that promotes a proactive and participative approach to continuously optimize all aspects of organizational activity [43]. This philosophy, deeply rooted in the Japanese organizational culture and described in detail by [53], emphasizes the involvement of all employees, from the operational to the managerial level, in identifying and implementing small but constant improvements in work processes, products and services.

In contrast to traditional improvement approaches, which focus on radical change and major investments, Kaizen promotes the idea that significant progress can be achieved through a series of small, incremental steps that are easy to implement and low cost [53]. This incremental approach allows organizations to improve their performance steadily without disrupting workflow or requiring significant financial resources.

Central to the Kaizen philosophy is the active involvement of all employees in the improvement process. By encouraging and rewarding individual and team initiatives, organizations can create a culture of accountability and commitment to quality and efficiency [54]. Employees are the most knowledgeable about work processes and are therefore in the best position to identify opportunities for improvement and propose practical and effective solutions.

In the context of automotive repair services, Kaizen can be applied to improve a wide range of aspects, from shop organization and parts inventory management to customer interaction and the billing process. By implementing constant, even minor, improvements, organizations can achieve significant results in terms of increased productivity, reduced costs, improved service quality, and ultimately increased customer satisfaction [27,49].

In conclusion, Kaizen is a powerful and versatile management philosophy that can be successfully applied in any organization, including the automotive repair service industry. By promoting active employee involvement and continuous improvement, organizations can create a culture of excellence and achieve higher levels of performance and customer satisfaction.

2.7. Poka-Yoke

Poka-Yoke, a Japanese concept that translates as "prevention of unintentional errors", is a proactive quality management technique aimed at eliminating or significantly reducing the possibility of defects in production or service delivery processes [55–57].

This approach, introduced by Shigeo Shingo, is based on the creation of simple and effective mechanisms, devices or procedures to prevent human errors or detect them at an early stage, before they have a negative impact on the quality of the final product or service.

Poka-Yoke can be implemented in a variety of ways, from the use of physical devices that prevent incorrect operations from being carried out, to the implementation of verification and control procedures that flag any deviations from quality standards. In the context of car repair services, examples of the application of Poka-Yoke include:

- Physical protection: The use of rubber sleeves on elevators to prevent damage to vehicle doors, fender covers, door limiters, hoods, and trunk liners
- Checks and controls: the use of checklists to ensure that all required operations have been performed correctly and completely

- Warning systems: the implementation of visual or audible warning systems to signal any deviation from normal operating parameters of equipment or processes.

By implementing Poka-Yoke, organizations can achieve several important benefits, including:

- Reduce costs: By preventing defects from occurring, the costs associated with fixing defects, rejects and wasted time and resources are reduced.

Increase customer satisfaction: By ensuring consistently high-quality products and services, customer confidence and satisfaction are increased.

Improve employee morale: By eliminating the frustration and stress associated with errors, employee morale and motivation are improved.

- Increase efficiency: By standardizing processes and eliminating non-value-adding activities, operational efficiency is increased.

In conclusion, Poka-Yoke is a valuable quality management technique that can be successfully applied in the automotive repair service industry to prevent errors, reduce costs and increase customer satisfaction [58,59].

By adopting a proactive approach and implementing simple and effective mechanisms and procedures, organizations can ensure a higher quality of service and strengthen their position in the market.

FMEA (Failure Mode and Effects Analysis) is a systematic methodology used to identify, analyze, and prioritize the potential failure modes of a process or product, as well as their effects. It is a proactive tool that helps organizations prevent errors before they occur. In the automotive industry, FMEA is mandatory under the IATF 16949 standard [60] and is a key component of advanced product quality planning (APQP).

There are two main approaches to prioritizing identified risks:

1. Risk Priority Number (RPN): This is the traditional approach that has been used for a long time. It is calculated as the product of three scores:

- Severity (S): The seriousness of the defect's effect.
- Occurrence (O): The probability of the defect occurring.
- Detection (D): The ability of the current system to detect the defect before it reaches the customer.
- RPN = S × O × D.

2. Action Priority (AP): This is a more recent approach, preferred in newer editions of the FMEA manual, which prioritizes risks based on the necessary actions and a logical analysis of Severity, Occurrence, and Detection, rather than a simple number. Unlike RPN, which can sometimes be misleading (two risks with the same RPN can have very different risk profiles), the AP approach provides a clear priority: High, Medium, or Low, based on a decision table.

Regarding the differences between Japan and Europe, while both use FMEA, implementation can reflect cultural differences: the Japanese approach, centered on Gemba (the actual place where the action happens) and the involvement of workers at the operational level, often integrates FMEA directly into Kaizen teams, seeking simple, visual, and immediate solutions (Poka-Yoke) to reduce Occurrence (O) and Detection (D) scores. The European (and American) approach has historically been more formal, based on multidisciplinary expert teams and extensive documentation, with a more frequent use of the RPN calculation. However, current trends, including in IATF 16949, encourage a more fluid integration of risk analysis tools like FMEA with practical approaches such as Poka-Yoke. In fact, Poka-Yoke is considered a measure to reduce the Occurrence or Detection score within an FMEA analysis.

2.8. Visual Management

Visual management is an essential approach in organizations that want to optimize their processes and improve their performance, as highlighted in the literature [61–63]. This technique is based on the use of visual indicators, such as charts, graphs, dashboards, or light signals (such as the Andon system), to communicate important information about process performance, work objectives, quality standards, and other aspects relevant to the organization's work [64].

By presenting information in a clear, concise and easy to understand way, visual management facilitates communication and transparency within the organization, allowing all employees to quickly and easily understand the current state of processes and to identify potential problems or opportunities for improvement. This approach helps to increase employees' awareness and accountability, encouraging them to become actively involved in problem solving and continuous process improvement [62].

In the context of automotive repair services, visual management can be used to monitor and control a wide range of aspects, from job scheduling and resource allocation, to tracking completion deadlines and managing spare parts inventories.

In conclusion, visual management is a valuable tool for organizations looking to improve their performance and optimize their processes [57]. By implementing this technique and creating an organizational culture based on transparency, involvement and continuous improvement, organizations providing automotive repair services can achieve higher levels of quality, efficiency and customer satisfaction.

2.9. The IATF 16949 Standard: A European and Japanese Convergence

The IATF 16949 standard, developed by the International Automotive Task Force, a group of automotive manufacturers and trade associations, is essential for ensuring quality in the global automotive supply chain. While it has roots in Western standards like ISO 9001, IATF 16949 incorporates fundamental principles from Japanese management philosophy, particularly from the Toyota Production System (TPS).

The main differences are often cultural and related to implementation. While IATF 16949 mandates a rigorous, standardized, and documented evidence-based framework, the Japanese approach, although compliant, tends to focus more on aspects like Kaizen (continuous improvement), Jidoka (automation with a human touch to prevent defects), and the full involvement of employees in the quality process. The standard itself is a point of convergence, promoting a unified approach to quality globally, but the implementation philosophy can vary. For example, a Japanese organization might view adherence to the standard to facilitate Kaizen improvements, while a European organization might see compliance as an end in itself—a contractual requirement to enter the market.

2.10. The Integrated Quality Management Framework

Figure 3 provides a visual representation of the integrated quality management framework, proposed and validated by this research. The model illustrates the synergy between theoretical foundations, European management approaches, and Japanese operational philosophies, demonstrating how the integration of these elements, supported by visual management and employee involvement, leads to measurable results and long-term sustainability in the automotive service sector.

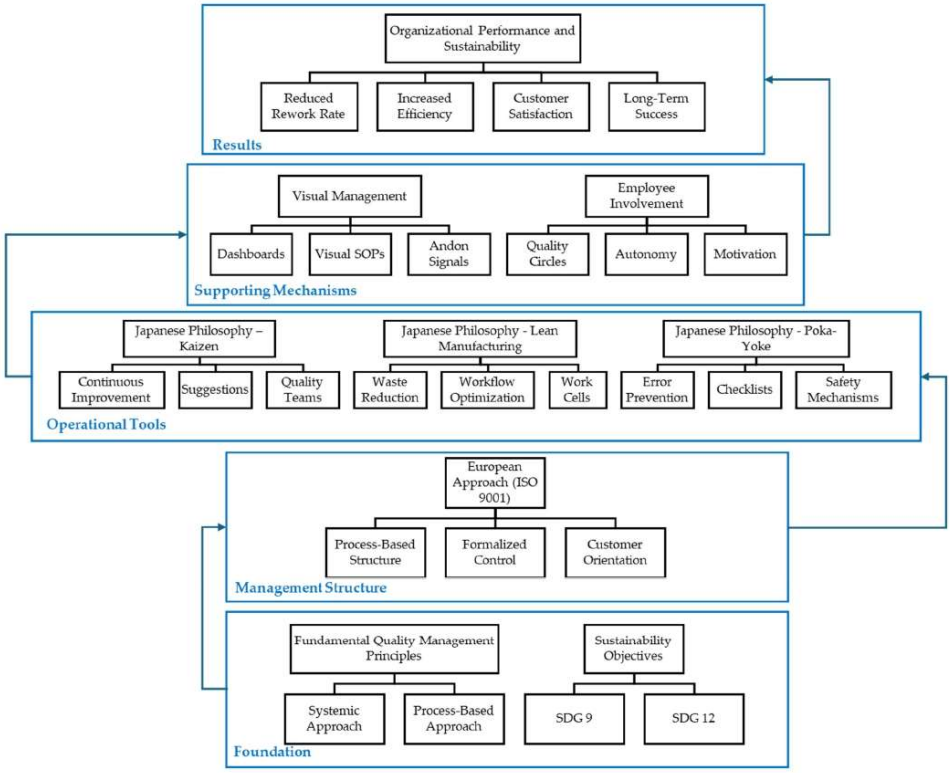


Figure 3. The Integrated Quality Management Framework for Automotive Services.

3. Research Methodology

The present study adopts a mixed-methods, pre-and-post-implementation, case-based study without a control group to investigate the effects of implementing integrated quality management tools in two Romanian automotive repair organizations. The two automotive centers (A and B) served as the study entities, each focusing on implementing specific tools (visual management in Center A and Lean cells in Center B). This approach allows for an internal comparative analysis. This methodological approach enables both quantitative performance evaluation and qualitative process observation, contributing to the empirical validation of a hybrid quality model grounded in European and Japanese principles.

The research was conducted over a 6-month operational period (January–June 2024), during which both service centers initiated a structured implementation of process monitoring tools and continuous improvement techniques. The organizations selected were medium-sized authorized repair workshops affiliated with multinational vehicle brands, located in urban areas and employing between 25 and 40 technicians. These centers were chosen based on three selection criteria:

- active commitment to quality initiatives;
- process documentation maturity (ISO 9001 certified);
- willingness to integrate Kaizen and Lean tools.

Data was collected through the following sources and instruments:

- Direct participatory observation of work processes and technician behaviors;
- Structured interviews with department heads and quality managers (n = 8);
- Internal performance logs extracted weekly, including metrics such as rework rate, technician efficiency, order completion time, customer complaints, and internal nonconformities;
- Customer satisfaction feedback, processed using Net Promoter Score (NPS);
- Visual management audit checklists completed biweekly;
- Correlation analysis using Pearson's r to test relationships between applied tools and performance indicators (threshold of $p < 0.05$ for significance).

To ensure transparency and replicability, the collected dataset was anonymized and is summarized in Table 1, including six weeks of comparative data (pre- and post-implementation). Data analysis was performed using Microsoft Excel.

Table 1. Key Performance Indicators (KPIs) and Operational Results (Pre- and Post-Implementation Data) over a Six-Week Period.

Week	Technician Efficiency (%)	Rework Rate (%)	Throughput Time (Days)	Internal Nonconformities	NPS (Customer Satisfaction)	Visual Management Compliance (%)
1	89.1	7.8	4.3	9	52	38
2	90.4	7.2	4.1	8	56	41
3	93.6	6.4	3.9	6	59	45
4	97.2	4.3	3.6	5	66	61
5	101.5	3.1	3.1	3	74	79
6	105.2	2.6	2.7	2	82	91

The following performance indicators (KPIs) were monitored:

- Technician Efficiency (%), calculated as: (Total Invoiced Hours/Total Present Hours) × 100%. Data was extracted weekly from the internal Dealer Management System (DMS).
- Rework Rate (%), calculated as: (Number of customer returns for the same defect within 30 days/Total number of repairs completed) × 100%. Data was sourced from post-service customer feedback logs.
- Service Throughput Time (days), calculated as: (Vehicle Handover Date—Vehicle Intake Date) in days. Data was logged from work orders in the DMS.
- NPS (Net Promoter Score), calculated from customer surveys using the standard NPS formula: % Promoters (score 9–10)—% Detractors (score 0–6). Surveys were sent via SMS or email post-service.
- Internal Nonconformities (procedural deviations per week).
- Visual Management Compliance Rate (% execution of visual standards).

The methodology was developed in accordance with principles of applied service operations management, aligning data collection and analysis with the practical realities of automotive repair workflows. In addition, the methodological framework reflects the intent of SDG 9 (Innovation and Infrastructure) and SDG 12 (Responsible Consumption and Production) by capturing the systemic effects of process efficiency, error reduction, and resource use in service environments.

Through this approach, the study ensures methodological rigor while maintaining practical applicability. The triangulation of data from multiple sources (quantitative and qualitative) strengthens the validity of findings and supports the generalizability of the results to similar automotive service contexts, particularly in SMEs engaged in quality transformation.

To explore the practical applicability and effectiveness of integrated quality management principles in real-world conditions, the study was conducted across two medium-

sized automotive repair organizations in Romania, referred to here as Service Center A and Service Center B. Both centers operate independently, serve similar customer volumes (between 30 and 50 vehicles per day), and follow standard operational procedures aligned with ISO 9001. However, each was selected based on its willingness to participate in structured process improvement interventions and allow continuous performance monitoring.

Service Center A focused primarily on implementing visual management systems and standard work procedures, particularly in diagnostic and final inspection phases. This center provided a suitable environment for evaluating the operationalization of visual controls, checklists, and technician-led quality initiatives through Quality Circles.

Service Center B served as the primary context for the deployment of Lean Manufacturing and work cell restructuring. The facility underwent a targeted reorganization based on value-stream mapping, enabling direct observation of efficiency gains and waste reduction. Both service centers contributed empirical data over a six-month period, which formed the basis of the performance analyses presented in the following sections.

The choice of these two sites allows the comparison of results across different implementation strategies and highlights the contextual factors influencing the effectiveness of Kaizen, Lean, and Poka-Yoke methodologies in service environments.

A key limitation of this study is the absence of a control group. While the pre-and-post-implementation case study approach allowed for a robust empirical evaluation of the results, the lack of a control group makes it difficult to precisely separate the impact of our interventions from other external factors. Therefore, while the established correlations are statistically significant, they demonstrate a strong relationship between the implementation of the tools and the improvement of the indicators, but they cannot establish absolute causality, as other uncontrolled variables may influence performance.

4. Research Presentation

4.1. Integration of Process Monitoring Systems

Integrating process monitoring systems is a complex and multidimensional challenge for modern organizations. This integration is not limited to the technological implementation of systems, but also involves a profound change in organizational culture, work processes and the way employees interact and collaborate.

The monitoring initiative focused on four core service processes:

- initial diagnostics and client intake,
- mechanical repair intervention,
- final quality control, and
- vehicle handover.

Within these, task standardization, time recording, and nonconformity tracking were introduced progressively.

Specific tools were assigned by process area:

- Kaizen was applied in the diagnostics and quality control phases, using weekly improvement meetings and technician-led suggestion systems.
- Poka-Yoke was introduced during final checks through structured checklist validation and error-prevention tags (e.g., torque-marking, fluid cap indicators).
- Lean principles guided the redesign of task flows using value-stream mapping and workstation reconfiguration (e.g., U-shaped layout in mechanical zones).
- Visual management practices included kanban-style progress boards, color-coded workspaces, and visual SOPs displayed at point of use.

Process monitoring was conducted in real time by quality coordinators, with data being uploaded weekly to internal dashboards. The system was synchronized with ISO 9001

workflows but extended beyond compliance to include root-cause tracking, non-value-added time recording, and team-based improvement logs. These additions operationalized the PDCA cycle (Plan–Do–Check–Act) at the level of work cells. The data collected served as the foundation for correlation analyses and performance comparisons described in Section 5.

Organizations that have successfully implemented a quality management system and developed a strong organizational culture based on values such as continuous improvement, customer orientation and individual accountability have a significant advantage in the process. These organizations already have in place a structure and set of practices that facilitate the integration of monitoring systems, enabling them to optimize their processes, improve the quality of their products and services, and increase their operational efficiency.

Figure 4 shows a visual representation of the main flow of activities involved in an automotive service process. This diagram outlines the key stages that a vehicle goes through in a car service, from receipt to handover to the customer.

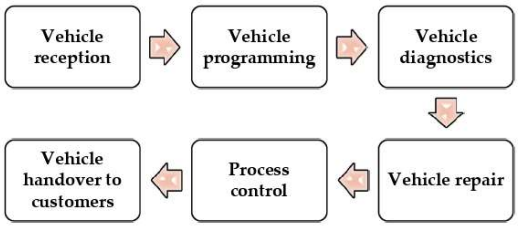


Figure 4. Steps in the service process.

Steps in the Service Process:

- Vehicle Reception: This is the first stage of the process, where the customer brings the vehicle in for servicing and presents their requests or problems.
- Vehicle Scheduling: At this stage, a schedule for service work is established, considering the availability of technicians and equipment.
- Vehicle Diagnostics: This stage involves identifying and assessing the technical problems of the vehicle, using various diagnostic methods and tools.
- Vehicle repair: At this stage, specialist technicians carry out the necessary repair work to solve the problems identified in the diagnostic stage.
- Process control: This stage involves checking the quality of the work carried out and ensuring that it meets technical standards and specifications.
- Handing over the vehicles to the customer: This is the final stage of the process, where the customer takes back the repaired vehicle and receives information about the work carried out and any recommendations for further maintenance.

This figure provides an overview of the car service process, highlighting the interdependence between the different steps and the importance of a systematic and integrated approach. By understanding this workflow, automotive service organizations can identify opportunities to improve processes, increase efficiency and ensure customer satisfaction.

Other comments follow:

- Figure 4 shows a general model of the car servicing process. In practice, there may be variations or additional steps, depending on the specifics of each organization and the type of services offered.
- The diagram emphasizes the importance of quality control at every stage of the process to ensure that the work is carried out correctly and that the vehicle is delivered to the customer in perfect working order.

- Figure 4 can be used as a starting point for analyzing and optimizing automotive service processes, identifying potential bottlenecks or inefficiencies and implementing improvements.

Quality measurement, monitoring and control are fundamental elements of any quality management system. These processes enable organizations to objectively assess their performance, identify areas for improvement and take corrective action to ensure that products and services meet customer requirements and expectations.

The importance of measurement and monitoring:

- Ensuring customer satisfaction: By measuring and monitoring performance, organizations can identify and correct potential non-conformances before they reach customers, thereby ensuring customer satisfaction
- Continuous improvement: Measurement and monitoring enable organizations to identify opportunities to improve their processes and products, thereby contributing to a steady increase in performance

Informed decision-making: Data collected through measurement and monitoring provides management with valuable information for strategic and operational decision-making.

Measurement, monitoring and quality control processes can include a variety of methods and tools, such as:

- Statistical analysis: these allow the analysis of collected data to identify trends, variations and potential causes of non-conformities
- Simulations: these allow the testing and optimization of processes prior to their implementation, thus reducing the risk of errors and non-conformities
- Internal and external audits: These allow the assessment of the compliance of processes and products with applicable standards and requirements
- Measuring and monitoring devices: These allow the collection of data on process and product performance.

To ensure the accuracy and reliability of the data collected, it is essential that the measuring and monitoring devices are regularly checked and validated. This involves:

- Confirming that devices are suitable for use: Devices must be selected and used in accordance with applicable specifications and requirements
- Maintaining proper accuracy: Devices must be calibrated and serviced regularly to ensure that they operate within specified parameters
- Identifying the status of devices: Devices must be clearly labeled or marked to indicate their status (e.g., calibrated, in service, etc.).

The implemented system also aligns with Sustainable Development Goals (SDG) 9 and 12. By reducing rework rates, optimizing technician task allocation, and minimizing unnecessary resource consumption, the monitoring approach supports both innovation in industry infrastructure and responsible consumption practices. These outcomes directly contribute to improved environmental and operational sustainability in line with the European Green Deal and global SDG frameworks.

4.2. Quality Circles and Kaizen Teams

Kaizen, a Japanese term meaning "continuous improvement", is a management philosophy that emphasizes the involvement of all employees in the process of improving the organization's performance. This philosophy is based on the idea that every employee, regardless of his or her position in the organization, can contribute to identifying and implementing small but constant improvements that, over time, can lead to significant change and an increase in the organization's competitiveness.

Within the studied automotive centers, Kaizen was applied using weekly quality circle sessions in diagnostic and final verification departments. Participants were technicians and team leaders, whose suggestions and process observations were logged and categorized by theme. Over 40 such proposals were submitted during the observation period, of which 65% were accepted for pilot testing. Metrics used to evaluate impact included mean diagnostic time, number of checklist deviations, and rework instances.

Quality circles are an important tool in implementing the Kaizen philosophy. They are small groups of employees, usually from the same department or work area, who meet voluntarily and regularly to identify, analyze and solve problems related to their work. Quality circles are led by a leader, who may be a supervisor or an experienced colleague, and are supported by the organization's management.

Figure 5 shows the components and interactions in a quality circle, highlighting the key roles and associated responsibilities.



Figure 5. Structure of the quality circle.

The components of the Quality Circle are:

- Members: These are the employees who voluntarily join the circle and are directly involved in the activities of identifying, analyzing and solving problems.
- Leader: The leader is usually the members' direct superior or an experienced foreman. The role of the leader is to guide and coordinate the activities of the circle, ensuring effective communication and a productive working environment.
- The coordinator: The coordinator is responsible for managing the quality circle program throughout the organization. The coordinator provides the necessary support to the leaders and members, facilitates communication between the Circles and the rest of the organization, and promotes a culture of continuous improvement.
- Management: Represents the leadership of the organization, which plays a key role in ensuring the success of the Quality Circles by providing support, resources and recognition for their efforts and achievements.

Interactions and Responsibilities:

- Members—The Leader: Circle members interact directly with the leader, presenting identified problems, participating in discussions and proposing solutions. The leader, in turn, provides guidance, facilitates communication and ensures that the activities of the Circle are carried out in an efficient and effective manner.
- The Leader—The Coordinator: The leader reports to the coordinator on the progress of the Circle, the problems encountered, and the solutions proposed. The coordinator provides support and guidance to the leader, facilitates access to resources and ensures communication with the management of the organization.

- Coordinator—Management: The coordinator presents to the management the results of the quality circle activities, proposals for improvement and requests support and resources for their implementation. Management, in turn, evaluates the proposals, allocates the necessary resources and provides feedback and recognition for the efforts made.

This figure illustrates the structure and dynamics of a quality circle, emphasizing the importance of collaboration and effective communication between the different roles involved. It also highlights the crucial role of management in ensuring the success of quality circles by providing support, resources and recognition.

Figure 5 provides valuable insight into how quality circles work and the key factors that contribute to their success. By understanding and applying these principles, organizations can harness the potential of their employees and create a culture of continuous improvement that enables them to achieve their goals and enhance their competitiveness.

Figure 6 shows a comprehensive list of activities that may take place during a Quality Circle meeting. These activities are essential for the effective functioning of the Quality Circle and the achievement of its continuous improvement objectives.

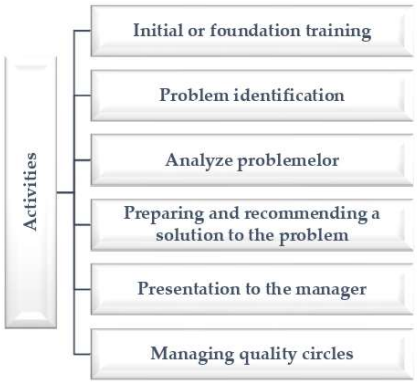


Figure 6. Activities within the Quality Circle.

Quality Circle activities include:

- Brainstorming: This brainstorming technique encourages members to freely express their thoughts and suggestions without being judged or criticized. Brainstorming can be used to identify problems, generate potential solutions or explore new opportunities for improvement.
- Pareto analysis: This statistical method allows problems to be identified and prioritized according to their impact on performance. By focusing efforts on the most important issues, the quality circle can achieve significant results with limited resources.
- Ishikawa Diagrams: Also known as cause-and-effect or fishbone diagrams, these are used to identify and analyze the root causes of a problem. By visually representing the relationships between causes and effects, Ishikawa diagrams make it easier to understand the complexity of the problem and identify appropriate solutions.
- Histograms: These graphs allow visualization of the distribution of a quality characteristic, highlighting central trends and variation in the data. Histograms can be used to assess the stability of a process, identify areas for improvement, and monitor the effectiveness of corrective measures implemented.

- Control charts: These statistical tools make it possible to monitor the variation of a process over time, identify causes of variation, and take corrective action to keep the process under control. Control charts are essential for ensuring process stability and preventing the occurrence of non-conformities.
- Flow diagrams: These diagrams graphically represent the steps in a process, allowing you to visualize the workflow and identify potential bottlenecks or inefficiencies. Flowcharts are useful for understanding and optimizing processes as well as for communicating and documenting them.
- Scatter diagrams: These graphs allow you to analyze the relationship between two variables, identifying possible correlations or dependencies. Scatter diagrams can be used to better understand the factors that influence the performance of a process or product.
- Stratification: This technique involves dividing the data into homogeneous groups to facilitate analysis and identify causes of variation. Stratification can be used in combination with other tools, such as Pareto charts or histograms, to gain a deeper understanding of problems and potential solutions.
- Questionnaires: These can be used to collect information and opinions from customers, employees or other stakeholders, thus providing valuable insight into the organization's performance and opportunities for improvement.
- Benchmarking: This technique involves comparing the organization's performance with that of other similar organizations to identify best practices and set ambitious improvement targets. Benchmarking can be a powerful tool for driving innovation and performance growth.

Figure 6 highlights the diversity of activities that can take place within a quality circle, emphasizing the importance of using a variety of tools and techniques to address problems and identify effective solutions. It also emphasizes the active role of the circle members in the continuous improvement process and the importance of collaboration and open communication.

Figure 6 gives an overview of how Quality Circles operate and the tools and techniques they use to achieve their objectives. By understanding and applying these methods, organizations can create a work environment in which employees are encouraged and supported to take responsibility for continuous process and quality improvement, thereby contributing to the long-term success of the organization.

The benefits of Quality Circles are:

- Improving the quality of products and services: By identifying and solving problems in the workplace, Quality Circles help to improve the quality of products and services offered by the organization.
- Increasing productivity: By optimizing work processes and eliminating waste, Quality Circles can help to increase productivity.
- Motivating and involving employees: Participation in Quality Circles gives employees the opportunity to develop their skills, take responsibility and contribute to the success of the organization, which can lead to increased motivation and involvement.

4.3. Lean Manufacturing in Automotive Services

In Service Center B, Lean implementation began with a full value-stream mapping of the mechanical repair process. Wasted motion, excessive inventory, and wait times were identified. Based on this, technicians were reorganized into Lean cells around service types (e.g., suspension, brake systems, diagnostics), and standard work charts were introduced. The intervention was monitored using lead time per service order and technician productivity, which are discussed in Section 5.

The Lean Manufacturing concept, although it has its origins in the manufacturing industry, can be successfully adapted and implemented in automotive service to improve efficiency, quality and customer satisfaction.

In practice, this means:

- Eliminate waste: Identify and eliminate any activities that do not add value to the customer, such as waiting time, searching for tools or parts, repeated repairs due to initial errors, or unnecessary technician travel.
- Optimize workflow: Efficiently organize the shop floor, parts inventory and scheduling to ensure a continuous and uninterrupted flow of work, thereby reducing waiting times and increasing productivity.
- Just-in-time parts delivery: Implement a supply system to ensure that the required spare parts are available exactly when needed, thereby avoiding excessive inventories and related costs.
- Continuous improvement (Kaizen): Encouraging all employees to identify and propose improvements in work processes by implementing suggestions and ideas that can lead to increased efficiency and quality of service.
- Customer focus: Understanding and meeting customer needs and expectations by providing quality services at competitive prices and in the shortest possible time.
- Employee development: Investing in the continuous training and development of staff to equip them with the skills and knowledge needed to provide high quality services and to adapt to technological and market changes.
- Simplify and standardize processes: Eliminate unnecessary bureaucracy and complexity in work processes by establishing clear and easy-to-follow procedures to ensure consistency and quality of service. 8. Promote teamwork: Encourage collaboration and effective communication between different departments and employees to ensure optimal workflow and rapid problem solving.

By applying these principles and practices, automotive services can create an organizational culture focused on efficiency, quality and customer satisfaction. This will lead not only to increased profitability, but also to enhanced reputation and customer loyalty, thus ensuring long-term business success.

4.4. Andon: Visual and Auditory Signage for Efficiency and Quality

The Andon system, an essential tool in visual management, uses light and sound signals to quickly and effectively communicate process status information and alert staff to problems or anomalies.

In car servicing, the Andon system can be deployed for:

- Reporting problems to the service line: A red light may indicate a major equipment malfunction or a critical problem in the repair process, requiring immediate intervention.
- Stock level monitoring: A yellow light may indicate that the stock of a particular spare part is low and requires restocking.
- Workflow management: A green light can indicate that a particular workstation is free and available to take a new order.

By using Andon, it facilitates fast and efficient communication between employees and ensures a prompt reaction in case of problems, leading to reduced downtime, increased productivity and improved quality of service.

Advantages of using Andon in car servicing include:

- Rapid problem detection and resolution: by signaling problems immediately, delays are avoided and the negative impact on customers is reduced.

- Improved communication and collaboration: employees are informed in real time about the status of processes and can intervene quickly to provide support or resolve problems.
- Increased employee accountability and involvement: Each employee is responsible for monitoring and reporting issues at their workstation, leading to increased accountability and involvement.
- Error and accident prevention: By signaling potentially dangerous situations, Andon helps prevent workplace accidents and increase workplace safety.

The integration of Andon into the visual management of car service centers is an effective and easy to implement solution to improve communication, increase efficiency and ensure a higher quality of customer service.

4.5. Poka-Yoke in Car Service: Error Prevention for Service Excellence

The Japanese concept of Poka-Yoke, or "prevention of unintentional errors", focuses on eliminating the possibility of defects by implementing simple and effective solutions at the design stage of processes or products.

Practical applications in car servicing:

- Physical protection: The use of barriers, covers or restrictors to prevent accidental damage to vehicles during servicing.
- Checklists: Implement detailed checklists for each stage of the repair process, ensuring that all operations are carried out correctly and completely.
- Color codes and labels: Use color codes or labels to identify parts, tools and equipment, thereby avoiding confusion and assembly errors.
- Sensors and alarms: Install sensors and alarms to alert technicians of anomalies or exceedances of operating parameters during repairs.

Benefits of Poka-Yoke in car servicing:

- Reduction of errors and repeat repairs: By preventing human error, the number of non-conformities is reduced, thus reducing the need for subsequent repairs, saving time and resources.
- Improvement of service quality: Eliminating errors leads to an increase in the quality and reliability of the services provided, resulting in higher customer satisfaction.
- Increased efficiency and productivity: By standardizing processes and eliminating time lost due to errors, workflow is optimized, and productivity is increased.
- Improved workplace safety: Preventing errors can also help reduce the risk of accidents and increase employee safety.

Implementing Poka-Yoke requires:

- Detailed process analysis: Identify critical points where errors may occur and assess the associated risks.
- Creativity and employee involvement: Employees who work directly in the processes are best able to identify potential errors and propose practical preventive solutions.
- Continuous monitoring and improvement: Poka-Yoke solutions must be constantly monitored and improved to ensure that they remain effective and relevant in the context of technological and process changes.

By adopting a proactive approach and implementing simple and effective solutions, automotive services can prevent errors from occurring, reduce costs and increase customer satisfaction, thus ensuring a long-term competitive advantage.

Table 2 presents a practical application of the Poka-Yoke concept in automotive services in the form of a detailed worksheet for monitoring the work required to prepare vehicles for

delivery. This worksheet standardizes the final check process, ensuring that all important aspects are considered before the car is handed over to the customer.

Table 2. Main verification categories and number of associated operations in the monitoring fiche.

Verification Category	Number of Operations
Vehicle Exterior	13
Vehicle Interior	14
Engine Compartment	12
Checks with Car Lifted (Medium and High)	7
Road Test	3
Car Wash	4

The table below summarizes the main check categories and the number of associated operations in the monitoring worksheet, providing an insight into how Poka-Yoke is implemented to prevent errors and ensure service quality:

This detailed check sheet acts as a Poka-Yoke mechanism by:

- Standardization: Defines a clear set of operations to be performed, eliminating ambiguity and ensuring consistency.
- Prevention of errors of omission: By explicitly listing each check, it reduces the risk of technicians skipping important steps.
- Facilitation of problem detection: Provides a structured framework for inspection, increasing the likelihood of identifying any non-conformity before the machine is delivered.

Therefore, Table 2 illustrates how a simple but effective tool can be used to implement the Poka-Yoke concept in car servicing, contributing to higher quality of service and customer satisfaction.

4.6. Jidoka: Automation with Human Intelligence in Car Service

Jidoka, a complementary Poka-Yoke concept, takes error prevention to the next level by automating the detection and stopping of processes in the event of anomalies. In automotive services, Jidoka can be implemented by:

- Sensors and automation: use sensors to monitor critical vehicle parameters during repairs (oil pressure, engine temperature, etc.) and automatically stop the process in case of non-conforming values.
- Intelligent diagnostic systems: using computerized diagnostic systems to automatically identify faults and give clear instructions to technicians to fix them.
- Equipment with self-checking functions: Use of service equipment with self-checking and self-calibrating functions to signal any faults or maintenance needs.

Benefits of Jidoka in car servicing:

- Superior quality of repairs: By automatically detecting and correcting errors, a consistently high quality of work is ensured.
- Reduced downtime: automatic shutdown of processes in the event of anomalies allows rapid intervention and reduces downtime, increasing productivity.
- Efficient use of human resources: Technicians can be assigned to higher value-added tasks, while the Jidoka system takes care of automated process monitoring and control.
- Improving safety: Automatic anomaly detection can prevent workplace accidents and protect both employees and equipment.

Implementing Jidoka requires:

- Investment in technology: Purchase and installation of sensors, diagnostic systems and self-checking equipment.

- Staff training: familiarize employees with new technologies and procedures so that they can intervene effectively in case of problems.
- Data analysis and continuous improvement: Collect and analyze data generated by the Jidoka system to identify process improvement opportunities and prevent similar problems from occurring in the future.

By integrating Jidoka into automotive service centers, a significant increase in quality, efficiency and safety can be achieved, transforming repair processes into an intelligent and self-regulating system capable of delivering high quality customer service.

In addition, the implementation of Jidoka can help reduce unnecessary costs by eliminating non-value-adding activities and optimizing the use of resources. Thus, it can maximize the value added to each job and increase the profitability of the organization.

4.7. Visual Workplace Management: A Key to Efficiency and Engagement

Visual management at the workstation is an essential strategy for optimizing operations in an automotive service. This approach involves the use of visual cues, such as diagrams, labels, markings and posters, to convey essential information in a clear and easy-to-understand way.

The implementation of visual management in car servicing can include:

- Accessible documentation: Display work instructions, safety procedures and other relevant documents in a clear and organized way, within easy reach of technicians, to eliminate time wasted searching and reduce errors.
- Visible Performance Indicators: Display work objectives, progress and KPIs to drive employee engagement and accountability.
- Efficient workspace organization: Use markings and labels to demarcate work areas, identify tool and parts storage locations, and ensure optimal workflow.
- Visual inventory management: Implement Kanban or other visual methods to monitor stock levels and signal the need for replenishment.
- Process Standardization: Using visual diagrams and instructions to standardize work processes and ensure that all technicians follow the same procedures, thus reducing variability and errors.
- 5S Implementation: Applying 5S principles (sorting, systematizing, cleaning, standardizing, disciplining) to create an organized, clean and efficient work environment.

The benefits of visual management in car servicing:

- Improved communication: Information is passed quickly and efficiently, reducing misunderstandings and miscommunication.
- Increased productivity: By eliminating wasted time and optimizing workflow, productivity and efficiency of operations can be increased.
- Improved quality: Standardizing processes and visually monitoring them helps reduce errors and increase the quality of service.
- Increased employee engagement and accountability: Employees feel more engaged and accountable when they have access to clear information and can see the impact of their work on overall performance.
- Creating a safer working environment: By visually signaling hazardous areas or safety procedures, the risk of accidents can be reduced.

Visual management is an effective and easy-to-implement strategy that can bring significant benefits to automotive service organizations. By creating a transparent, organized and performance-oriented working environment, this approach can help to increase customer satisfaction, improve operational efficiency and strengthen the service's competitive position in the market.

In both service centers, visual workplace methods were audited bi-weekly using a 5S compliance checklist and incident tracking sheets. Performance indicators such as tool retrieval time, missing part reporting, and workstation readiness were measured, offering quantifiable insight into visual management effectiveness. The results of these metrics are presented in Table 2 and analyzed in Section 5.

4.8. Aligning Quality Management Tools with Sustainable Development Goals

This section analyzes and visually illustrates how quality management tools, rooted in Japanese principles, directly contribute to the achievement of the United Nations' Sustainable Development Goals (SDGs), particularly SDG 9—Industry, Innovation, and Infrastructure and SDG 12—Responsible Consumption and Production. Table 3 details the specific correlation between tools such as Kaizen, Lean Manufacturing, Poka-Yoke, and Visual Management and their impact on operational sustainability within automotive service organizations. This approach demonstrates that process improvements are not an end in themselves, but also serve broader strategic objectives related to social and environmental responsibility.

Table 3. Contribution of Quality Tools to SDGs 9 and 12.

Quality Tool	Contribution to SDG 9	Contribution to SDG 12
Kaizen	Fosters continuous innovation in processes and promotes a culture of problem-solving.	Reduces waste (Muda) and promotes efficiency, contributing to sustainable resource use.
Lean Manufacturing	Optimizes workflow and redesigns infrastructure (e.g., U-shaped cells) to increase productivity.	Eliminates non-value-adding activities and reduces material, time, and energy waste.
Poka-Yoke	Automates error prevention, making processes more robust and intelligent.	Prevents defects and rework, reducing the need for new parts and minimizing resource consumption.
Visual Management	Improves process transparency and communication, acting as an innovative tool for real-time control.	Enables early detection of non-conformities, preventing waste and ensuring responsible service delivery.

5. Research Results

To achieve positive results from the implementation of changes necessary for organizational development, the manager who initiates the change must have the support of the members of the organization, especially the managers at subordinate levels.

Table 4 shows some specific action steps differentiated according to the process initiated. If the manager is confronted with lack of trust in the organization, low concern for quality issues, low customer focus and a tendency to create a public image of the organization, the change should initially focus on organizational culture, core beliefs and values rather than on systems.

Each department manager should be responsible for achieving the assigned objectives. Given the complexity of the activities carried out in the car repair service provider organization, to enable each manager to effectively monitor the performance level of his/her department in real time, a few indicators relevant to the work of each department have been established.

Table 4. Measures specific to change processes.

Characteristic	System Change Process	Organizational Culture Change Process
Orientation	Towards the problem to be solved	Towards added value
Approach	Gradual, easy to control	Broad, difficult to control once the process has begun
Changes	Increase of changes in the system	Implies the transformation of basic perceptions
Focus	On establishing performance indicators, measuring results, and improving the system	On the quality of life in the organization
Diagnosis	Discovering discrepancies between systems	Examining the effects of dysfunctions due to basic perceptions
Leadership	Does not change significantly	Change in leadership is usually fundamental

To manage the performance level of the service activity, the following indicators need to be monitored:

- Productivity: This is calculated as the ratio between the number of hours worked and the total number of working hours available in a month. The recommended value is a minimum of 85%. This indicator may not exceed 100%, as service technicians cannot work more hours than they are present at work
- Efficiency: This indicator measures the ability of technicians to carry out repairs within the standard times set by the manufacturers. Efficiency is calculated as the ratio of the total number of hours sold (invoiced) to the total number of hours worked by directly productive staff. The value of this indicator shall be at least 100%.

Table 4 shows a comparison between two types of organizational change processes: system change and organizational culture change.

Each process has different characteristics and approaches, and understanding these differences is crucial for managers who want to successfully implement change in their organization:

- Orientation: System change focuses on solving specific problems and improving operational efficiency, while organizational culture change aims at transforming employees' core values and perceptions, which can lead to deeper and more sustainable change.
- Approach: System change can be implemented gradually and controlled, whereas organizational culture change is a more extensive and difficult to control process once it has started.
- Change: System change focuses on modifying existing processes and procedures, while organizational culture change involves a transformation of employees' mindsets and behaviors.
- Focus: System change focuses on establishing and monitoring performance indicators to measure and improve results, while organizational culture change focuses on creating a positive work environment and improving the quality of life in the organization.
- Diagnosis: In the case of system change, diagnosis focuses on identifying inconsistencies and dysfunctions within existing systems. In contrast, diagnosis for organizational culture change involves a deeper analysis of employee perceptions and values to identify barriers to change and develop appropriate strategies.
- Leadership: System change can be achieved without major changes in leadership style, while changing organizational culture often requires a fundamental transformation of leadership to promote and sustain the desired new values and behaviors.

In conclusion, Table 4 provides valuable insight into the differences between the system change process and the organizational culture change process. Choosing the right approach depends on the specific context of the organization and the objectives pursued.

In some cases, a combination of the two approaches may be necessary to achieve the desired results.

Table 5 provides a summary of the indicators to be monitored by the managers of the motor vehicle repair service organization.

Table 5. Monitoring indicators.

Department	Position	Indicator	Details/Target
Finance	Finance Manager	Value of uncollected sums within contractual terms	-
		Value of sums collected from customer service contracts	-
		Value of uncollected sums from insurance company service contracts	-
		Value of fixed and variable expenses	-
Service	After-Sales Manager	Total number of invoiced hours per workshop	-
		Income from spare parts sold in the workshop	-
		Number of orders in unfinished production	Maximum closing deadline: Cars: 15 days Commercial vehicles: 15 days Damaged vehicles: 30 days
Vehicle Sales	Sales Manager	Number of new vehicles sold monthly	-
		Number of used vehicles sold monthly	-
		Number of customers contacted daily	Minimum 10 customers (new or existing)
		Age of vehicle stock	Maximum 90 days from the stock entry date
Procurement	Head of Procurement	Volume of spare parts purchases from importers	Minimum 100,000 EUR/month
		Value of spare parts and materials stock	Maximum 800,000 EUR/month (according to budget)
		Value of stock without movement	Maximum 10% of the total stock value (parts with 0 sales in the last year)
		Income from parts sold directly through stores	Minimum 20,000 EUR/month
		Income from parts sold on active sales contracts (Active Sales)	Minimum 5000 EUR/month
		Stock rotation factor for parts	Between 4 and 8
Service Workshop	Workshop Manager	Number of labor hours in the workshop	-
		Income from spare parts sold in the workshop	-
		Percentage (%) of delayed service orders compared to the total number of open orders per workshop	Maximum 15% unclosed orders of more than 30 days from the opening date
Administrative	Head of Administrative Department	Evolution of electricity expenses	-
		Evolution of gas expenses	-
		Evolution of phone expenses	-

The table above provides an overview of key performance indicators (KPIs) used to monitor and evaluate success in different departments of an organization. These indicators range from financial measures, such as uncollected amounts and expenses, to operational indicators such as the number of orders in production or the time it takes to close orders. By carefully tracking these KPIs, managers can identify areas for improvement, make informed decisions, and ensure optimal performance of each department in achieving organizational goals.

Effective inventory management is crucial for automotive repair service providers. To ensure optimal stock levels and efficient operations, the spare parts commercialization activity is closely monitored using key performance indicators (KPIs).

Key Performance Indicators (KPIs):

- Average Stock: Calculated as the mean of the stock value at the beginning and end of the analyzed period. It provides insights into the overall inventory level maintained.
- Stock Rotation Factor (FR): Measures how many times the average stock is sold within a 12-month period. A higher FR indicates efficient inventory turnover.
- Service Degree (GS): Represents the percentage of requested spare parts that are readily available in stock. It reflects the organization's ability to fulfil customer demands promptly.

Calculation and Interpretation:

$$FR = \text{Annual Net Turnover} / \text{Average Stock}$$

- Annual Net Turnover (or cost of goods sold) is calculated as: Initial Stock + Value of Entries—Final Stock.

$$GS = (\text{Number of Positions Delivered} / \text{Number of Positions Requested}) \times 100\ [\%]$$

- The system automatically updates the GS after each sale or purchase transaction.

By actively monitoring these KPIs, automotive repair service providers can maintain optimal stock levels, reduce carrying costs, improve customer satisfaction, and enhance overall operational efficiency (Table 6).

Table 6. Key Inventory Management KPIs.

KPI	Description	Calculation
Average Stock	Overall inventory level	(Initial Stock + Final Stock)/2
Stock Rotation Factor (FR)	Inventory turnover efficiency	Annual Net Turnover/Average Stock
Service Degree (GS)	Availability of requested parts	(Number of Positions Delivered/Number of Positions Requested) × 100 [%]

Key strategies for maximizing profit from spare parts sales include:

- Adaptation of stock to customer demand
- Flexible discount policies, in line with the market—Regular renegotiation of purchase prices
- Active marketing to promote competitive advantages

The Auto Repair Shop Manager has a key role in ensuring the efficient and profitable operation of the shop. Responsibilities include managing human and technical resources, monitoring performance, ensuring quality and meeting delivery deadlines. By successfully performing these tasks, the shop manager contributes to increased customer satisfaction and overall organizational success (Table 7).

Table 7. Specific Tasks for the Head of the Car Repair Shop.

Task	Description
Update technicians' availability in the scheduler	Keep the technicians' schedule up to date, ensuring efficient resource allocation.
Permanently check technician workload	Monitor the technicians' workload to avoid overload or inactivity.
Ensure technical and non-technical training for technicians	Facilitate the continuous training of technicians, both technically and in other relevant areas (communication, customer relations, etc.).
Follow-up on the evolution of productivity–efficiency indicators	Monitor and analyze KPIs constantly to identify opportunities to improve workshop performance.
Ensure compliance with work completion deadlines	Supervise the repair process to ensure that work is completed within the established deadlines.
Ensure the quality of the work performed	Implement and control quality procedures to ensure a high standard of services provided.
Ensure the verification of SDVs	Systematic verification of vehicles after service (SDV) to confirm that repairs have been carried out correctly and completely.

A system (Figure 7) has been introduced to enable workshop managers to efficiently and easily manage repair completion deadlines in the service workshops by remotely visualizing the deadline by which the vehicle must be handed over to the customer by the receiver. If he finds that the deadline cannot be met, the workshop manager notifies the service advisor so that the customer is informed in good time.

Table 8 presents a few concrete measures that can be implemented to improve the performance of the Service department in terms of both quality and quantity.



Figure 7. Visual Management System for Motor Vehicle Delivery Deadline.

Table 8. Measures to Improve Service Department Performance.

Measure	Description	Benefit
Redirect phone calls in the morning	Service advisors can focus on customers present and on vehicle reception.	Increases efficiency and reduces customer waiting times.
Store disassembled parts on special carts	Parts are easy to identify and handle.	Reduces time wasted searching for parts and optimizes workflow.
Store SDVs in designated areas and identify them with photos, codes, and locations	SDVs are easy to find and manage (Figure 8).	Eliminates unproductive time and improves workshop organization.
Implement a visual management system for special tools	Technicians can quickly and easily identify the necessary tools.	Reduces time wasted searching for tools and increases productivity.
Deliver spare parts to customers' premises	Provides a valuable additional service for customers with their own service or vehicle fleets.	Increases customer satisfaction and can generate additional revenue.
Recommend customers to bring the vehicle the evening before the scheduled service	Allows work to start earlier and shortens waiting time.	Improves workshop efficiency and productivity.



Figure 8. Model to identify SDV.

Implementing these measures can make a significant contribution to improving the performance of the service department, both in terms of quality and quantity. By optimizing processes, reducing downtime and increasing customer satisfaction, the department can become more efficient and profitable.

By implementing actions and adopting an organizational culture focused on customer-centricity and continuous improvement, the Service department can achieve a higher level of performance and make a significant contribution to the success of the entire organization.

Actions to increase the number of billed hours in service include (Table 9):

Table 9. Actions to Increase Car Service Workshop Performance.

Action	Description	Potential Impact
Hire personnel for Info Desk Receptionist	Improve customer flow management and communication.	Reduce waiting times, increase customer satisfaction.
Print scheduling/pre-order at the time of scheduling the vehicle for service	Provide clear and detailed information about scheduled services.	Improve organization and reduce errors.
Create and implement a list of allocated times for maintenance and common service operations for receptionists and Info Desk	More accurate estimation of work duration.	Optimize scheduling and increase productivity.
Train receptionists on the quality of recording customer complaints in the pre-order/order	Correct and complete recording of problems reported by customers.	Avoid misunderstandings and increase the quality of repairs.
Introduce all vehicles into service by 8:00 AM at the latest	Technicians can start work immediately at the beginning of the workday.	Maximize productive time and increase efficiency.
Implement and ensure the operation of Active Reception	Proactively approach customers to identify and offer additional services.	Increase sales and revenue.
Offer all additional work	Present customers with all repair and maintenance options.	Increase revenue and improve customer satisfaction.
Prepare additional orders by technicians (mechanic, electrician)	Identify and record all necessary work during the repair.	Avoid omissions and increase revenue.
Ensure communication with the customer to ensure their availability regarding the identification/detailing of reported malfunctions	Clarify problems and obtain customer agreement for additional work.	Improve communication and avoid misunderstandings.
Introduce monitoring of productivity and efficiency indicators	Track and analyze performance to identify improvement opportunities.	Optimize processes and increase efficiency.
Increase the number of service entries	Attract more customers and increase workload.	Increase revenue and profitability.

Optimizing the sales process:

- Empower service advisors and parts sales managers to give discounts, speeding up the sales process.
- Collect information on lost sales (out of stock, long delivery times, overpricing) through the management system, eliminating the need for manual reporting.

Efficient stock management:

- Offer special prices for parts with non-moving stock, thereby reducing costs and boosting sales

- Develop active spare parts sales service with the aim of generating at least 10% of total parts sales
- Constant monitoring of stock and urgent orders by the Head of Supply and After Sales Manager.

Quality assurance of service processes:

- Preventing non-conformities that can lead to material losses, customer dissatisfaction and decreased organizational performance
- Coordination of the continuous improvement process by the Director of After Sales Services.

The organization must understand and meet the needs of both internal and external customers to ensure long-term success.

Detailed process analysis, working with suppliers and identifying weaknesses are key to improving performance.

Quality management requires that all employees are involved in understanding processes, continuous improvement and the use of statistical methods for analysis and planning.

The presented action plan aims to increase the performance of the car service workshop through a series of measures aimed at optimizing processes, improving communication with customers, and increasing operational efficiency. Implementing these actions can contribute to achieving the goal of increasing the number of invoiced hours per car, which will lead to increased revenue and profitability for the workshop.

5.1. Case—Visual Management and Standard Workflows

In Service Center A, the introduction of visual controls (colored zones, real-time status boards, standardized work instructions) led to a progressive reduction of rework rate from 7.8% to 2.6% and a decrease in throughput time from 4.3 to 2.7 days. Additionally, the Net Promoter Score (NPS) rose from 52 to 82 points, indicating a strong positive reaction from customers. Visual management compliance, measured through a 10-point checklist, improved from 38% to 91%.

Internal audits also confirmed a significant drop in internal nonconformities (from 9 to 2 per week), attributed to standardized technician routines and visual error-prevention cues. These results suggest that visual transparency and procedural clarity enhance coordination, reduce waste, and facilitate early error detection.

5.2. Case Study B—Lean Cell Reconfiguration

In Service Center B, workshop layout was restructured based on Lean principles into U-shaped repair cells, which allowed teams to operate with greater autonomy and task continuity. This resulted in an increase in technician efficiency from 90% to over 105%, based on productive hour utilization.

Work-in-progress (WIP) time was reduced by 1.8 days on average, and customer complaints related to delays decreased by 37% over the same observation period. These outcomes support previous findings by [6,7], reinforcing the idea that Lean implementation in services improves both speed and employee control.

5.3. Correlation Analysis of Tools vs. KPIs

To validate the relationship between the implemented improvement tools and service performance indicators, a Pearson correlation test was conducted. The analysis was applied to the dataset collected over the six-week observation period (n = 6), based on the data presented in Table 1.

The results of the statistical analysis confirmed strong and significant relationships, as follows:

- Visual Management Compliance vs. Rework Rate: r = −0.75, $p < 0.05$. This negative and significant correlation indicates that as compliance with visual management standards increased, the rework rate consistently decreased.
- Lean Cell Implementation (binary coded) vs. Technician Efficiency: r = +0.89, $p < 0.01$. The positive and very strong correlation highlights the direct impact of reorganizing the workflow, according to Lean principles, on increasing workforce efficiency.
- Checklist Use (Yes/No) vs. Throughput Time: r = −0.62, $p < 0.05$. This negative correlation confirms that the use of Poka-Yoke tools, such as standardized checklists, contributed to a significant reduction in order completion time.

These strong and statistically significant correlations validate that the implemented tools are not only conceptually sound but also empirically effective in reducing defects, increasing productivity, and optimizing process flow.

The combined findings demonstrate that integrating visual management, standardized work, Lean cell layout, and continuous improvement culture delivers consistent gains in service operations. The empirical data supports the claim that such tools lead to reduced error rates, shorter lead times, and greater staff engagement.

Furthermore, the study fills a documented literature gap by offering KPI-based evidence in automotive services where theoretical applications of Lean and Kaizen were often detached from data. Unlike most existing research focusing on manufacturing or large-scale implementation, this study validates improvements in medium-sized, real-world service centers, providing a replicable model for SMEs.

The results also highlight the importance of employee involvement and visual coordination in facilitating sustainable process control, directly contributing to SDG 9 (Industry, Innovation) and SDG 12 (Responsible Consumption).

The results obtained in this study align with and, in some respects, exceed the results reported in the academic literature. For example, while Ref. [2] demonstrated a 38% reduction in rework in the context of automotive diagnostics, our study achieved an even more significant reduction, from 7.8% to 2.6% (a reduction of approximately 66%) in the specific context of Romanian service centers. This result is notable because it validates the effectiveness of our hybrid model not only in controlled pilot projects or large companies but also in small and medium-sized enterprises, an area insufficiently explored in previous research. Additionally, the increase in technical efficiency from 89% to 105% demonstrates an exceptional improvement, comparable to global best practices, and confirms the potential for productivity growth through the implementation of Lean principles. Thus, our main contribution is to provide solid empirical evidence that an integrated quality management model can generate a substantial impact, replicable within the SME ecosystem of the automotive industry.

The impact of these improvements was directly felt at the level of customer satisfaction and sustainability goals. According to the data collected, the Net Promoter Score (NPS) increased from 52 to 82, indicating a significant improvement in customer perception of service quality. Customer complaints related to delays also dropped by 37%, a direct result of optimizing the work completion time.

Furthermore, the results explicitly align with the Sustainable Development Goals (SDG 9 and SDG 12). The reduction in the rework rate from 7.8% to 2.6% and the decrease in the average service completion time by 1.6 days directly contribute to SDG 12 (Responsible Consumption and Production), by reducing the waste of materials and unnecessary labor hours. The improvement in technician efficiency from 89% to 105% demonstrates innovation in industrial infrastructure and a more efficient use of human resources, thereby supporting SDG 9 (Industry, Innovation, and Infrastructure).

6. Conclusions

In today's global marketplace, companies need to align their strategies and action plans to build strong customer partnerships and respond quickly to market changes.

Service quality is a critical success factor that requires a holistic approach. This involves effective management of all aspects of the repair process, from the initial scheduling to the final assessment of customer satisfaction. Implementing the concept of "pull production" and optimizing workflow can significantly contribute to increased efficiency and on-time delivery, which are key factors for customer satisfaction.

The empirical findings from the two service centers confirm these theoretical assertions. Service Center A registered a 66% reduction in the rework rate, from 7.8% to 2.6%, following the implementation of visual management and standardized workflows. Meanwhile, Service Center B achieved an increase in technician efficiency from 90% to 105%, because of workshop restructuring based on Lean principles. These results substantiate the effectiveness of integrating Japanese tools into process monitoring systems adapted to the automotive services context.

Ensuring quality of service is the responsibility of the entire organization, not just those in direct contact with customers. Employees must be well trained in managing customer relations and dealing with complaints. An organizational culture based on transparency, accountability and customer orientation is essential to achieve superior performance.

Quality management systems are a powerful strategic tool to achieve and maintain high quality standards.

This research also advances the field by proposing a replicable framework of integrated quality management that combines European regulatory structures with Japanese operational philosophies. The model can be transferred to other service sectors, particularly where process variation and human error represent critical quality challenges. Its adaptability stems from the modular deployment of tools such as Kaizen, Poka-Yoke, and Andon based on process maturity levels.

Implementation of practices such as Jidoka, Poka Yoke and Andon, together with the adoption of a "don't receive, don't make and don't ship non-conforming products" philosophy, can help prevent errors and continuously improve processes.

In conclusion, the success of an automotive services organization depends on its ability to adapt to market dynamics, deliver high quality services and build strong customer relationships. By implementing effective quality management strategies and cultivating a customer-centric organizational culture, companies can achieve superior performance and strengthen their market position.

In addition, the alignment of the implementation strategies with Sustainable Development Goals (SDG 9: Industry, Innovation and Infrastructure and SDG 12: Responsible Consumption and Production) reinforces the relevance of the study in the broader context of sustainable industrial services. By reducing waste, improving energy use through error prevention, and enhancing service lifecycle traceability, the model offers not only quality but also sustainability benefits. Thus, the paper demonstrates that quality management practices, such as Kaizen, Lean, and Poka-Yoke, are essential tools not only for achieving operational excellence but also for supporting responsible and resource-efficient economic development.

From a methodological standpoint, the study applied a mixed-methods approach, which includes participatory observation, real-time monitoring, and correlation analysis between the implemented tools and key operational KPIs. This structure ensures transparency and analytical rigor, but it can be improved in future research.

This mixed-methods approach, which includes participatory observation, real-time monitoring, and correlation analysis between the implemented tools and key operational KPIs, ensures robust methodological validation, even in the absence of a control group.

Future studies should include a control group or validation based on extended time series to strengthen causal inferences and validate the generalization of the results to a larger sample of businesses in the automotive industry.

To broaden and deepen our understanding of the dynamics of the automotive services industry and to identify new opportunities for growth and improvement, the following research directions show promise:

- Investigating the impact of digital technologies on the efficiency and quality of automotive services
- Studying the relationship between organizational culture and performance in the automotive service industry
- Analyzing how emerging technologies can be used to improve the customer experience and optimize service processes
- Assessing the effectiveness of different quality management strategies in the specific context of the automotive industry.

Beyond its practical implications, the paper contributes methodologically by applying a mixed-methods approach that includes participatory observation, real-time monitoring, and correlation analysis between implemented tools and operational KPIs. This structure ensures transparency, analytical rigor, and potential replicability of the results. It sets the basis for future empirical studies using control groups or time-series validation.

In conclusion, this paper has explored in detail the strategies and practices needed to improve performance in the automotive service industry, emphasizing the importance of quality management, customer orientation and continuous adaptation to market dynamics.

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